

**BEFORE PROCEEDING WITH COMPLETE UNPACKING AND SETUP,
CONSULT UNPACKING AND INSPECTION INSTRUCTIONS**

**model 1176LN
PEAK LIMITER**

EFFECTIVE WITH SERIAL NUMBER 7652



**UREI Incorporated
8400 BALBOA BOULEVARD
NORTHRIDGE, CA. 91325-4100 U.S.A.
PHONE: (818) 895-UREI (895-8734)
FAX: (818) 891-5475**

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SECTION I
INTRODUCTION

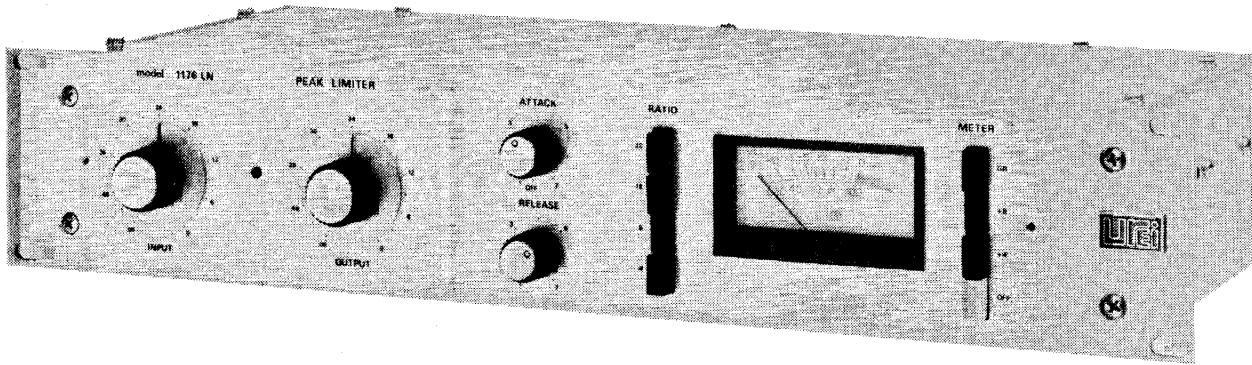


FIGURE 1-1. MODEL 1176LN FRONT PANEL.

1.1 DESCRIPTION

The Model 1176LN Peak Limiter is the most widely used device of its kind. Since its introduction in the late '60's, thousands have been used for applications which require precise, automatic control of peak signal levels in recording studios, disc mastering facilities, broadcast stations, sound reinforcement installations, etc. Continuing evolutionary developments have substantially changed the inner workings of the 1176 series, but the same excellent performance is common to all units, starting with number 1.

In the 1176LN, peak limiting is accomplished by utilizing an FET as a voltage variable resistor. A unique circuit permits severe limiting without added distortion, and the compression ratio may be optimized for various program materials.

Attack time is adjustable from less than 20 microseconds to 800 microseconds. The fast attack time is independent of program peak frequency or duration. Using the tone burst method, a 50 kHz peak is fully stabilized at the limited level within 1 cycle. The release time is also continuously adjustable on the front panel from 50 milliseconds to 1.1 seconds.

The gain structure throughout the limiter also maintains an excellent signal-to-noise ratio at normally used control settings. The front panel meter may be switched to read either the amount of gain reduction or the output signal level referenced to +4 or +8 dBm.

Provision is made to interconnect two 1176LN Limiters for those applications where two channels of program material are processed, and the balance of these audio channels must be maintained. The signal with the larger peak-to-peak amplitude will cause the same amount of gain reduction in both limiters. For this mode of operation, the accessory Model 1176SA Stereo Adapter is required.

1.2 SPECIFICATIONS

ELECTRICAL:

INPUT: Balanced bridging, differential amplifier.

INPUT IMPEDANCE: 20 kohms, used as balanced input.
10 kohms, used as unbalanced (single-ended) input.

MAXIMUM INPUT LEVEL: +20 dB maximum (Ref. 0.775 volts rms).

MAXIMUM GAIN: 45 dB, ± 1 dB.

FREQUENCY RESPONSE: ± 1 dB, 20-20,000 Hz.

OUTPUT: Floating, transformer isolated.

OUTPUT LOAD: 150 ohms or greater.

MAXIMUM OUTPUT LEVEL: +24 dBm into 600 ohm load (12.28 volts).

DISTORTION: Less than 0.5% THD, 50 Hz to 15 kHz with limiting, at 1.1 seconds release setting; (as with all limiting devices, distortion of low frequency peaks increases with faster release time).

SIGNAL TO NOISE RATIO: Greater than 81 dB at threshold of limiting, 30 Hz to 15 kHz.

ATTACK TIME: Less than 20 microseconds for 100% recovery; adjustable to 800 microseconds with front-panel control.

RELEASE TIME: 50 milliseconds minimum, 1.1 seconds maximum (for 63% recovery). Adjustable with front-panel control.

THRESHOLD vs OUTPUT LEVEL:	Compression Ratio Setting	Input Level at Minimum Limiting Threshold ± 2 dB	Relative Output at Threshold*
	20:1	-24 dB	+10 dBm
	12:1	-25 dB	+9 dBm
	8:1	-26 dB	+8 dBm
	4:1	-30 dB	+7 dBm

*with output gain control set to provide a reserve of approximately 10 dB.

NOTE: Throughout this manual, where the expression "dB" is used to denote a signal level, it is referenced to 0 dB = 0.775 V rms.

POWER REQUIREMENTS: 100 - 125 VAC, or 200 - 250 VAC, 50/60 Hz,
switch selectable, less than 10 W.

ENVIRONMENT: Operating, 0°C to +50°C;
Storage, -20°C to +60°C.

1.3 PHYSICAL

DIMENSIONS: 483 x 89 mm rack panel. Depth behind
panel 203 mm (19" x 3-1/2" x 8").

FINISH: Panel is 3.18 mm (1/8") brushed clear
anodized aluminum in 2 shades. Chassis
is cadmium plated steel.

WEIGHT: 5 kg (11 lb).

SHIPPING WEIGHT: 6.6 kg (14.5 lb).

ACCESSORIES: Model 1176SA Stereo Adapter.
Model 301 XLR/QG Adapter for signal input
and output.
Model SC-2 Security Cover.

1.4 FRONT PANEL CONTROLS

INPUT AND OUTPUT LEVEL: Continuously adjustable.

ATTACK TIME: Continuously adjustable, 20 microseconds to
800 microseconds. (Fastest attack is in the
maximum clockwise (CW) position.)

LIMITING ON/OFF: This switch is coupled with the Attack
Time control. In the full counterclockwise
position (CCW) the limiting function is
disabled.

RELEASE: Continuously adjustable from 50 milli-
seconds to 1.1 seconds. (Fastest release
is obtained in the maximumum CW position.)

COMPRESSION RATIO: Switch selectable with four interlocking
pushbuttons.

METER FUNCTION: Three interlocked pushbuttons switch the
limiter ON and switch the meter to read
either the amount of gain reduction or the
output signal level referenced to +4 dBm
or +8 dBm. The fourth pushbutton switches
the AC the power OFF.

GAIN REDUCTION
"0" ADJUST: Screwdriver adjustment accessible through a hole in the front panel (between the input and output level controls).

POWER SWITCH: Any of the meter function buttons switch the 1176LN ON. The device is switched OFF by depressing the red power switch button.

1.5 CONNECTIONS : Rear chassis barrier strip for input and output. Power through 3 wire IEC-style connector.

STEREO INTERCONNECTION: Phono jack at rear of chassis. Requires 1176SA Stereo Adapter to couple 2 limiters.

(See also Installation Instructions,
Section 2.5, Figures 2-1 and 2-2.)

SECTION II

INSPECTION AND INSTALLATION

2.1 UNPACKING AND INSPECTION

Your Model 1176LN was carefully packed at the factory, and the container was designed to protect the unit from rough handling. Nevertheless, we recommend careful examination of the shipping carton and its contents for any sign of physical damage which could have occurred in transit.

If damage is evident, do not destroy any of the packing material or the carton, and immediately notify the carrier of a possible claim for damage. Shipping claims must be made by the consignee.

The shipment should include:

Model 1176LN Peak Limiter

UREI Instruction Manual (this book)

Two-part Warranty Card bearing the same serial number as the Model 1176LN.

Rack mounting hardware.

2.2 ENVIRONMENTAL CONSIDERATIONS

The system will operate satisfactorily over a range of ambient temperatures from 0°C to +50°C (+32°F to 122°F), and up to 80% non-condensing relative humidity.

If the system is installed in an equipment rack with high heat producing equipment (such as power amplifiers), adequate ventilation should be provided in order to assure longest component life. Also, while circuitry susceptible to hum pick-up is sufficiently shielded from moderate electromagnetic fields, installation should be planned to avoid mounting the system immediately adjacent to large power transformers, motors, etc.

2.3 POWERING

The 1176LN may be operated from either 100 - 125 VAC or 200 - 250 VAC mains (50 Hz or 60 Hz, single phase.) As indicated in Section 2.4, the nominal line voltage may be selected with a rear panel switch. BE SURE TO VERIFY BOTH THE ACTUAL LINE VOLTAGE, AND THE SETTING OF THE VOLTAGE SELECTOR SWITCH BEFORE CONNECTING THE 1176LN TO THE MAINS.

To comply with most Electrical Codes, the 1176LN is supplied with a three-wire IEC style connector, the grounding pin of which is connected to the chassis. In some installations this may create ground-loop problems. Ground loops can result in hum and buzz if a significant potential difference exists between the AC conduit ground and the grounded metal enclosure in which the chassis is installed. If hum is experienced, one may check for the possibility of ground loops by using a 3-prong to 2-prong AC adapter between the power cord and the mains supply, ungrounding the AC plug temporarily. This ungrounds the Model 1176LN, and may cure the hum or buzz, but is not a substitute for proper system grounding. Be aware that unless the Model 1176LN Peak Limiter is AC grounded, a safety hazard can exist. UREI accepts no responsibility for legal actions or for direct, incidental or consequential damages that may result from violation of any electrical codes.

2.4 LINE VOLTAGE SWITCH

Unless a tag on the line cord specifies otherwise, the Model 1176LN was shipped ready for operation with nominal 115 VAC power mains. In order to change this for nominal 230 V (50 Hz or 60 Hz), slide the VOLTAGE SELECTOR switch on the rear panel to the 230 position. The voltage is visible in a window next to the switch slot. Be sure to change the fuse to the correct value: 1/8-amp slo-blo when changing to 230 V operation or 1/4-amp slo-blo for 115 V operation. A small screwdriver should be used to move the recessed switch.

2.5 EXTERNAL CONNECTIONS

Permanent input and output signal wires should be shielded cable, and connected in accordance with standard wiring practice, as indicated on the rear panel barrier strip. If the XLR/QG connectors are to be used, install the accessory Model 301 according to the instructions supplied with the adapter. (See also "Mounting Instructions," Section VI Figure 6-1).

If the Model 1176LN output is connected to a high impedance circuit, we recommend shunting the "+" and "COM" output terminals with a 620 ohm, 1/2 watt resistor. This assures optimum loading.

(See Figures 2-1 and 2-2 on the following page
for recommended connection procedures; and
Section 2.6 regarding input termination.)

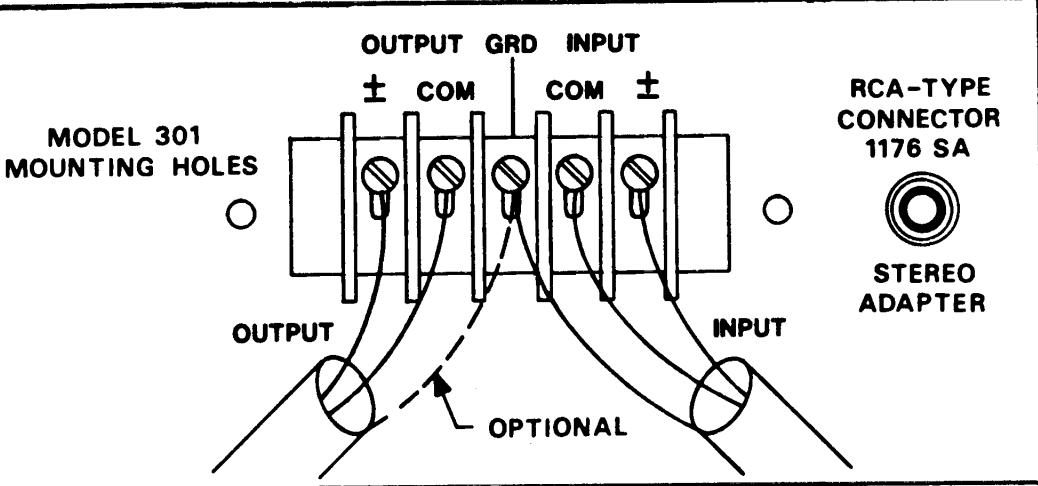


FIGURE 2-1. CONNECTING THE MODEL 1176LN WITH BALANCED INPUT AND BALANCED OUTPUT CIRCUITS.*

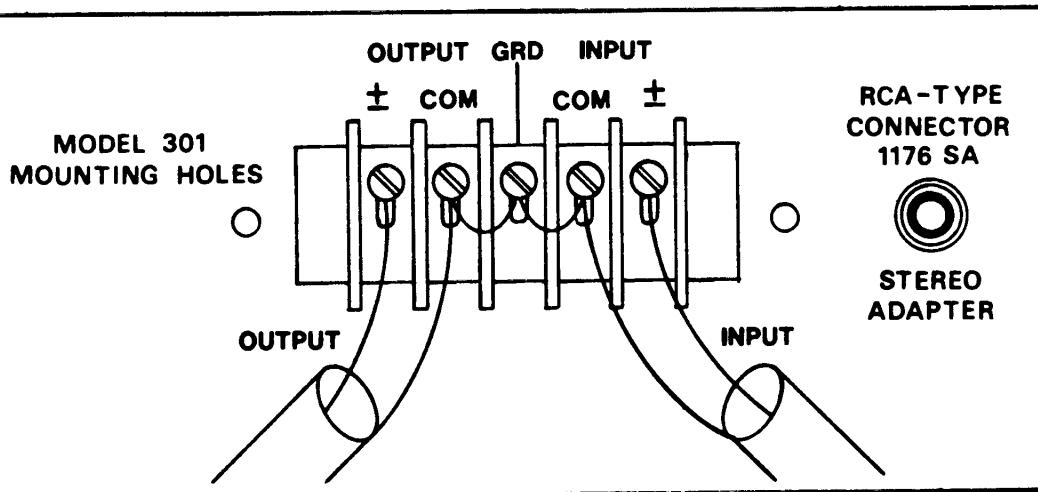


FIGURE 2-2. CONNECTING THE MODEL 1176LN WITH UNBALANCED INPUT AND UNBALANCED OUTPUT CIRCUITS.*

*With a balanced input and unbalanced output, or vice-versa, use the appropriate connections suggested by each of the above diagrams. No special switching or transformers are needed.

2.6 IMPEDANCE AND TERMINATION

Audio engineering had its roots in the telephone industry, and "600 ohm circuits" (together with their predecessors, "500 ohm circuits") are carry-overs from telephone transmission practices. Long audio transmission lines, like their video counterparts, must be properly sourced from and terminated in equipment which matches their characteristic impedance, if optimum frequency response and noise rejection are to be achieved.

However, transmission line theory and techniques are not only unnecessary but impractical within modern recording studios, broadcast studios and other local audio systems where transmission circuits are seldom more than several hundred feet in length. The advent of negative feedback circuitry and solid-state electronics has spawned modern audio amplifiers and other signal processing devices having source impedances of only a few ohms. They are essentially indifferent to load impedances and by varying their output current inversely to changes in load impedance, maintain the same output voltage into any load impedance above a rated minimum, with no change in frequency response. Most new designs (all at UREI) have high input impedance to allow use with various source impedances.

Most modern audio systems, therefore, utilize amplifiers and other active devices which have very low output impedances and high (10K to 50K) input impedances. These products may thus be cascaded (operated in tandem), or many inputs may be connected to a single output of a preceding device, without regard to impedance "matching". Switching, patching, etc. is simplified because "double loads" and "unterminated" bugaboos are essentially eliminated. "Floating" (ungrounded) transformer outputs minimize ground loop problems, and differential transformerless input circuitry (or input transformers) minimize common mode noise or interference which may be induced into the interconnecting wires or cables, or produced by different ground potentials.

Where audio must be transmitted through cables or wire pairs of more than several hundred feet in length, however, transmission line termination practices should still be observed.

The Model 1176LN has an input impedances of 20,000 ohms when used in a balanced, differential input configuration, and 10,000 ohms when used unbalanced (one side grounded). This makes the device suitable for use with any normal source impedance, low or high. Only when it is used from a source which requires a low impedance termination (such as a 600-ohm transmission line or older vacuum tube equipment) is a source termination resistor required at the 1176LN input.

2.7 ACCESSORIES

2.7.1 MODEL 301 ADAPTER

Two holes are provided adjacent to the ends of the IN/OUT barrier strip. This allows simple mounting of the Model 301 and adapts the limiter to be connected to signal cables fitted with XLR/QG termination.

2.7.2 STEREO ADAPTER 1176SA

The 1176SA Stereo Adapter is used to interconnect two 1176LN Limiters. The adapter is provided with an adhesive backing which allows it to be mounted on the rear chassis of the limiter or a nearby surface. Two cables are supplied with the 1176SA and are connected between the adapter and the two limiters. For calibration, see Section III, Operating Instructions, ¶ 3-6.

2.7.3 SECURITY COVER SC-2

An optional Security Cover is available to cover all operating controls of the Model 1176LN, and to protect against any inadvertent misadjustment of critical settings.

SECTION III

OPERATING INSTRUCTIONS

3.1 GENERAL DEFINITIONS

Before operating the 1176LN Peak Limiter with program material, it may be helpful to become familiar with the terminology used in this manual.

Compressors and Limiters are typically used in applications where the dynamic range of program material is too large to be processed by succeeding equipment, or where the peak-to-peak amplitude is too large for the headroom of the following equipment.

The two different names generally refer to the degree to which the dynamic range is restricted. The relationship of input level change versus output level change is called the Compression Ratio. If, for example, an increase of 8 dB input signal level should cause the output to increase by 2 dB, this would represent a 4:1 compression ratio.

Although no strict standards exist, amplifiers with compression ratios of up to 8:1 are typically considered to be Compressors, while those with ratios higher than 8:1 are called Limiters. By this definition, the following graph shows that the Model 1176LN can function as a compressor or a limiter since it has compression ratios selectable from 4:1 to 20:1.

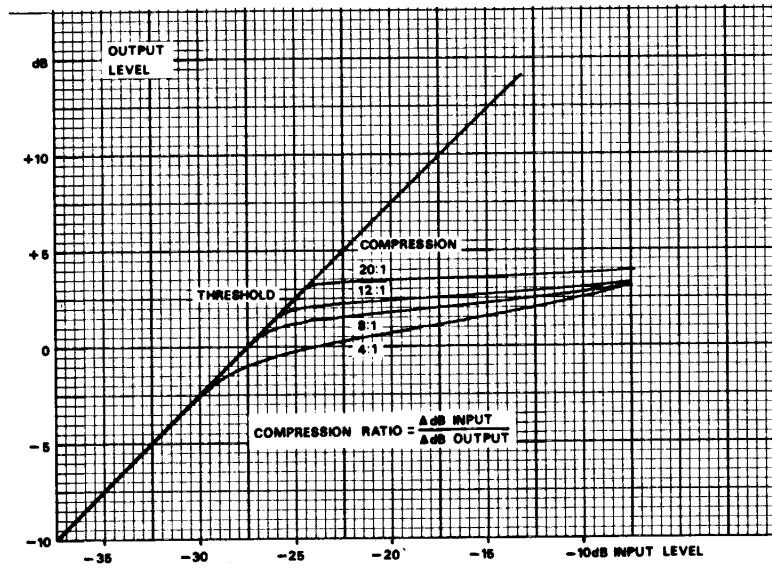


FIGURE 3-1. MODEL 1176LN TRANSFER CHARACTERISTICS.

The transfer characteristic graph (Figure 3-1) also indicates the region of the Threshold. Signals at levels below the threshold will not be affected by the compression/limiting action. Higher signal levels will cause a controlled decrease in amplifier gain resulting in a change of dynamic range. The 1176LN Input Level control adjusts the amount of signal to be processed above the threshold, and hence the degree of compression or limiting.

The Attack Time of the 1176LN is the time it takes for the device to respond to a signal which exceeds the threshold. It is variable, and since the adjustment may have a significant effect on the sound quality of the program material, a more detailed description is given in the section on application.

The Release Time may be defined as the time for the limiter to return to its normal gain, after the signal which caused the gain reduction has dropped below threshold. The release time is variable and can also alter the sound of the program material considerably. The adjustments are discussed in more detail in the section on application.

3.2 INITIAL SET-UP

After the Model 1176LN has been installed and is connected to both the signal source and the succeeding equipment according to Section II, power may be turned ON by pushing any of the meter function switches. Set the controls as follows:

Input = CCW
Output = Half rotation
Attack = Fully CCW, switch to OFF position
Release = Half rotation
Compression Ratio = 8:1
Meter Function = +4 dB

3.3 PERFORMANCE CHECK

The following steps will verify the general performance of the limiter and indicate the operation of all functions. If the unit fails to pass these tests, malfunction is indicated.

3.3.1 INPUT-OUTPUT SIGNAL LEVEL

Apply a sine wave signal with a level of approximately 0 dB (0.775 V rms) to the input terminal. Turn the Input control CW to approximately half-rotation. There should be an indication on the VU meter. Adjust the Output control until the VU meter reads "0". Measured with an external meter, the output signal will read about +4 dBm.

Push the +8 dB meter function switch. The VU indication will drop by +4 dB. The actual output level will not change.

3.3.2 METER ZERO ADJUST (Allow 15 minutes warmup)

Push the "GR" meter function switch. The VU meter should read "0" since the limiting function is disabled (the Attack control knob is turned OFF). If the "0" indication has drifted beyond ± 1 dB, it should be adjusted. Using a small screwdriver, this may be done through the hole in the front panel located between the Input and Output level controls.

3.3.3 GAIN REDUCTION CHECK

Turn the Attack control ON; gain reduction should be indicated. Observe the tracking between the indicated amount of gain reduction and the actual change in output (VU) level, as measured with an external meter. The tracking should be within ± 1 dB.

Selecting other compression ratios of the limiter will indicate some gain reduction in each setting, however the actual amount will vary due to the different threshold sensitivities.

3.4 APPLICATION

3.4.1 CONTROL SETTINGS

Since all important parameters of the Model 1176LN are variable, the instrument is flexible enough to be used in virtually all phases of sound processing, from recording of a single track to reproduction of the full program material. The limiter finds application as a creative instrument during production, as well as a device for automatic level control and protection against high amplitude problems.

There is no single correct setting of the controls; rather experimentation is necessary to find the best combination of compression ratio, attack and release time, and the amount of gain reduction for the job at hand. Experience will show that the dynamic parameters (attack and release time) have a stronger effect on the character of the program material than the static parameters (compression ratio and threshold).

3.4.2 EFFECTS OF COMPRESSION RATIO

A moderate form of gain reduction is achieved with ratios up to about 8:1. The dynamic range of the program material is controlled without obvious alteration. The average signal level will be increased and the softer passages will be made louder.

A more drastic gain reduction results from compression ratios of 12:1 and 20:1. The output signal level is limited, and for practical purposes cannot exceed a preset level. Dynamic range is significantly reduced, and high level peaks are minimized.

3.4.3 EFFECTS OF THRESHOLD

Changing the relationship of the average input level to the threshold will determine the amount of gain reduction, or how much of the signal envelope is affected by the limiter action.

If only occasional large-amplitude peaks are allowed to exceed this threshold, the program material remains very much the same. However, overload problems which would be caused by these peaks are eliminated. The result can be an increase in loudness because the operator can raise the signal level without adding distortion due to headroom limitations.

When the input is adjusted so that the average signal level is above the threshold all the time, then the entire program material will be compressed. Monitoring the amount of gain reduction is made easy when the meter function is switched to the "GR" mode.

3.4.4 EFFECTS OF ATTACK TIME

Fast transients and high frequencies with large peak-to-peak amplitudes can only be limited or compressed if a fast attack time is chosen. Then any overshoot and, with it, overload problems, are kept to a minimum. However, limiting with a fast attack time alters the musical quality of some instruments which are characterized by sharp percussive attacks.

A slow attack time will allow the first segment of fast amplitude changes to pass through the limiter unaffected. The limiter reduces gain after the initial envelope attack of the program material. Thus, slow attack maintains the "punch" of such percussive instruments as drum, bass, piano, guitar, etc. with some sacrifice of amplitude control.

The aim of the user in adjusting the limiter for the correct attack time then is to find the best setting for the task at hand. It may be a compromise between a permissible amount of initial peak-to-peak amplitude before full compression, and how much alteration of the program material is acceptable.

These general guidelines are mainly applicable when the 1176LN is used for the limiting of individual signal sources. For mixed program material, a middle-of-the-range setting will usually be a good starting point for additional experimentation.

3.4.5 EFFECTS OF RELEASE TIME

This control, too, may be set to accommodate different program material requirements. The best adjustment maintains a quick response of the limiter to dynamic changes of the signal while avoiding such affects as "pumping" or "breathing." Again, let us examine the behavior with some extreme settings.

If the Release Time is set very short, the limiter will return the gain reduction to zero every time the signal drops below the threshold. For low frequency solo passages, such as bass and drum, this can occur between cycles or individual notes and beats. We would hear the gain come up each time, and, with it, the softer passages or background noise. Extremely short release times may even introduce harmonic distortion if the gain reduction changes between cycles.

Setting the Release Time to a very long duration will maintain the initial gain reduction caused by a large amplitude, and the dynamic range of the passage which follows is strongly affected. If the gain reduction continues through a soft program section, it may make this section inaudible because it, too, will be reduced in gain. Also, short dynamic changes will be ignored due to the continuous high level of gain reduction.

The most desirable Release Time setting for particular program material can usually be found quickly by experimentation. Here, too, the effects of varying the adjustment are more obvious with individual signals, and less apparent with a full mix. As with the Attack control, a good starting point is half rotation.

3.5 PLACEMENT OF THE 1176LN LIMITER IN THE SIGNAL PATH

3.5.1 AFTER PREAMP

Small signals need to be amplified before they will cause proper operation of the 1176LN Limiter. Only signal levels which are above the threshold of the limiter can cause gain reduction. For example: In the 4:1 compression ratio, the lowest threshold is -30 dB. If the signal applied to the input is about -20 dB, then the 1176LN will provide a maximum of 10 dB compression with the Input Level control set to maximum. The sensitivity is high enough that it should not be difficult to obtain sufficient signal levels from most sources which supply the audio to be processed by the 1176LN.

This consideration is appropriate when the limiter is patched into the signal path at a point where individual inputs are to be controlled artistically before mixing (solo tracks).

3.5.2 EQUALIZATION, BEFORE OR AFTER THE LIMITER?

In most cases, better results are obtained if one places the limiter after the equalizer. This becomes evident when one considers that the equalizer could eliminate the amplitude balance so carefully achieved with the limiter. An exception to this would be in the case of large dynamic changes in program material that are too difficult for the equalizer to handle, and that would thus result in overload or a poor signal-to-noise ratio. Then the 1176LN should be used to condition the audio signal before it is applied to the equalizer or other device.

3.5.3 FULL PROGRAM MATERIAL

It is good to recall that the action of a limiter is most obvious when applied on the full program material because at this point one does not benefit from the masking that occurs when individually limited sources are mixed. Therefore, it is even more important to carefully select the dynamic parameters, like attack and release time, to achieve an optimum result. Here are some additional tips:

On live program material, the fastest attack time possible will afford the maximum protection against overload, but will cause some alteration of the sound. On pre-recorded tape, disc or film, slower attack time may be used to maintain a high average level.

For program material containing relatively little low frequency energy, the release time may be fast, thereby increasing the short interval average level. The highest apparent average level may be attained with the shortest release time before "pumping" becomes objectionable. For program material containing more than average low frequency energy, the release time must be increased to the point that no low frequency distortion is apparent. A further compromise may be made by slightly reducing the amount of limiting action in favor of slightly faster release time: the result -- a higher average level.

Adjustment of the Attack Time control also affects the amount of sibilant speech sound. These high frequency components in speech are normally at much lower level than the low frequency components, and the control voltage derived from sibilants alone is much less than from the "vowel" or low frequency sounds. In cases where attack time is extremely slow, the rise time and amplitude of the high frequency sibilants will not cause control voltage to be developed until the "vowel" energy envelope occurs. This results in the full gain applied to the sibilants and reduced gain to the vowels, creating an exaggerated sibilant sound. Again, experimentation is the best tool.

3.5.4 PRIOR TO OUTPUT AMPLIFIER

Here the limiter fulfills mainly the function of protection. Most equipment which is fed from the low level signal path's output terminal is sensitive to amplitude overload; the power amp's peak-to-peak headroom, the saturation point of recording tape, the modulation allowed in a transmitter, the amplitude handling capability of film recording devices, etc.

If one were to summarize the ideal operation of a well adjusted limiter, one could say:

"It should afford infallible protection against overload, while maintaining the highest level, contribute no apparent degradation to the dynamic range which might subjectively affect the artistic value of the program, and, at the same time, maintain the individual quality of all sounds, regardless of their starting transients."¹

3.6 STEREO INTERCONNECTION OF TWO 1176LN UNITS

To calibrate the accessory 1176SA Stereo Adapter, first remove signals from both limiters, and disable gain reduction by rotating the Attack controls fully CCW. Connect the 1176SA to both limiters. Set the meter function switches for "GR" mode. Adjust the Meter Zero adjustment on the 1176SA until both meters read zero. If the meters cannot be zeroed, reverse the stereo interconnect cables, and the meters can then be zeroed.

The same compression ratio should be selected in both units. Also, the limiters should be set up separately for threshold and output level before being linked together for stereo operation. When two 1176LN limiters are interconnected, the Attack controls on both units will interact, as will the Release controls. Since the timing capacitors are in parallel, the fastest attack time will be double that of a single unit. Attack time on either limiter can be separately adjusted to control both units. Maximum release time is the same as that of a single unit. A good procedure would be to set the Release control on one 1176LN to maximum, and use the Release control on the other unit to control release time.

A given pair of 1176LN's will normally track properly through at least 10 dB of gain reduction. In some instances, transconductance of the two VVR FET's (Q1) will differ to the extent that equal gain reduction will not be obtained as limiting is increased. This condition is more apt to be present in 1176LN's with widely different serial numbers, as FET's within the same factory production run are normally quite well matched. Should this anomaly be observed, it will be necessary to select FET's for Q1 which match more closely in transconductance. This is better done at the factory.

1. Ref. M.T. Putnam, Audio Engineering Society paper, Spring, 1967.

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 amplifier 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 performed 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. 2. Device in full limiting. 3. Loose or broken wires between PC board and front panel controls or barrier strips. 4. Incorrect hookup. 5. Bad amplifier section.	Check supply voltages. Remove Q1. If signal passes, go to problem of "full limiting". Isolate and resolder. See Section II, Installation. Repair.
No limiting.	1. Limiting switched OFF. 2. No compression ratio button is depressed. 3. Input level is below threshold. 4. "Q" Bias misadjusted. 5. GR amplifier defective. 6. Wire from Attack control to R7 is open.	Turn Attack control CW. Select desired ratio. Increase input signal level. Adjust (¶ 5.3.2). Repair. Repair.
Always in full limiting.	1. Shorted GR bus. 2. Negative supply voltage. 3. "Q" Bias misadjusted. 4. Contaminated PC board.	Check wiring; check stereo interconnect; unplug 1176SA. Replace zener diode and realign. Adjust (¶ 5.3.2). Clean (¶ 5.5).
Hum through output. (Continued on next page)	1. Ground Loop, etc. 2. Failure to unbalance output transformer into unbalanced load.	See Section II, Installation. Ground "COM" to chassis.

TABLE 5-1. TROUBLESHOOTING (Continued)

PROBLEM	POSSIBLE CAUSE	REMEDY
(Hum through output)	3. Mounted too close to strong EMI field. 4. Power supply.	Relocate unit. Check filter caps.
Distortion (during no limiting mode).	1. Power supply voltage. 2. Input level too high. 3. Defective output amp.	Repair as needed. Adjust. Repair.
Distortion (during limiting).	1. "Cracking" sound on attack. 2. Low frequency distortion.	Attack set too fast or check Q-Bias (¶5.3.2). Select slower settings of Attack and/or Release controls.
Release control changes the output level.	1. Contaminated PC board. 2. Diodes CR3, CR4 leaky. 3. Caps C19, C20 leaky. 4. Attack pot R77 faulty.	Clean (¶ 5.4.4). Replace with Fairchild FD 333. Replace, 6.8 μ f, 35V. 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. 2. Dirty switch assembly.	Repair. 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 pollutants 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

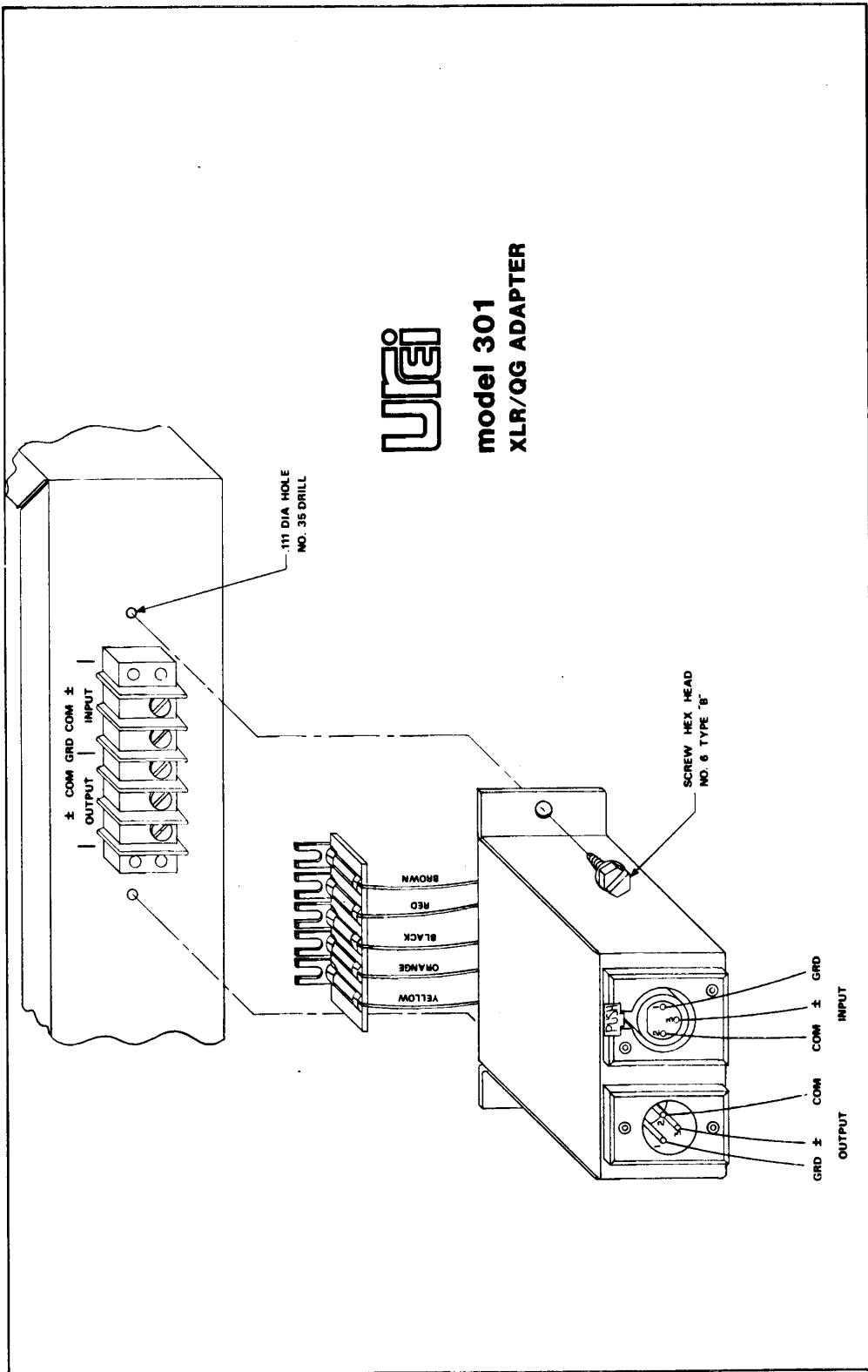


FIGURE 6-1. MOUNTING INSTRUCTIONS FOR MODEL 301.

1. Visual Inspection

Conditions: This inspection must be done before any tools or setup are applied to the product.

Test: Check to make sure the front panel and meter face are free from scratches, stains, discolorations, silkscreen errors, etc.. See that all appearance parts are properly aligned and free from defects in their appearance and functional behavior. Also check to see that there is no loose hardware and that all workmanship standards for soldering have been met.

Inspect all the power supply electrolytic capacitors and diodes along with all the product's i.c.'s to be installed with the correct polarity BEFORE turning the unit on. Also check the fuse value to be 250 volts, .25 amps, 3AG slow blow.

If any of the above requirements are not met send the unit to be reworked and notify the leadperson who delivered the products to the test department of the unit's failure.

2. Power Supply

CAUTION: DO NOT lean over the product when the power is first applied if the top cover is off the unit. Be ready to quickly turn off the power if a destructive condition should manifest itself.

Conditions: No input signal and no output load on the unit.

Set the line voltage with an autotransformer to 120 Vac.

Test: Place a d.c. voltmeter probe on the input to the power supply regulator VR1 and then switch on the power to the unit. Measure the voltage to be according to the following table along with all other specified measurements and tolerances.

Test Point	d.c. Voltage	Tolerance
input of VR1	+40.5	+ or - 1.5 Volt
anode of CR6	-10.0	+ or - .5 Volt
output of VR1	+30.0	+ or - 1.0 Volt
+ terminal of C15	+14.0	+ or - 1.0 Volt

Place a d.c. voltmeter probe on the input to the VR1 regulator and switch the line voltage switch, on the back of the unit, to the 230 position. Measure the voltage to be approximately +19.5 Vdc. Remember to set the line voltage switch back to the 115 position.

Vary the line voltage level with the autotransformer from 100 Vac to 140 Vac and measure the difference between these two voltage levels at the output of VR1 to be no more than 500 millivolts. Also, check to make sure that the red power LED is properly illuminated when the power is switched on.

Note: For all the following tests that do not involve limiting be sure to have the Attack pot switched off in the full counterclockwise position.

Conditions: No input signal or load on the output.
Set the line voltage with an autotransformer to 120 Vac.

Test: Measure the input power of the unit at it's line cord to be less than 10 watts. If a power meter is not available then the average power can be determined by measuring the r.m.s. voltage and the r.m.s. current, and multiplying their product by the cosine of the phase angle between them.

4. Gain

Conditions: No load on the output.
Input and output pots full clockwise.

Test: Apply a -25 dbu, 2 kHz input signal then measure the output level to be within +1 or -1 dbu of +22 dbu.

Note: Units without their FET's will have this gain however units that have been properly biased and have the limiting switched off will have approximately 1 db less gain.

5. Common Mode Rejection

Conditions: No load on the output.
Input pot full clockwise.
Make sure the reference signal does not clip.

Test: Apply a -10 dbu, 2 kHz input signal and set an output reference level with the output pot. Connect the signal to both the + and - input terminals at the same time then adjust trimpot R2 for a minimum output level. Measure the output level at 60 Hz and 20 kHz to be more than 70 db below the 2 kHz reference level that was set before tying the + and - together.

6. Input Impedance

Conditions: Use an a.c. voltmeter with an input impedance > 1 M Ω .
The shield and common wires on the input must not be shorted to each other or to any ground.

Note: This test requires two 10 k Ω , 1% resistors in series with the input of the 1176LN. One from the (+) output of the generator to the (+) input terminal of the 1176LN, and another in series from the (-) terminal of the generator to the (COM) input terminal of the 1176LN.

Test: With the 1176LN disconnected from the series resistors, place the a.c. voltmeter on the output of the 10 k Ω source resistors and set the generator for a reference level of 0 dbu at 2 kHz. Connect the input of the 1176LN to the output side of the source resistors and see that the level drops 6.0 db with + or - .25 db tolerance.

Conditions: Square wave generator is needed for this test.

No load on the output.

Make sure the reference signals do not clip.

Test: Place an a.c. voltmeter directly across the + and - output terminals of the limiter and set a reference level of +20 dbu at 2 kHz using a sine wave. Connect a 600 Ohm resistor and see that the level drops .55 db with + or - .1 db tolerance.

Set the sine wave generator for an output reference level from the limiter to have a +10 dbu output at 2 kHz with no load. Connect a 150 Ohm resistor and see that the level drops 2 db with + or - .1 db tolerance.

Apply a 2 kHz square wave to the input of the limiter and check the output waveform on an oscilloscope to have no ringing on either the positive or negative tops after the leading and trailing edges. This should be done using no load and a 600 Ohm load on the output.

Note: The load resistors should have at least a .5 watt rating with a 1% tolerance on their values of resistance.

8. Frequency Response

Conditions: Make sure the reference signal does not clip.

600 Ohm load on the output.

Test: Apply a 2 kHz input signal and set an output reference level of 24 dbu. Sweep the signal generator from 20 Hz to 20 kHz and check to see that the output level changes no more than +.5 db and -1 db from the reference level.

Increase the frequency of the input signal until the output level drops to 3 db below the reference level then measure this frequency to be approximately 55 kHz with + or - 10% tolerance.

Note: Be sure to monitor the input signal level so as to insure that the reference input level does not vary. Some generators need to settle, especially at low frequencies, before a measurement can be made.

9. Maximum Input and Output Levels

Conditions: Input pot full clockwise.

150 Ohm load on the output.

Test: Apply a -10 dbu, 2 kHz input sine wave signal then adjust the output pot so that the signal just starts to clip. This level should be greater than 20 dbu.

Set the input pot so that the output level drops 40 db. Increase the input signal until the output waveform shows clipping then measure the input signal to be greater than +20 dbu (7.75 Vrms).

Conditions: Trimpot R81 full counterclockwise.

Attack pot full counterclockwise. (Switched off.)

Release pot full clockwise.

Ratio switch set to 20:1.

Test: Apply a -10 dbu, 2kHz input signal and adjust the input and output pots for a 10 dbu output reference level. Adjust R81 so that the output level drops exactly 1.0 db.

Note: If the FET (Q1) is installed in the 1176LN then it is necessary to remove it after setting a reference level in order to make sure that it is not conducting and thereby giving a false reference level.

After it is determined that there is no change in level then the FET should be reinstalled for the calibration to be made.

11. Meter Calibration

Conditions: 600 Ohm load on the output.

Attack pot full counterclockwise. (Switched off.)

Release pot full clockwise.

Ratio switch set to 20:1.

Set the meter switch to the GR position.

Test: Before power is applied to the unit make sure the mechanical zero adjustment on the face of the meter is set on the mark just below the -20 Vu on the meter then apply a 2 kHz, -10 dbu input signal and set an output reference level of 10 dbu with the input and output pots. Set trimpot R55 (through the hole in the front panel) so that the meter on the 1176LN reads exactly 0 Vu.

Switch the attack pot full on and use the output pot to set an output level at 0 dbu then switch the attack pot full off and use the input pot to set an output reference of 10 dbu. Repeat this process until there is exactly a 10 db drop from the 10 dbu reference level when the attack switch is full on.

With the attack pot full on set the trimpot R54 for exactly a -10 db Vu on the meter on the 1176LN. Switch the attack off and reset 0 Vu with R55 then keep repeating this on/off calibration until it is no longer needed (usually 2 or 3 times).

Apply a 2 kHz, -10 dbu input signal and set an output reference level of 4 dbu with the output pot. Set the meter switch to the +4 position and see that the meter on the 1176LN reads 0 Vu within + or - .5 db. Repeat this setup for an output level of 8 dbu and the meter switch set to the +8 position.

Check to make sure that the lamps inside the meter of the 1176LN have the proper illumination and that they are matched in brightness to each other. Also the needle in the meter should have smooth motion throughout its range of operation.

Conditions: 600 Ohm load on the output.
600 Ohm terminator on the input terminal.
Input and Output pots full clockwise.

Test: Using a 30 Hz to 15.7 kHz bandpass pass filter on the input of an a.c. voltmeter measure the output level of the limiter to be less than -57 dbu. Rotate the input pot full counterclockwise and measure the level to be less than -63 dbu.

Use an oscilloscope that is triggered on the line frequency and set for 5 mSec/div to measure the output of the voltmeter. Look for a continuous white noise level that has no more than 1 db jumps in level. There should be no burst (popcorn) noise and maybe only small level spikes (60 and/or 120 Hz) induced from the power transformer.

Note: The bandpass filter that is specified in this test has slope rates for the high pass and low pass sections of 6 db/octave.

Also the specification sheet says that there must be greater than 81 db signal to noise ratio at the threshold of limiting. This number is calculated by adding the limiter's gain to the absolute value of the noise level and then subtracting the amount of the difference of 0 dbu and the threshold of limiting. Typically however, given the limit of -57 dbu and the threshold of limiting for the 4:1 ratio setting is specified at -30 dbu the s/n ratio will be 74 db. This improves at the 20:1 setting with the specified threshold at -24 dbu and therefore a s/n ratio of 80 db.

13. Ratios

Conditions: 600 Ohm load on the output.
Attack pot full counterclockwise. (Switched off.)
Release pot full clockwise.
Ratio switch set to 20:1.
Set the meter switch to the GR position.

Note: The meter on the 1176LN will have to be calibrated before this test is done in order to determine the 1 db of limiting point easily.

Test: Apply a 2 kHz, -10 dbu input signal and set an output reference level of 10 dbu with the input and output pots for each channel. Set the attack switch full on and set the 1176LN into 1 db of limiting using the meter on the limiter. Also, set an output reference level with the output pot.

Use the above setup for each of the ratio settings of 20:1, 12:1, and 8:1. The 4:1 ratio setting will need to be set for 3 db of limiting because of the soft knee in the threshold circuit for this ratio. A new output reference level must be made for each new ratio setting.

Increase the input signal 20 db and see that the output level will increase, from the new output reference level that must be set for each ratio, 1 db, 1.66 db, 2.5 db, and 5 db for each ratio setting respectively with a 20% tolerance for each ratio setting. Repeat this setup and test using 20 Hz and 20 kHz input signals. The 20 Hz test will need to be done with the release pot in the full CCW position.

Conditions: Tone Burst generator is needed.

Attack pot full counterclockwise. (Switched off.)

Release pot full clockwise.

Ratio switch set to 20:1.

Set the meter switch to the GR position.

Test: Apply a 2 kHz, -10 dbu, sine wave input signal and set an output reference level of 10 dbu with the input and output pots for each channel. Set the attack full on and adjust the 1176LN for 10 db of limiting. Set an output reference level with the output pot.

Apply a tone burst signal that has the same amplitude as the sine wave setup signal along with a gated output of a duration of 1 msec on and 1.5 seconds off and that also has several cycles of a 20 kHz signal. With an oscilloscope measure the time duration from the peak amplitude on the leading edge of the gated signal to the smallest amplitude (which should be the same as the reference level) to be less than 20 usec when the attack pot is full clockwise and greater than 800 usec when the attack is counterclockwise (but not switched off).

Repeat the sine wave setup above with 10 db of limiting. With an oscilloscope measure the time duration for the signal level to increase to 63% of the final amplitude of the output signal after quickly switching the input signal down to -30 dbu to be no less than 50 msec with the release pot full clockwise and no greater than 1.1 seconds when the release pot is full counterclockwise.

Note: For best resolution of the measurement use the full scale grid of the oscilloscope for the amplitude measurement.

A square wave generator can be used to determine that the attack and release circuit is working by using a 20 Hz input signal with about 10 db of limiting however this method should only be used to compare a known good unit to the device under test but the accuracy of the measurement is not precise.

If this measurement technique is used then it should be observed that when the release pot is full counterclockwise that the amount of difference in the leading edge overshoot, when the attack time is tested through the full range of the pot, will be the greatest and therefore the best means for measuring. When the release time is tested through the full range of the pot there should be a substantial difference in the amplitude and tilt of the square wave.

15.. Ratio Switching Envelope

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Conditions: 600 Ohm load on the output.

Attack pot full counterclockwise. (Switched off.)

Release pot full clockwise.

Ratio switch set to 20:1.

Set the meter switch to the GR position.

Test: Apply a 2 kHz, -10 dbu input signal and set an output reference level of 10 dbu with the input and output pots. Set the attack switch full on and set the 1176LN into 1 db of limiting using the meters on the limiter. Also, set an output reference level with the output pot.

Set the ratio switch to each of the 12:1, 8:1, and 4:1 settings and see that the output level drops 1 db, 1.5 db, and 2.5 db for each setting respectively. Increase the input signal 20 db and measure the maximum difference in output levels for all ratio settings to be less than 1.5 db.

16. Total Harmonic Distortion

Conditions: Attack pot full clockwise.

Release pot full counterclockwise.

Ratio switch set for 20:1.

600 Ohm load on the output.

Test: For each input signal of 30 Hz, 200 Hz, 2 kHz, and 15 kHz measure the THD at 1 db below clip to be less than .3% if Q1 is removed from the unit. When Q1 is in the 1176LN and it is biased correctly the THD is typically less than .3% when the limiting is switched off. The specification for distortion is from 50 Hz to 15 kHz in limiting at any level up to rated output to be less than .5% THD.

Note: Since the amount of limiting was not specified, and the THD is a function of the amount of limiting, then an amount of 5 db of limiting is what could be used for a typical real world measurement.

Make sure that the signal generator that is used has distortion less than .01% in order to insure an accurate measurement.

17. Threshold of Limiting

Conditions: Input, attack, and release pots full clockwise.

Ratio switch set for 20:1.

Meter switch set for GR.

Test: Apply a -20 dbu, 2 kHz input signal and see that the meter on the 1176LN is showing limiting. Decrease the input signal to the point where the meter is showing only -1 db Vu reading and measure the input signal at this point to be -24 dbu, with + or - 2 db tolerance. Change the frequency of the input signal to 20 Hz and 20 kHz and see that this threshold remains at the same level.

Repeat this test for the 12:1, 8:1, and 4:1 ratio settings that have -25 dbu, -26 dbu, and -30 dbu thresholds of limiting respectively with + or - 2 db of tolerance for each setting.

Note: It is important that the meter on the 1176LN has been calibrated and tested before this test is done.

Conditions: Attack pot full clockwise.
Release pot full clockwise.
Ratio switch set for 20:1.
Meter switch set for GR.

Test: Apply a -10 dbu, 2 kHz input signal and adjust the input pot so that there is 5 db of limiting (use the meter on the 1176LN) then use a hot moist breath for about 5 seconds on Q1 and see that there is no change in level.

Note: The hot breath can be produced by keeping your mouth wide open and gently forcing air from your throat. Also if a change in level does occur after the moist air is applied it is probably due to flux residues from the soldering process and should be cleaned with an isopropyl alcohol and distilled water solution with a 75% alcohol to 25% water mixture.



Calibration Instructions for the UREI type 1176LN peak limiter

1. Inject .775 Volts, 1 KHz into the limiter.
2. Turn Trimpot R 81 full CCW.
3. Set input and output level controls of the 1176 LN to "24" (mid rotation).
4. Set attack control full CCW and release control full CW, meter to "GR" and compression ratio to 20:1.
5. Adjust output control for a reading of +11 db (re.775V) as read on an external meter.
6. CAREFULLY adjust R 81 for an output of +10 db.
7. Set attack control full CW.
8. Set output control for 0 db (re .775V) as read on the external meter.
9. Set attack control full CCW.
10. Set input control for +10 db as read on the external meter.
11. Set attack control full CW.
12. Set output control for 0 db as read on the external meter.
13. Repeat from step #9 until a swing of +10 db/0 db is achieved.
14. Set attack full CCW, and meter to "GR".
15. Adjust the front panel trimpot (accessed through a hole located between the input and output controls) until the internal meter reads zero.
16. Set attack control full CW.
17. Set R 54 until the internal meter reads -10 db.
18. Set attack control full CCW.
19. Adjust the front panel trimpot for zero.
20. Repeat from step #16 until the internal meter reads zero and -10 with the attack control CCW and CW respectively.
21. Set attack control full CW.
22. Set meter switch to "+4" and confirm that the internal 7meter reads -4 db.
23. Set meter switch to "+8". The meter should read -8 db.

**METER CALIBRATION
1176
WITH DISCRETE COMPONENTS
IN METER CIRCUIT**

SETUP:

NO SIGNAL

DISCONNECT R44

CENTER (NULL) POT. R75

VOLTMETER ACROSS R74

CALIBRATION:

- (A) ZERO 1176 "GR" METER WITH R71(THRU FRONT PANEL ZERO ADJ.)
- (B)ADJUST "NULL" POT. FOR .00 VOLTS ACROSS R74. REPEAT A AND B UNTIL BOTH CONDITIONS ARE MET.)
- (C) ADJUST LIMITER FOR 10DB OF LIMITING, AS INDICATED IN THE 1176 CALIBRATION INSTRUCTION.
- (D) SELECT RESISTOR R44 FOR CORRECT TRACKING, IT MAY BE NECESSARY TO REPEAT STEPS A, B, C TO FINE TUNE THE CIRCUIT.

C98 + C15 3W 1176
 3 Power Supply +30 +14 -10 220-115V

② GAIN \approx 25 IN +20 OUT (± 2 dB) mes $\approx 72 \frac{1}{2}$ dB

3. CLIPPING $\approx \pm 27 = 25$ dB

4. Freq Resp & DIST +23dB 20-20KHz ± 1 dB -3%

5. CMRR ≈ -70 dB

6. NOISE ≈ -60 dB $\frac{\text{in}}{\text{out}} = -55$ dB mes ≈ -61 dB

7. $\frac{\text{in}}{\text{out}}$ $\frac{\text{out}}{\text{in}} = -10$ IN 1KHz

$$\text{Ov} = +11 \text{dB output}$$

with R81 turn cw until output drops 1dB (≈ 10 dB)

SW. ATTACK POT $\frac{\text{out}}{\text{in}}$ note 10dB limiting (if not adjusted with meter pot)

FOR SW. ATTACK POT OFF $\frac{\text{out}}{\text{in}} +10$ adjusted with $\frac{\text{input}}{\text{pot}}$

8. with (R55 hole on F.P.) adjust meter to "0"

ATTACK POT $\frac{\text{out}}{\text{in}}$ meter should read -10dB starting

if not adjusted with R54 check several times

9. MEASURE VOLTAGE ON WIPER AT R81 should read $\frac{-1.5}{+1.5} \text{ TO } 2 \text{ V}$
 $\frac{-7}{+7} \text{ TO } 2 \text{ V}$

10. CHECK ± 4 , ± 5 dB $\frac{\text{in}}{\text{out}}$

± 8

10. ADJUST INPUT TO 10dB LIMITING AND OUTPUT TO ± 15 dB.

MEASURE THE AC VOLTAGE OF $\frac{\text{in}}{\text{out}}$ MUST BE SYMMETRICAL
 ≈ 4 VRMS $\text{CIN} \frac{\text{out}}{\text{in}}$ $\text{COUT} \approx 1.5$ V

(2)

10. ~~10dB~~

20

Attack pot

Q

GR. -10dB 1kHz +10dB

OUTPUT adjusted with output pot

with input pot adjust meter on unit to read -1 (1dB limiting)

$$12:1 \text{ Meter} = -2 \text{ dB} \quad (2dB)$$

$$8:1 \text{ Read} = -2\frac{1}{2} \text{ dB} \text{ within } 1dB \text{ limit}$$

$$4:1 \text{ (UNIT)} = -4 \text{ dB} \quad 4.$$

11. WITH OUTPUT POT decrease out 1dB - Now should see +9dB
INCREASE INPUT 20dB 20:1 = 9.9dB

$$1dB \text{ limiting attack pot } 12:1 = 9.3dB$$

$$19 \text{ out - output pot } 8:1 = 9.2dB \quad 9.4$$

$$\text{attack pot } 4:1 = 9.5dB$$

12. 500Hz -10dB IN 10dB limiting

ATTACK

RELEASE

Q

12. 500Hz -10dB IN 10dB limiting 20:1

ATTACK RELEASE

+10dB OUTPUT with R16 ADJUST DIST. TO MINIMUM TIME .25s
 $\approx .088$

.15

CONTAMINATION

13. ATTACK OFF meter +4 (meter on unit F.P.) = 0. Breathe on

Q1

names

20:1 $\approx 10.1dB$ 12:1 $\approx 10dB$ 8:1 $\approx 10.2dB$ 4:1 $\approx 11dB$

100% 20dB 50% limiting

20dB released

INSTALLATION INSTRUCTIONS

UREI 1176 SA

STEREO ADAPTOR

The 1176 SA Stereo Adaptor is used to couple two UREI Model 1176 Limiting Amplifiers, to permit equal gain reduction in both channels of a stereo transmission when a peak occurs in either channel. Complete audio isolation is maintained between the two channels. This type of limiting is desirable in stereo FM broadcasting to prevent transmitter overmodulation without shifting the aural placement of point source sounds.

MOUNTING INSTRUCTIONS

The two 1176 Limiters which are to be coupled for stereo operation should preferably be mounted in immediately adjacent locations in rack or enclosure. If they must be separated, longer coupling cables of a type similar to those furnished with the 1176 SA will have to be provided.

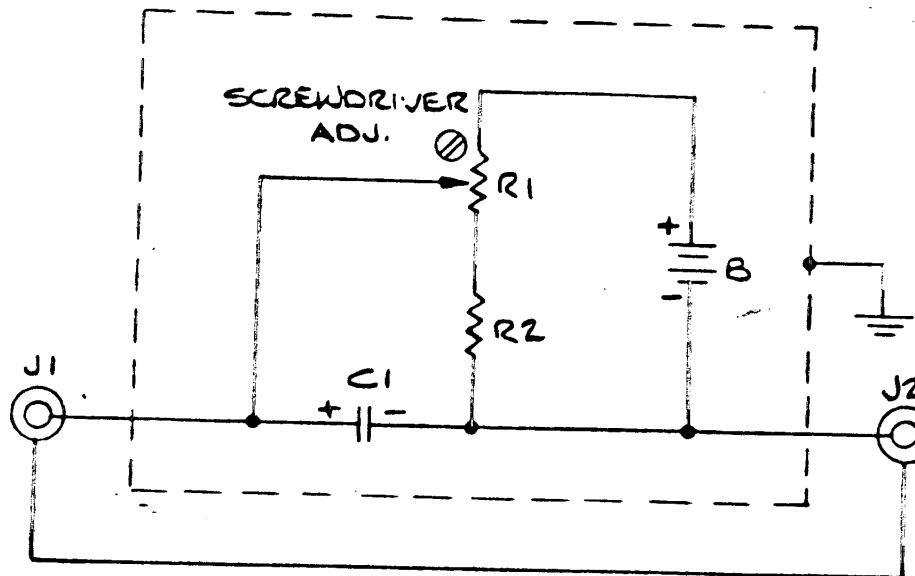
The 1176 SA can be affixed to the rear of the chassis of either 1176 (or to any other adjacent flat, smooth surface) by means of the pressure-sensitive adhesive on the back of the adaptor. A suggested location is in the rear center of the 1176, directly above the words "United Recording Electronics Industries".

- A. Remove green protective paper from adhesive by inserting fingernail under one corner. Do not touch adhesive with fingers, as oil will adversely affect its bonding ability.
- B. Locate the Adaptor box carefully over the area where it is to be mounted, then press the adaptor firmly to the surface. This must be done accurately, for the position of the 1176 SA cannot be changed after contact without destroying the adhesive coating.
- C. Insert one end of each of the two shielded cables into the jacks on the Adaptor, seating the connectors securely. Connect the other ends to the two limiters by inserting the connectors into the jacks marked "1176 SA" on the extreme right rear of the chassis.
- D. Follow the calibration procedure outlined in the 1176 Limiting Amplifier instruction manual.

The NEDA 15M mercury cell installed in the 1176 SA at the factory provides a reference bias only, and should last the shelf life of the battery, which is approximately 18 months. We suggest, however, that as part of your preventive maintenance a fresh cell be installed every six to nine months.

To replace the cell, remove the front plate assembly from the 1176 SA by removing the four Phillips screws. Observe correct polarity when inserting the fresh cell. Replace assembly and rebalance the system with reference to the Limiter Instruction Manual.

UNITED RECORDING ELECTRONICS INDUSTRIES
8460 San Fernando Road
Sun Valley, California 91352



BILL OF MATERIALS

NO REQ	MFGR & PART NO	DESCRIPTION	ID
1	OHMITE CL1041 OR EQUIV.	POTENTIOMETER 100K- Ω , LINEAR	R1
1	RESISTOR 150K Ω , 1/2W, 5% 82K 510 1/2W		R2
1	HOLLAND 111 OR EQUIV.	CAPACITOR 80 μ F, 125V. 100MF 1/2A 25V	C1
1	EVEREADY E-9 OR EQUIV.	PENLIGHT MERCURY NEDA 15M, (1.4V)	
1	KEYSTONE 139 OR EQUIV.	BATTERY HOLDER (FOR B)	B
2	SWITCHCRAFT 3501FP	PHONO JACKS ~ OR EQUIV.	J1, J2
1	OLSON ELECTRONICS CA-356 OR EQUIV.	PLASTIC BOX W/ ALUMINUM COVER (SEE NOTES 1 & 2)	
1	UREI B-1082G	SHIELD	
4		MAGNETS 1x3/4x3/16"	DOUBLE STICK TAPE
2		4-40x3/16" BHMS	
1		6-32x7/16" BHMS	

NC

1. ALUP DRIL
2. ALUP DALK
3. ASSE
4. J1 ~

UREI MODEL 1176 PEAK LIMITER REVISIONS LOG

<u>SERIAL NUMBER</u>	<u>"REVISION"</u>
101 - 216	REV A
217 - 1078	REV B
1079 - 1238	REV C
1239 - 2331	REV D
2322 - 2610	REV E
2611 - 7052	REV F
7053 - 7651	REV G
7652 onwards	REV H
	REV J
	REV K

1176 A

ORIGINAL TYPE SN 125-216
FET INPUT AMPLIFIER
OR FET GATE COUPLED TO INPUT,

1176 B TWO TRANSISTOR INPUT AMPLIFIER

POWER TRANSFORMER MAY BE ONE OF TWO TYPES
PT 5101 OR 4A861A

3.16.76
REVISED FET COUPLING TO FEEDBACK OF
PREAMP.

1176 LN ("C") BLACK FRONT PANEL

4.17.6
L-N MODULE ON 1176 "B" P.C. BOARD

BOOTSTRAP CONNECTION FOR LOWER 3RD HARMONIC
DISTORTION

LOWER 3RD BY 5dB -

LOWER GR SENSITIVITY BY 5dB

LOWER NOISE BY 3dB.

NO SCHEMATIC EXISTING.

1176 LN "D"
1239 → 2332 INCORPORATES L-N MODIFICATION ON
P.C. BOARD

CHANGE TO 13-0027 FET,

POWER TRANSFORMER PT-983.

GROUNDING POWER CORD,

METER LIGHTS,

1176 LN "E"
332 → 2610 10 M RESISTOR ON RATIO SWITCH,
11754 POWER TRANSFORMER,
115-230 SWITCH.

1176 LN "F"
OP AMP FOR GR METER CIRCUIT
16-11148 OUTPUT TRANSFORMER
DIFFERENT OUTPUT AMP.

1176 LN "G"
BRIDGING INPUT
THRESHOLD LOWER BY 6dB,
LOWER NOISE WITH INPUT CONTROL
BELOW 3/4
1C VOLTAGE REGULATOR IN POWER SUPPLY.

1176 CN(6) CONT'D)

OUTPUT TRANSFORMER LOADED AND
OPTIMIZED TO OPERATE INTO LOAD OR
NO-LOAD.

JUMPERS FOR CHANGE TO EUROPEAN
60 OHM OUTPUT IMPEDANCE.

1176 CN "H"

NEW LOOK FRONT PANEL

BIGGER VU METER

IEC POWER CONNECTOR

HISTER TERMINALS REMOVED

1176 I

12614 OUTPUT TRANSFORMER

356 I C FORMER DRIVE

NO MODIFICATION NECESSARY FOR
EXPORT OUTPUT IMPEDANCE,

ORIGINAL 1176
SER 101-125

REVISED
A REVISED TO DATE
PROJECT

BRUSHED
ALUMINUM

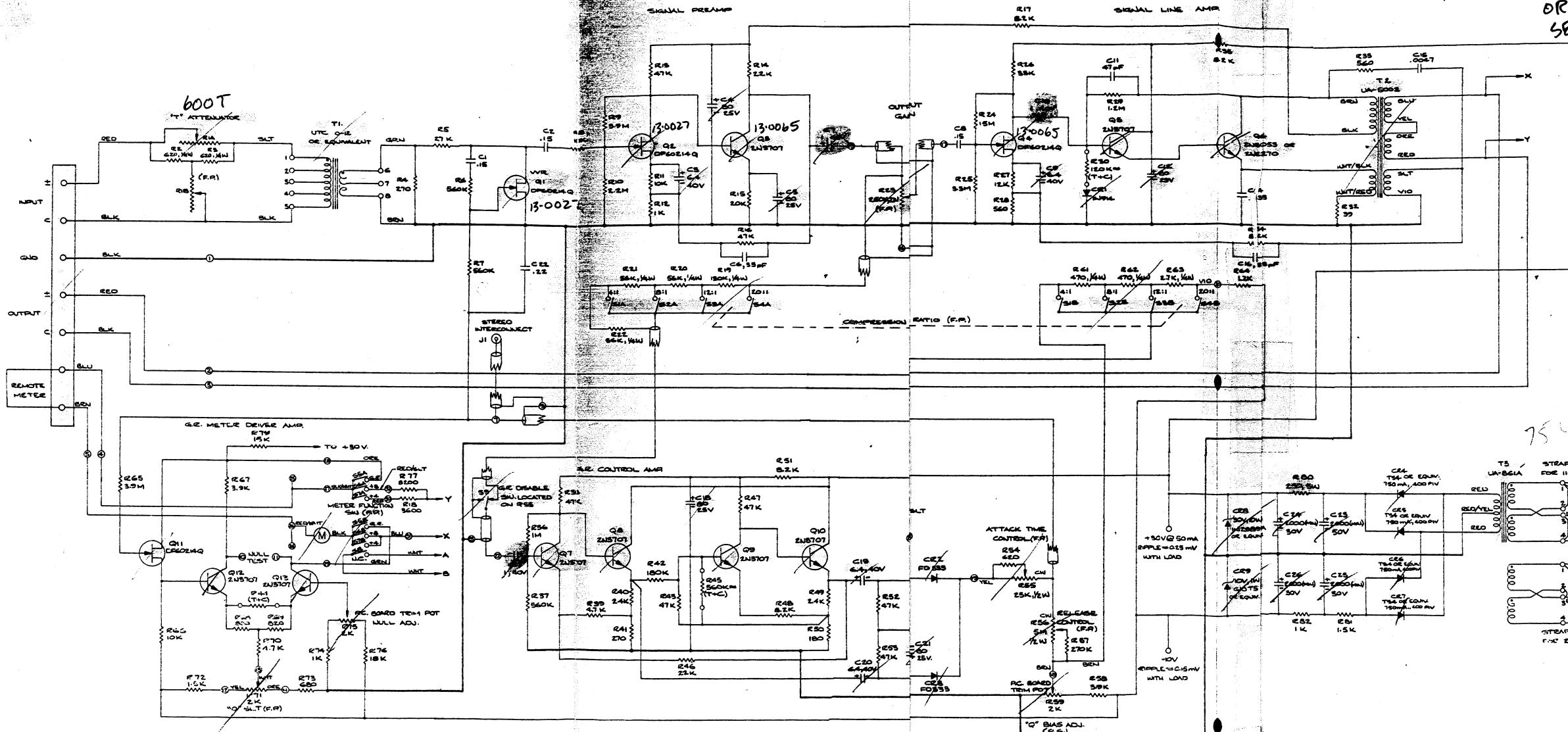
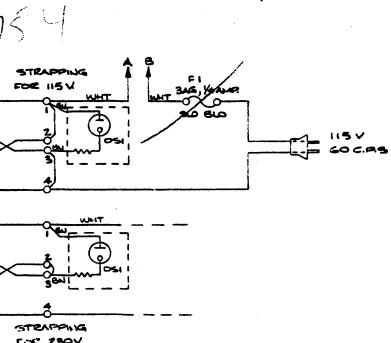
DWA #~~10674~~-10747/10747
NO LONGER AVAILABLE
USE 26-11113 - SPECIAL
ORDER 6 WK LEAD TIME

REPLACE 14F ELECTRICAL
WIRE 14F MILSPEC

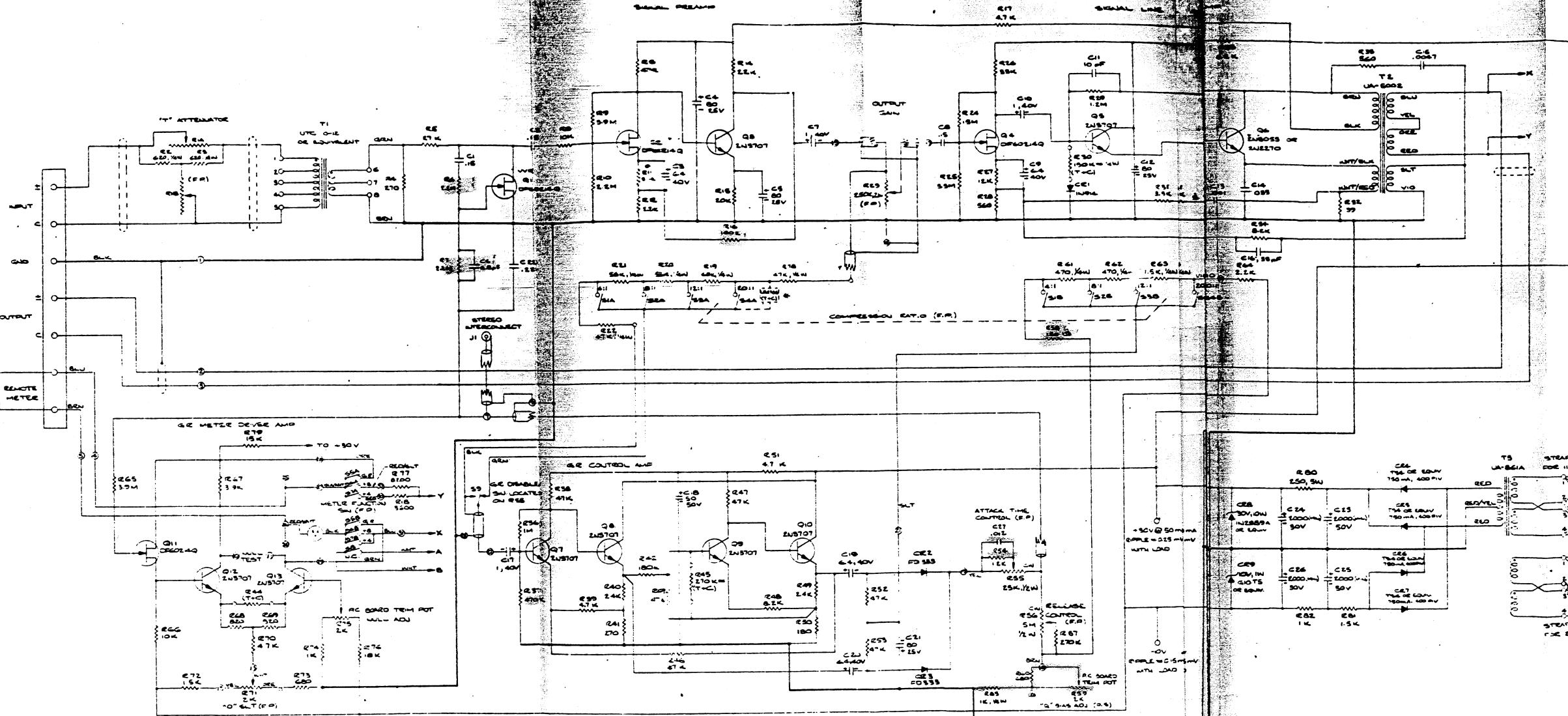
NOTES:
1. Q1 & II - SELECTED
Q5 & C - MATCHED TO LOW & HIGH H.F.E.
Q7, 8, 9 & 10 - H.F.E. 250 OR ABOVE
Q12 & 13 - IDENTICAL H.F.E. ± 10%

2. UNLESS OTHERWISE NOTED:
ALL RESISTORS VALUES IN OHMS, 1/2W, 5%.
ALL CAPACITORS VALUES IN MICROFARADS.
ALL SWITCHES NORMALLY OPENED.
3. PARTS LOCATED AT FRONT PANEL ARE
MARKED FR.
4. LINE VOLTAGE RANGES: 100V - 130V
200V - 260V

5. PARTS LAST OMITTED
R R22 260, 276
C C24
C25
CR9
Q Q15



REV "A"



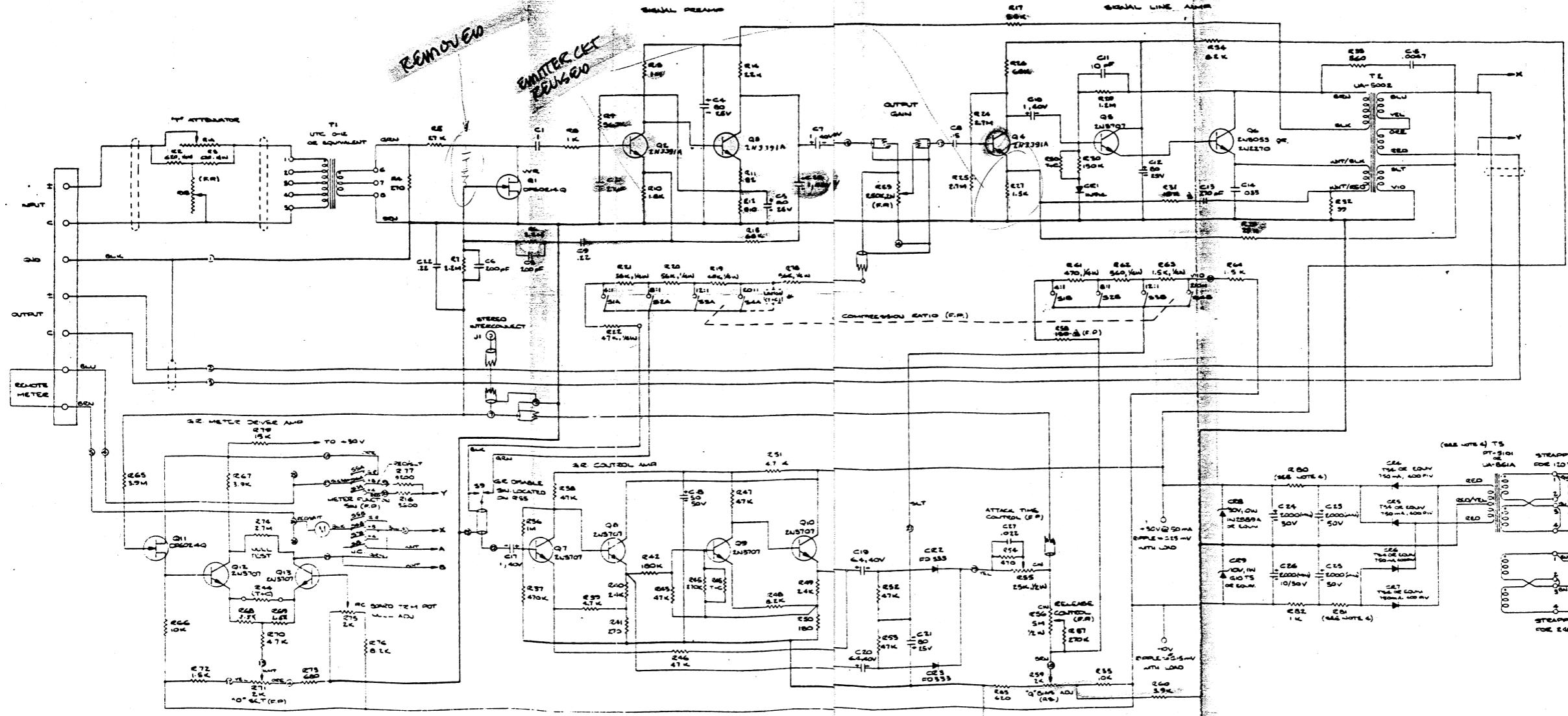
SER# 125 → 216

NO SIGNIFICANT
PARTS
CHANGES

GET CHANGES
THIS REV

PINS/OUTS		
1	DESCRIPTION	DATE
2	CHANGED TO DATE	REvised
3	CIRCUIT REVISED	1974

REV "B"



CHARGES		
ITEM	DESCRIPTION	DATE
▲	AMOUNT TO DATE	RECEIVED
▲	CIRCUIT SERVICED	REPAID
▲	CIRCUIT CHARGES	RECEIVED

CHANGES THIS
EVEN-

NOTES:
1. Q1 & II - SELECTED
Q5 & G - MATCHED TO LOW & HIGH H.F.E.
Q7, 8, 9 & 10 - H.F.E. ISO OR ABOVE
Q12 & 13 - IDENTICAL H.F.E. ±10%

2. UNLESS OTHERWISE NOTED:
 ALL RESISTORS VALUES IN OHMS; 1/2W, 5%
 ALL CAPACITORS VALUES IN MICROHENRIDS.
 ALL SWITCHES NORMALLY OPENED.
 3. PARTS LOCATED AT FRONT PANEL ARE

MARKED FOR
 4. FOR TS UN-061A : $280 = 250, 10W$; R21
 TS 075101 : $280 = 75, 10W$; R21
 5. PANTS LAST SHIPPED
 E 283 R16
 G 288 G16

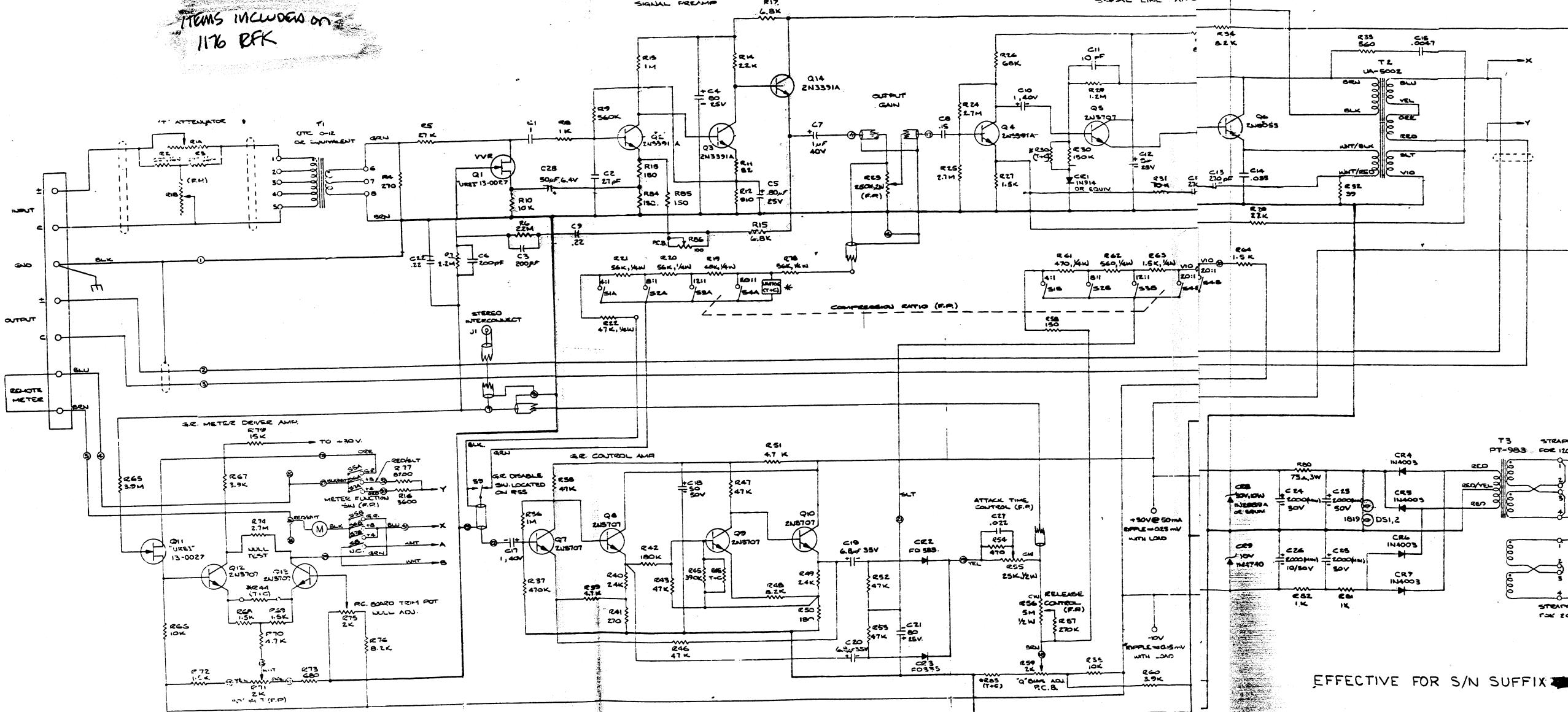
6. PARTS TO BE USED ON UNITS SERIAL NO. 150
AND UP ONLY. (PART NO J46706).

EFFECTIVE SCALE NO. 217 & SUBSEQUENT

UNIVERSAL AUDIO DIV.
STUDIO ELECTRONICS CORP.
11927 YM ROSE ST
SOLID STATE
LIMITING AMPLIFIER
MODEL 1176

REV "C"

ITEMS INCLUDED ON
1176 RFK

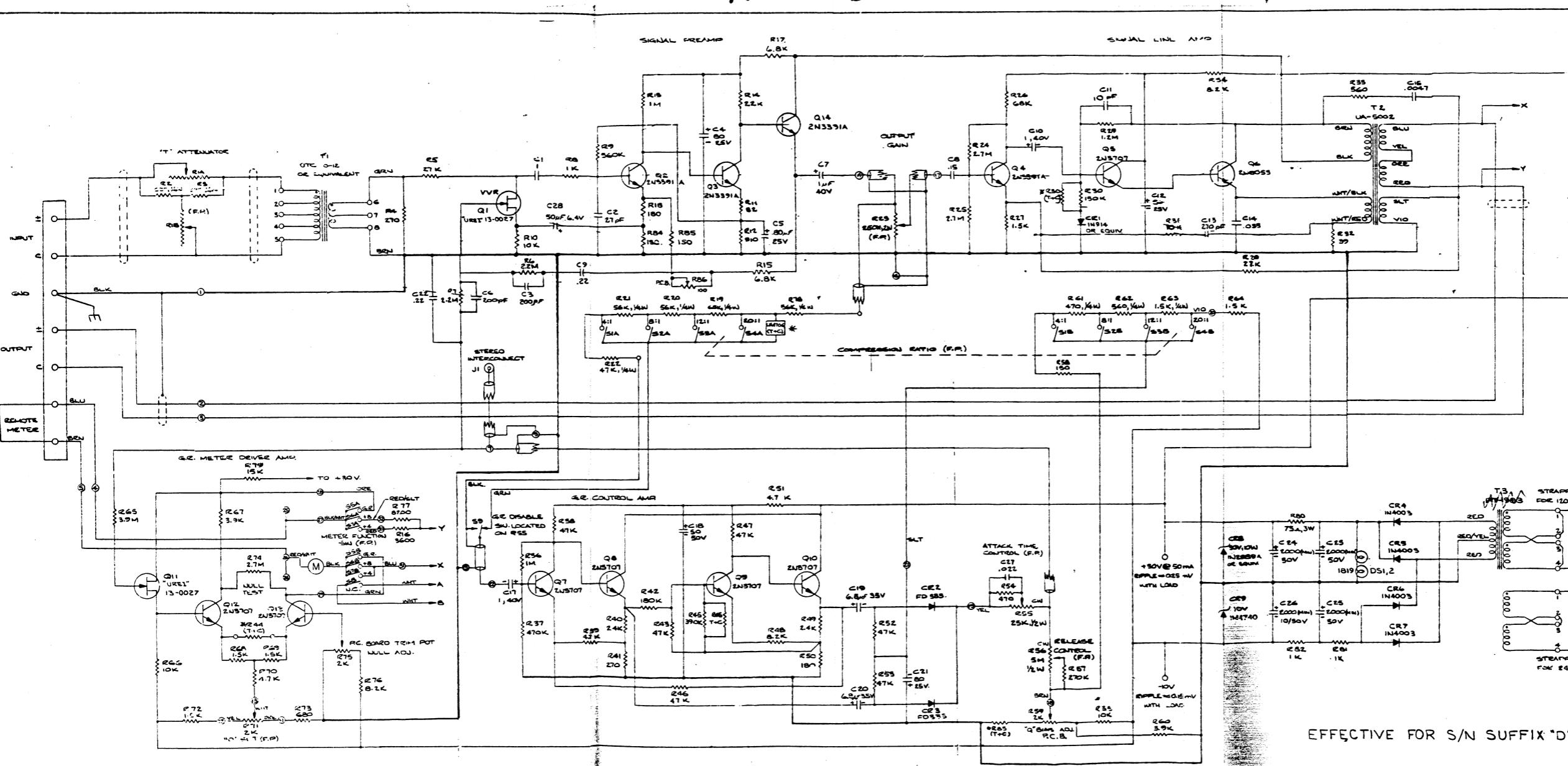


SER# 1079 → 1238
CHANGES THIS
REV

1176 C =
1176 B w/ AM
1176RFK ATTACHED

EFFECTIVE FOR S/N SUFFIX **C**

REV "D"



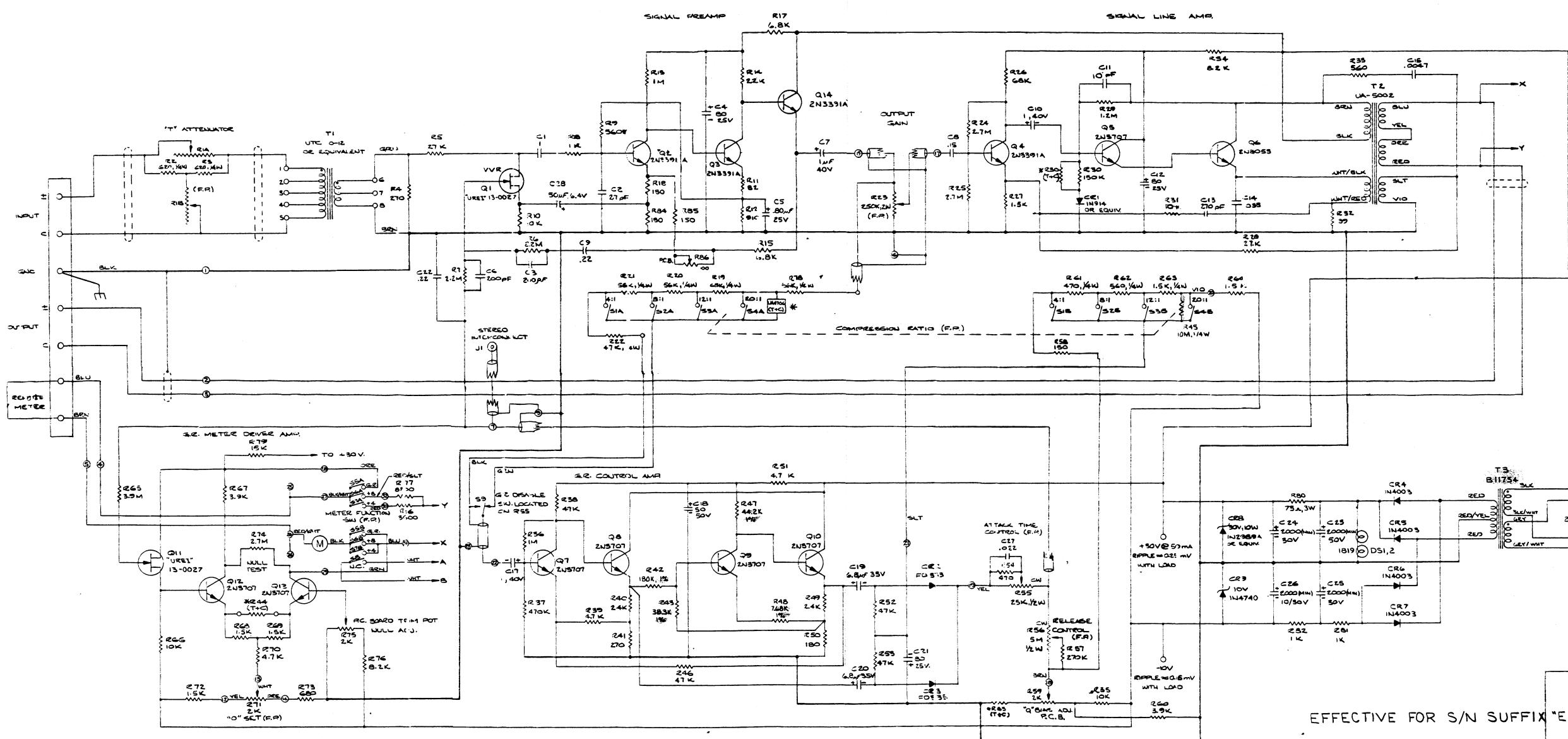
SER# 1239 → 2331

NO SIGNIFICANT CHANGES
BETWEEN REV C AND
REV D

1176 D INCLUDES
THE RFK CIRCUITRY
ON THE MOTHERBOARD

EFFECTIVE FOR S/N SUFFIX "D"

REV "E"



REVISIONS		
S/N	DESCRIPTION	DATE
A	PER ECO 0070 2-27-73	

#2332 → 2610

- NOTES:
- Q1 & II - SELECTED
 - Q5 & IV - MATCHED PAIR
 - Q7, 8, 9 & IO - H.F.E. 250 OR ABOVE
 - Q12 & 13 - IDENTICAL H.F.E. ±10%
2. UNLESS OTHERWISE NOTED:
ALL RESISTORS VALUES IN OHMS, $\frac{1}{2}$ W, 5%.
ALL CAPACITORS VALUES IN MICROFARADS.
ALL SWITCHES NORMALLY OPENED.
3. PARTS LOCATED AT FRONT PANEL ARE
MARKED F.P.
- * SYMBOL INDICATES FACTORY
SELECTED VALUE

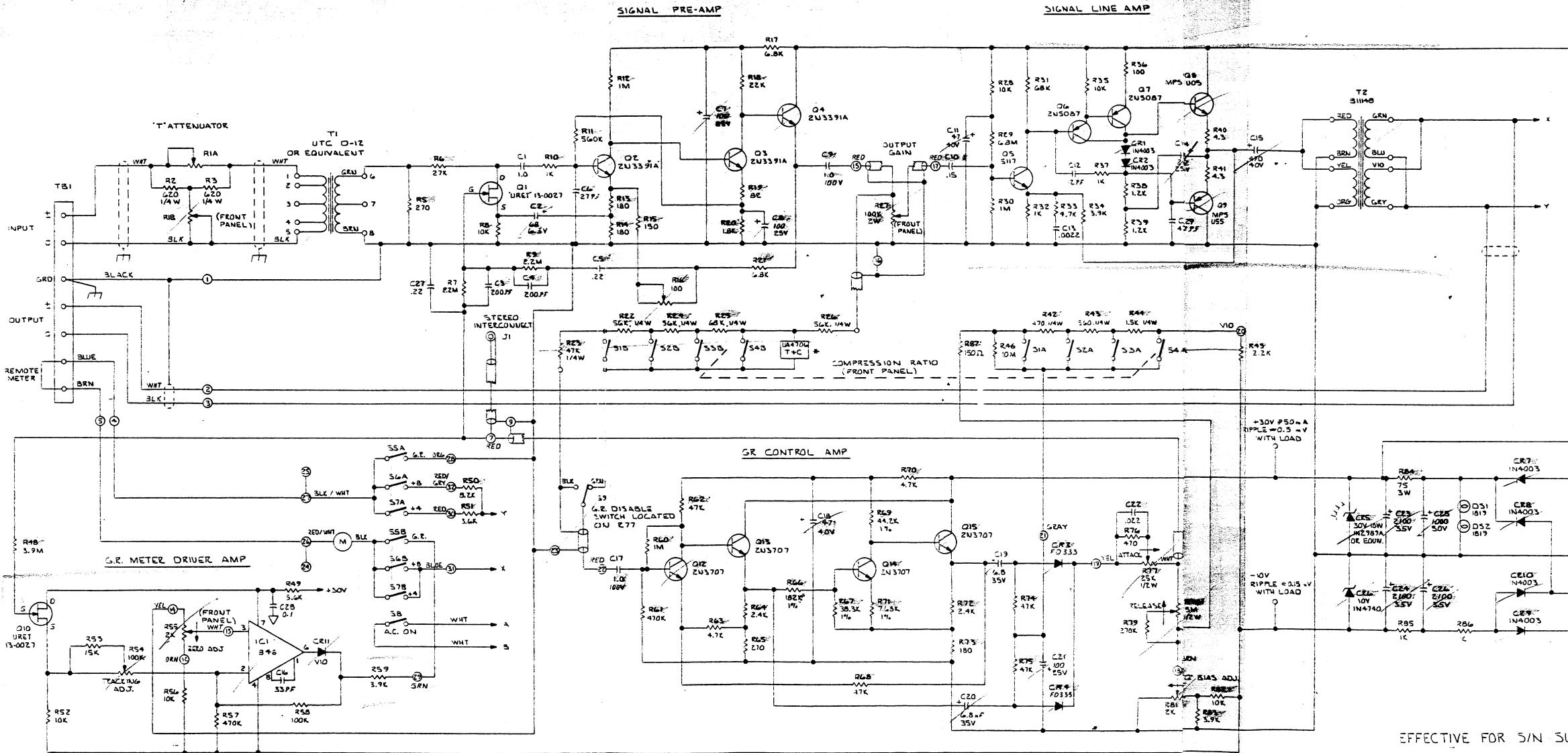
EFFECTIVE FOR S/N SUFFIX "E"

UNITED SOLID STATE
ELECTRONIC INDUSTRIES LIMITING AMPLIFIER
MODEL 1176 LN
DATE 7-9-73
DEPARTMENT CHECKED OWN.
LOS ANGELES CALIFORNIA / Z RI1228

REV "F"

#2611 → 1052

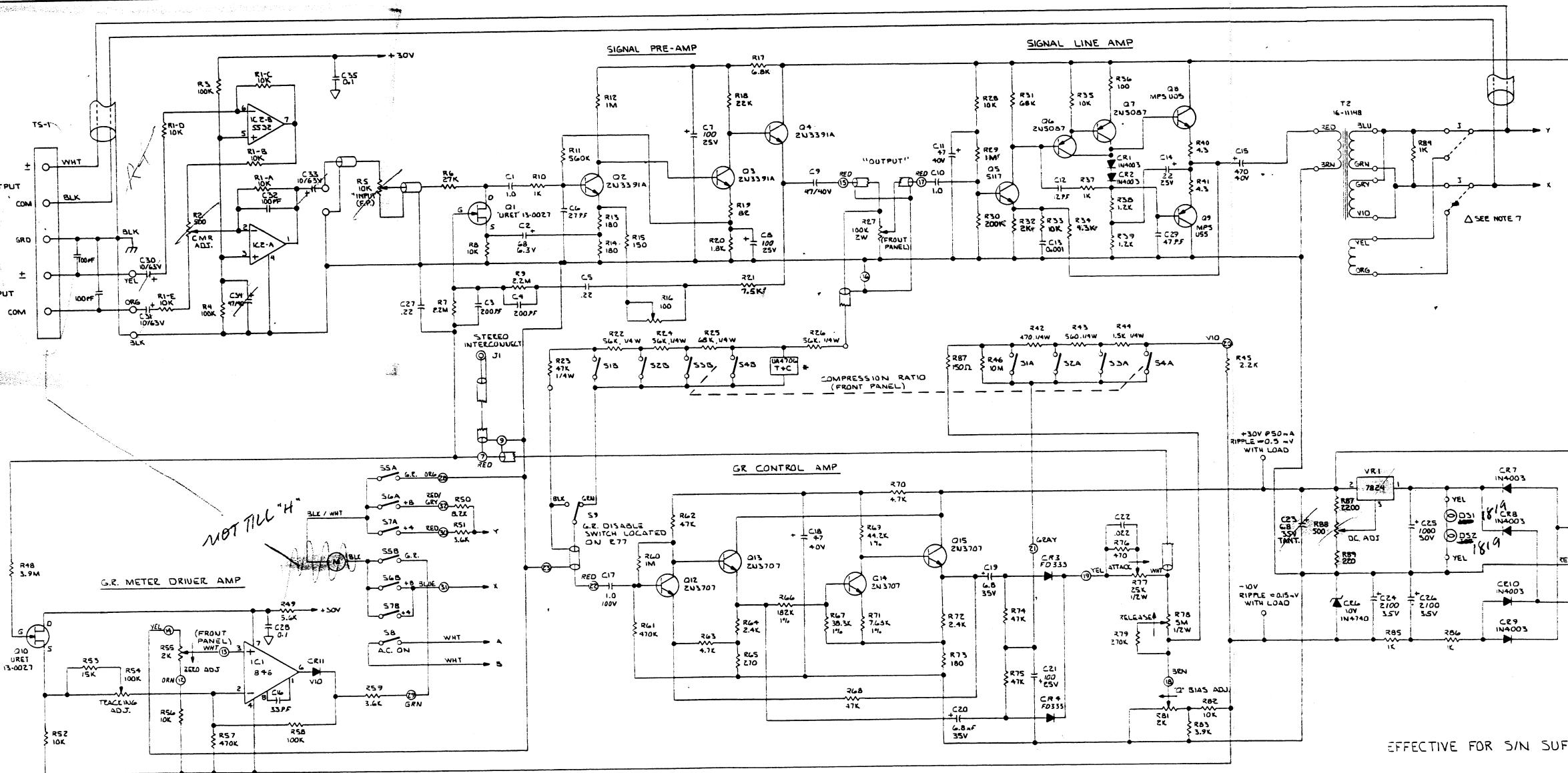
CHANGES THIS
REV.



NOTES: UNLESS OTHERWISE SPECIFIED
 1. ALL RESISTOR VALUES ARE IN OHMS
 1/2W ± 5%
 2. ALL CAPACITOR VALUES ARE IN MICROFARADS
 3. SWITCHES ARE NORMALLY OPEN
 4. Q1 AND Q2 ARE SELECTED
 5. Q1, Q3, Q4, AND Q5 ARE H.F.E. 250 OR ABOVE
 * SYMBOL INDICATES FACTORY SET VALUE

EFFECTIVE FOR S/N SUFFIX 'F'

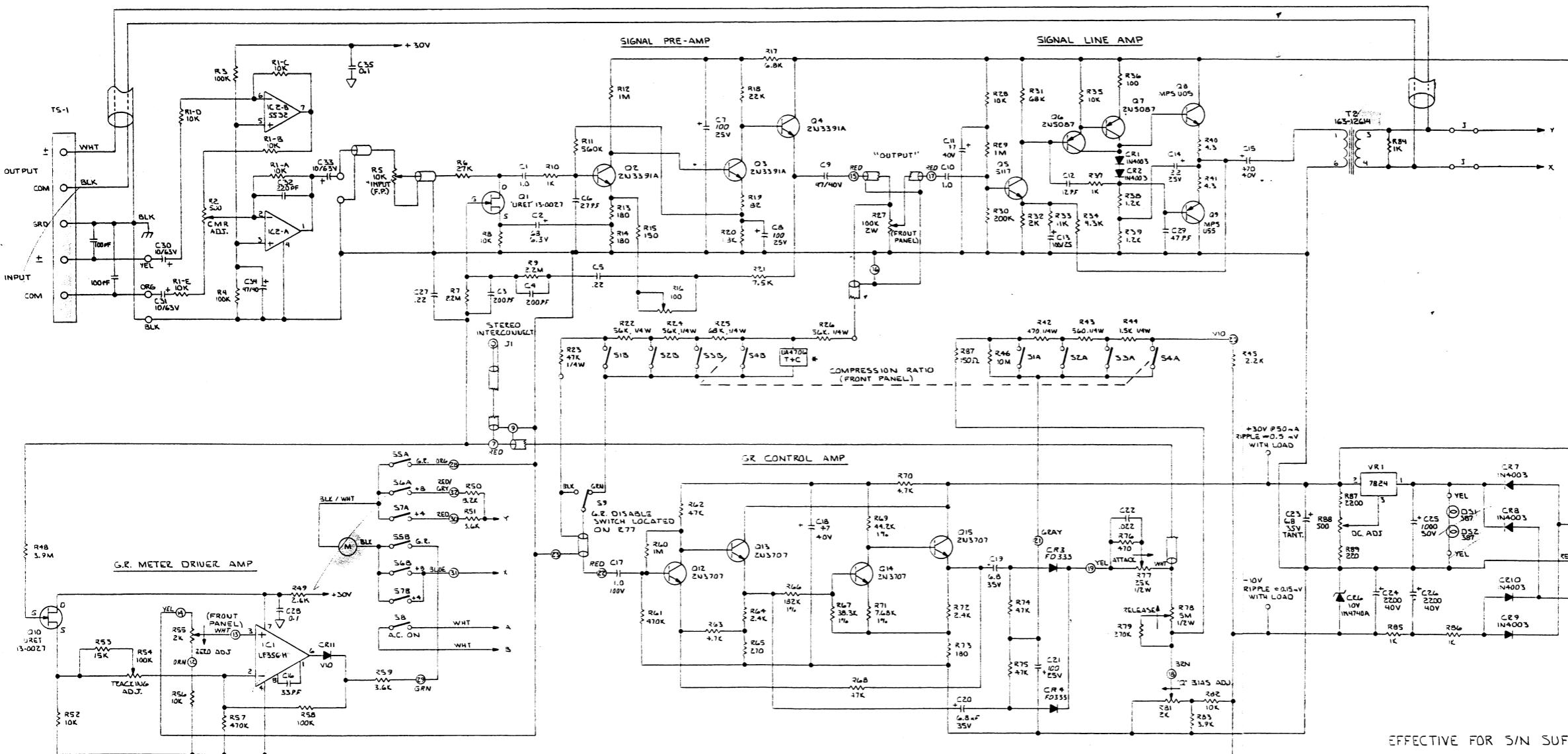
REV "G"



NOTES: UNLESS OTHERWISE SPECIFIED
 1. ALL RESISTOR VALUES ARE IN OHMS
 1/2W 25%
 2. ALL CAPACITOR VALUES ARE IN MICROFARADS
 3. SWITCHES ARE NORMALLY OPEN
 4. Q1 AND Q10 ARE SELECTED
 5. Q11, Q13, Q14 AND Q15 ARE N.F.E. 250 OR ABOVE
 6. # SYMBOL INDICATES FACTORY SET VALUE
 7. △ OUTPUT SHOWN WIRED FOR STANDARD MODEL. DOTTED LINES SHOW ALTERNATE JUMPER POSITION FOR 60 OHM OUTPUT (EXPORT ONLY) GAIN REDUCED 10dB.

CHANGES ITMS REV

REV "H"



- NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTOR VALUES ARE IN OHMS $\frac{1}{2}W \pm 5\%$
 2. ALL CAPACITOR VALUES ARE IN MICROFARADS
 3. SWITCHES ARE NORMALLY OPEN
 4. Q1 AND Q10 ARE SELECTED
 5. Q12, Q13, Q14, AND Q15 = H.F.E. 250 OR ABOVE
 6. * SYMBOL INDICATES FACTORY SET VALUE

NEW F.T. PATH
METER
CHASSIS

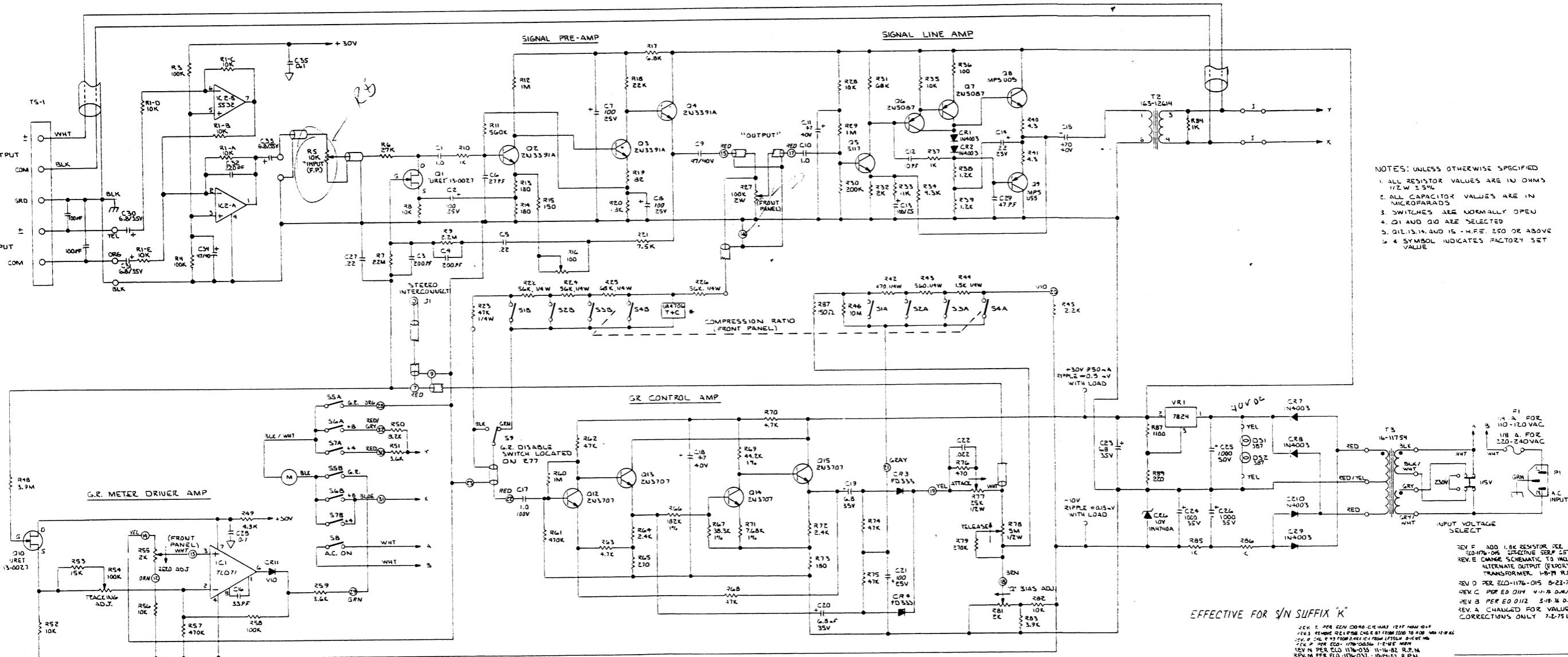
EFFECTIVE FOR S/N SUFFIX 'H'

#7652→

CHANGES
THIS REV

DATE 3-15-73
SHEET 1 OF 1
PAGE 1
117L-N Schematic
L.E. R11914

REV R



REV F ADD 1.8K RESISTOR P24
REV G ADD 1.8K RESISTOR P24
REV E CHANGES SCHEMATIC TO INCLUDE
ALTERNATE OUTPUT (EXPORT)
TRANSFORMER 16-1754 R.P.W.
REV D PER ECO-116-015 8-23-78
REV C PER ECO-0112 4-18-04W
REV B PER ECO-116-024 1-29-80 R.P.W.
REV A CHANGED FOR VALUE
CORRECTIONS ONLY 7-27-78 L.E.

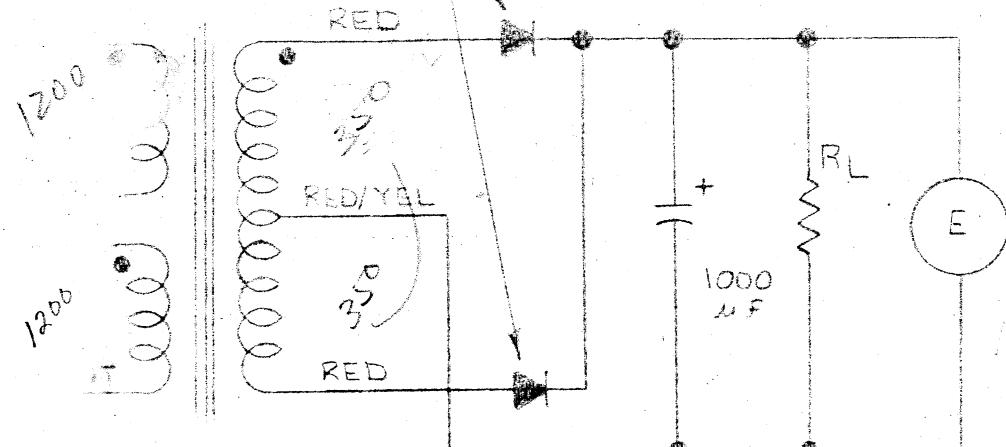
JFK 7824 10V 0.5A 0.5% NEW
JFK 7824 10V 0.5A 0.5% FROM ECO-116-015
JFK P PER ECO-116-024 1-29-80 R.P.W.
REV N PER ECO-116-024 1-29-80 R.P.W.
REV M PER ECO-116-024 1-29-80 R.P.W.
REV L PER ECO-116-024 1-29-80 R.P.W.
REV K PER ECO-116-024 1-29-80 R.P.W.
REV J PER ECO-116-024 1-29-80 R.P.W.
REV I PER ECO-116-024 1-29-80 R.P.W.
REV H CHANGE FUSE VALUE 6-27-78 R.P.W.
REV G CHANGE CIRCUITRY 1176-LN SUFFIX "K" BECOMES SUFFIX "G" 3-24-79 R.P.W.

UNITED SOLID STATE
LIMITING AMPLIFIER
INDUSTRIES MODEL 1176LN
MANUFACTURED BY
LOS ANGELES CALIFORNIA
L.E.

3-15-73 R/1147

SILICON RECTIFIERS

MARK UREI 16-11754
CODE DATE AND
SOURCE CODE ON
TOP SURFACE

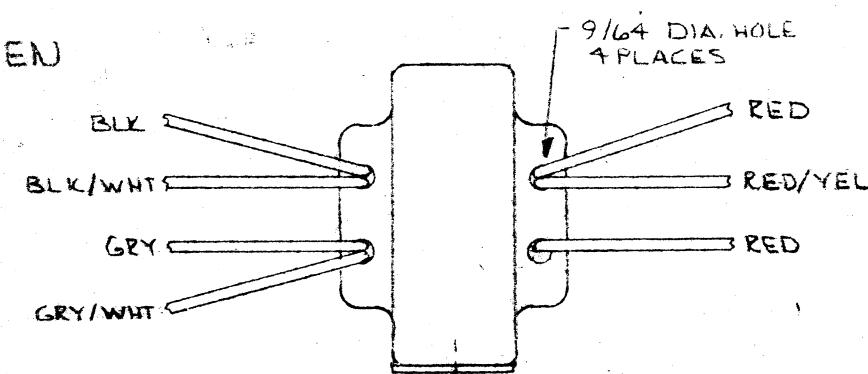
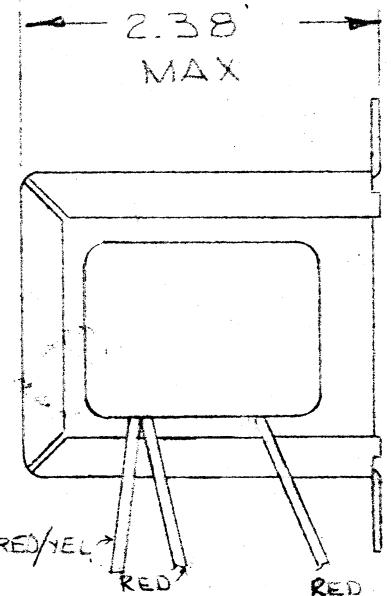


PULL LEADS ACROSS WHEN LEADING
PREFERRED WINDING DATA: PRIMARY 1200 TURNS #34 RED
SECONDARY 350 TURNS #30 C.T. WIND 2nd BIFILAR

9. TOTAL UNUSED OPENINGS IN TRANSFORMER CASE SHALL NOT EXCEED .25 SQ INCHES
8. VARNISH XFMR BEFORE INSTALLING CHANNEL OR END BELLS
7. TRANSFORMER MUST WITHSTAND 900V HI-POT BETWEEN ANY LEADS NOT INTERNALLY CONNECTED OR BETWEEN ANY LEAD AND CORE
6. INTERNAL HEAT RISE AT 160MA LOAD CURRENT WITH 130 VOLT 50HZ LINE MUST NOT EXCEED 40°C
5. WHEN RL IS OPEN E MUST NOT EXCEED 48 VOLTS D.C. WHEN RL = 150Ω E MUST NOT BE LESS THAN 35 V.D.C.
4. LEADS MUST BE FIRMLY ANCHORED CONSISTENT WITH GOOD TRANSFORMER DESIGN PRACTICE AND MUST BE ABLE TO WITHSTAND 10 LB PULL
3. LEADS SHALL BE #22 STRANDED P.V.C. 600V INSULATION
2. TRANSFORMER MUST BE FREE OF EXCESS WAX AND VARNISH AND PRESENT A CLEAN EXTERNAL APPEARANCE.
1. TRANSFORMER INCLUDES END BELLS WITH LEADS EXITING AS SHOWN

NOTES:

11754



COLOR	LENGTH	STRIP + TIN
BLACK	8"	NONE
BLK/WHT	"	"
GRAY	"	"
GRY/WHT	"	"
RED	"	"
RED/YEL	"	"
RED	"	"

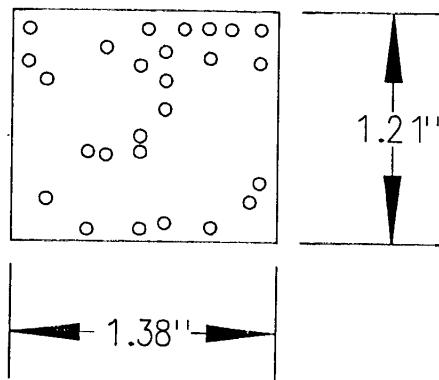
REV B CHANGE B1754

TO 16-11754 11-977 R.P.M.

8-9-76 Broadband
REVISED WIRE EXITS
REVISIONS

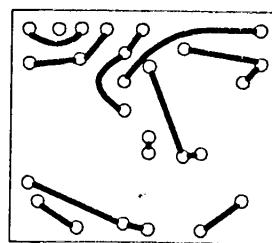
UNITED RECORDING ELECTRONICS INDUSTRIES	TRANSFORMER POWER
MODEL 920-10 1176-LN DEPARTMENT	DATE 1-17-73
LOS ANGELES CALIFORNIA	ISSUE
CHECKED L.E.	APPROVED
B11754B	

TOP VIEW

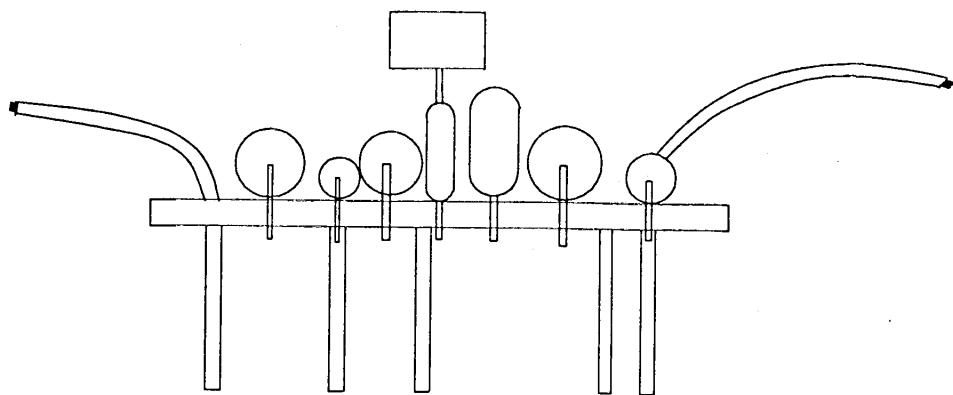
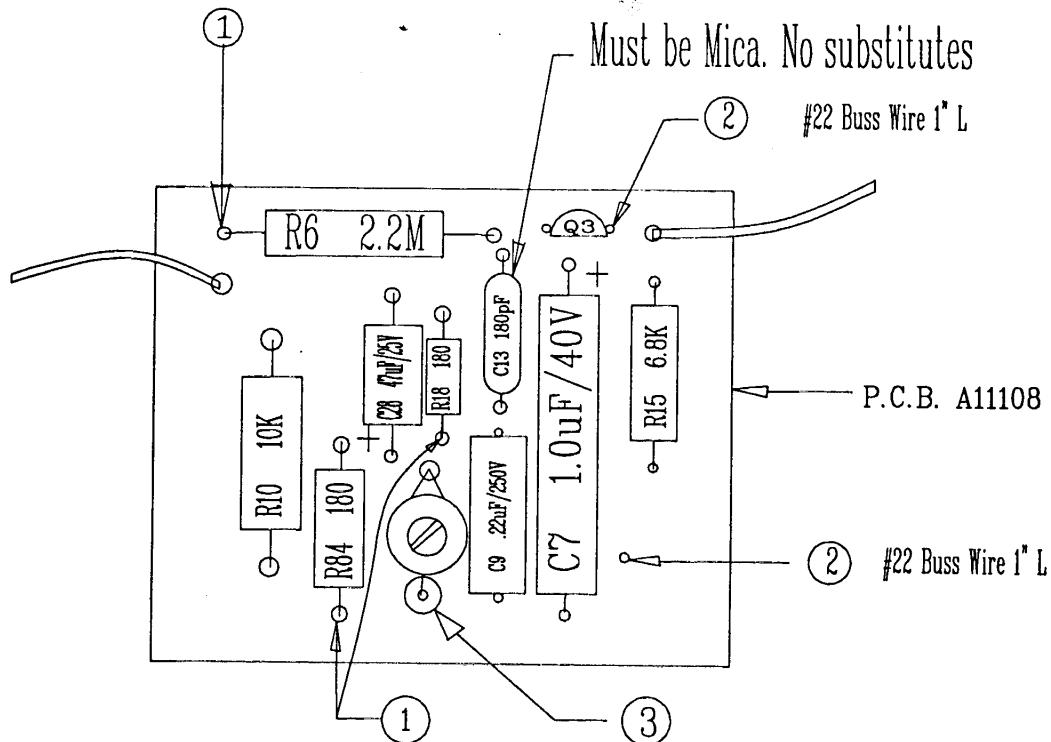


Component Side

BACK VIEW



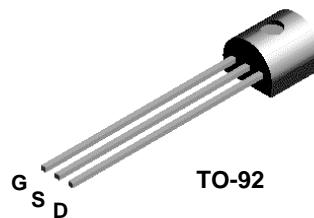
Solder Side



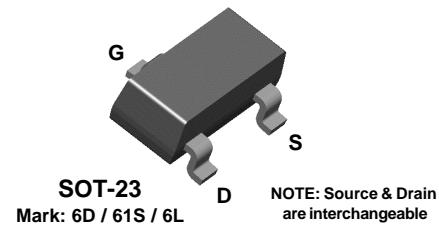
- ① Indicates Leads Shall Not Be Cut Off At Board
 - ② Adding #22 Gauge Buss Wire With 1" Long
 - ③ 150 Ohms Resistor, R85A



**2N5457
2N5458
2N5459**



**MMBF5457
MMBF5458
MMBF5459**



N-Channel General Purpose Amplifier

This device is a low level audio amplifier and switching transistors, and can be used for analog switching applications. Sourced from Process 55.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{DG}	Drain-Gate Voltage	25	V
V_{GS}	Gate-Source Voltage	- 25	V
I_{GF}	Forward Gate Current	10	mA
T_J, T_{stg}	Operating and Storage Junction Temperature Range	-55 to +150	°C

* These ratings are limiting values above which the serviceability of any semiconductor device may be impaired.

NOTES:

- 1) These ratings are based on a maximum junction temperature of 150 degrees C.
- 2) These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.

Thermal Characteristics

TA = 25°C unless otherwise noted

Symbol	Characteristic	Max		Units
		2N5457-5459	*MMBF5457-5459	
P_D	Total Device Dissipation Derate above 25°C	625 5.0	350 2.8	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	125		°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	357	556	°C/W

* Device mounted on FR-4 PCB 1.6" X 1.6" X 0.06."

N-Channel General Purpose Amplifier

(continued)

Electrical Characteristics

TA = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
OFF CHARACTERISTICS						
V _{(BR)GSS}	Gate-Source Breakdown Voltage	I _G = 10 µA, V _{DS} = 0	- 25			V
I _{GSS}	Gate Reverse Current	V _{GS} = -15 V, V _{DS} = 0 V _{GS} = -15 V, V _{DS} = 0, T _A = 100°C			- 1.0 - 200	nA nA
V _{GS(off)}	Gate-Source Cutoff Voltage	V _{DS} = 15 V, I _D = 10 nA	5457	- 0.5	- 6.0	V
			5458	- 1.0	- 7.0	V
			5459	- 2.0	- 8.0	V
V _{GS}	Gate-Source Voltage	V _{DS} = 15 V, I _D = 100 µA V _{DS} = 15 V, I _D = 200 µA V _{DS} = 15 V, I _D = 400 µA	5457 5458 5459		- 2.5 - 3.5 - 4.5	V V V

ON CHARACTERISTICS

I _{dss}	Zero-Gate Voltage Drain Current*	V _{DS} = 15 V, V _{GS} = 0	5457	1.0	3.0	5.0	mA
			5458	2.0	6.0	9.0	mA
			5459	4.0	9.0	16	mA

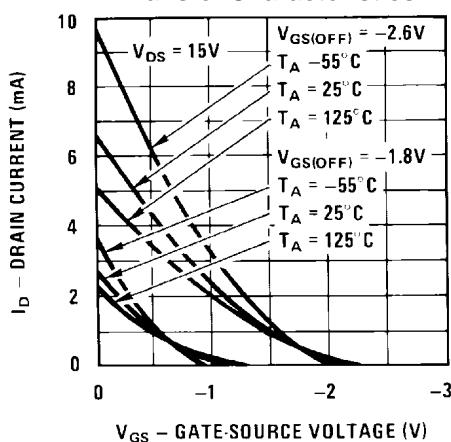
SMALL SIGNAL CHARACTERISTICS

g _{fs}	Forward Transfer Conductance*	V _{DS} = 15 V, V _{GS} = 0, f = 1.0 kHz	5457	1000		5000	µmhos
			5458	1500		5500	µmhos
			5459	2000		6000	µmhos
g _{os}	Output Conductance*	V _{DS} = 15 V, V _{GS} = 0, f = 1.0 kHz			10	50	µmhos
C _{iss}	Input Capacitance	V _{DS} = 15 V, V _{GS} = 0, f = 1.0 MHz			4.5	7.0	pF
C _{rss}	Reverse Transfer Capacitance	V _{DS} = 15 V, V _{GS} = 0, f = 1.0 MHz			1.5	3.0	pF
NF	Noise Figure	V _{DS} = 15 V, V _{GS} = 0, f = 1.0 kHz, R _G = 1.0 megohm, BW = 1.0 Hz				3.0	dB

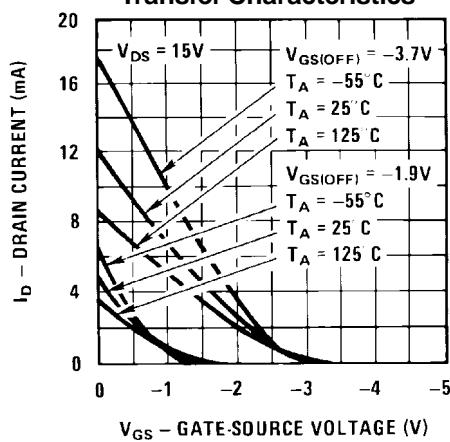
* Pulse Test: Pulse Width ≤ 300 ms, Duty Cycle ≤ 2%

Typical Characteristics

Transfer Characteristics



Transfer Characteristics

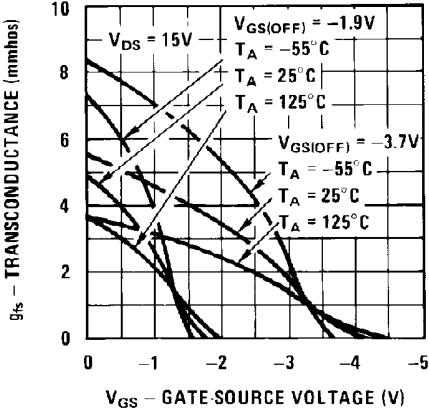


N-Channel General Purpose Amplifier

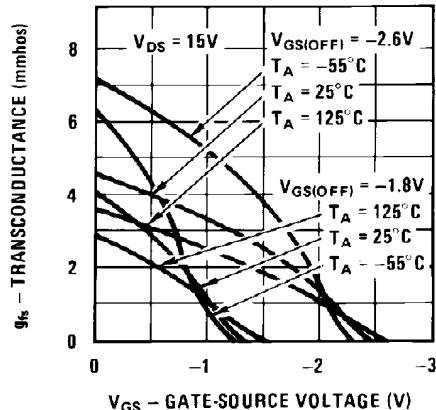
(continued)

Typical Characteristics (continued)

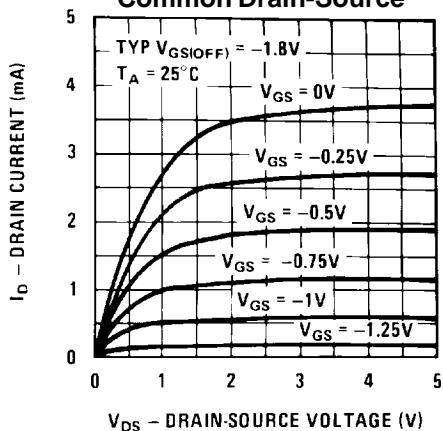
Transfer Characteristics



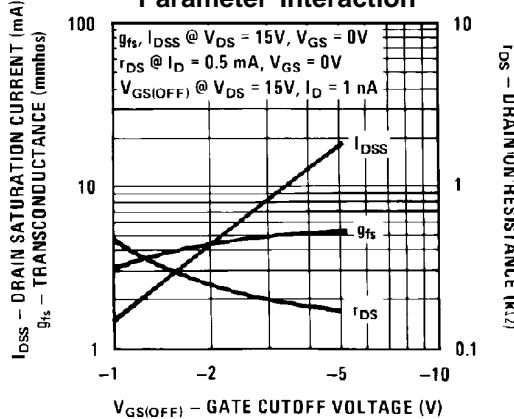
Transfer Characteristics



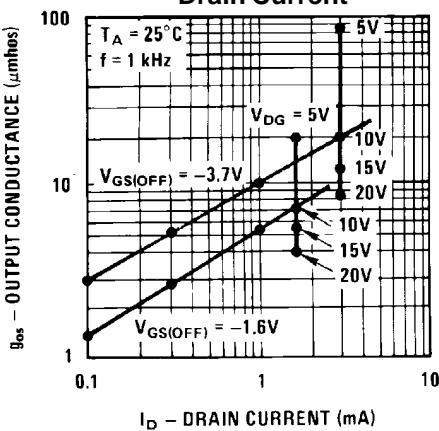
Common Drain-Source



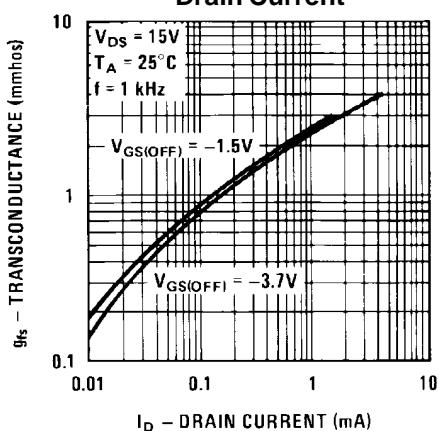
Parameter Interaction



Output Conductance vs. Drain Current



Transconductance vs. Drain Current

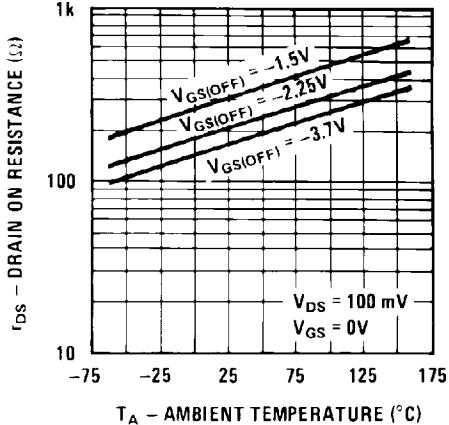


N-Channel General Purpose Amplifier

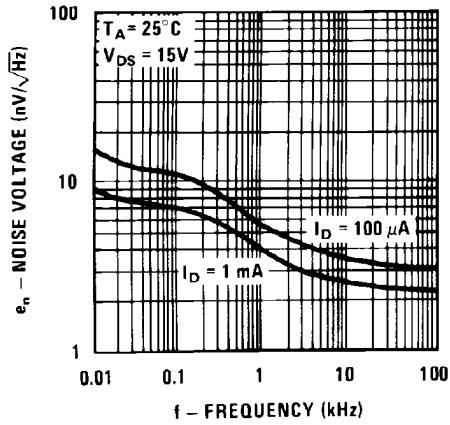
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Typical Characteristics (continued)

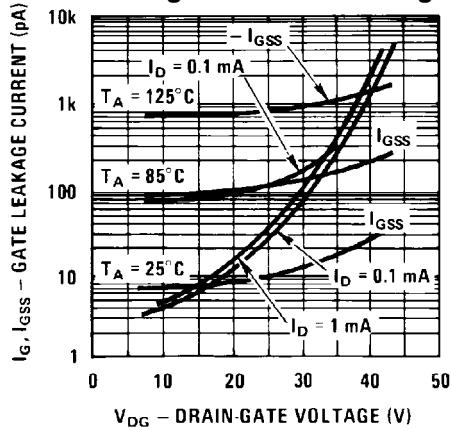
Channel Resistance vs. Temperature



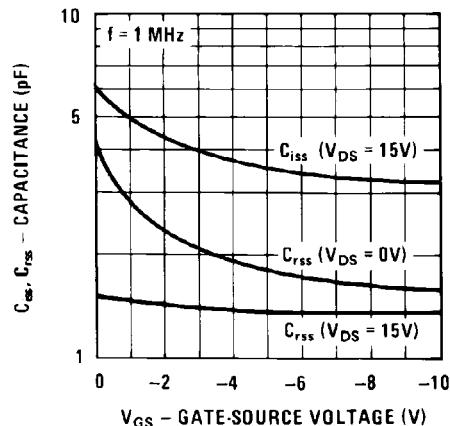
Noise Voltage vs. Frequency



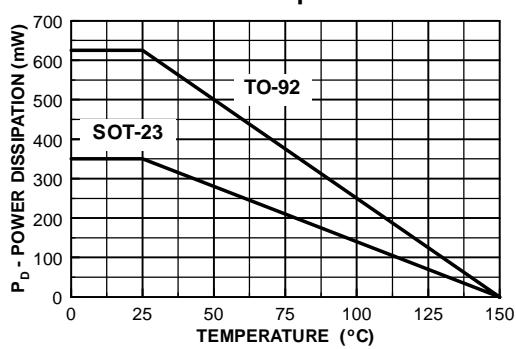
Leakage Current vs. Voltage



Capacitance vs. Voltage



Power Dissipation vs. Ambient Temperature



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