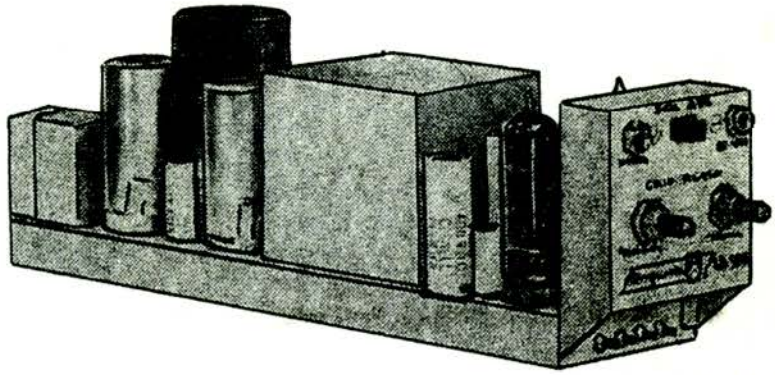
Langevin

A DIVISION OF SONOTEC INCORPORATED
503 SOUTH GRAND AVE. • SANTA ANA, CALIF.

MODEL AM-5301
LEVELINE AMPLIFIER

+ 37 dbm OUTPUT (6 WATTS)



NEW -- THUMP FREE -- LOW DISTORTION -- ECONOMICAL

An improvement in Compressor-Limiter Design

FEATURES

Fast Attack: 100 microseconds standard

Expansion controlled by Threshold Level Adjustment

Compression Ratio continuously variable up to 5 to 1

Distortion Diminishes with Compression

Small Size: 3" high by 2-5/8" wide by 10" long

Uses Etched Circuitry for Uniformity: Glass epoxy circuit board of military quality; heavy 2 oz. conductors coated with anti-corrosive film.

CONTENTS

GENERAL DESCRIPTION

This new limiter amplifier is a miniature plug-in unit which acts as an automatic ag aging or as a peak level control amplifier in TV-Broadcast, Microwave, Recording and Industrial Sound applications. It operates with a push-pull variable gain input stage driving a 2 stage push-pull program amplifier. Silicon rectifiers provide bias to regulate gain of the input stage.

Maximum program variations up to 30 db can be controlled, thus relieving studio personnel of many exacting level adjustments. In recording, this unit allows higher signal-to-noise ratios by loading the tape or disc; thus the engineer is not required to anticipate overloads.

APPLICATIONS

EXPANDER-COMPRESSOR -- With an average program material level sufficient to produce 15 db of gain reduction, the output signal will be compressed for incoming signals exceeding 15 db, and expanded for incoming signals below 15 db. Enables regular recorded material to be used for background music applications where the dynamic range must be compressed.

AUTOMATIC MASTER GAIN CONTROL -- Simply replace the program amplifier with the Leveline Amplifier. Substitutes directly for Langevin Program Amplifier AM-5117 to get limiting feature. Just plug-in.

AUTOMATIC LEVEL CONTROL FOR A REMOTE LINE -- The Leveline units permit unattended operation of the remote line.

AUTOMATIC CONTROL OF LEVEL DIFFERENCES BETWEEN 2 OR MORE PROGRAM SOURCES -- Controls differences between turntables, projectors, network program and microphone preamplifier sources.

USE AS A "DUCKER" -- A program can be automatically lowered the recommended 8 db (one-half loudness) to allow an announcer to override without apparent program interruption.

USE AS A NORMAL PROGRAM AMPLIFIER -- Turning off the integral chassis bias limiting control allows operation as a conventional program amplifier, or as a 6 watt monitor amplifier.

USE AS A PEAK LIMITER IN RADIO BROADCAST -- The Leveline units give 100 microsecond attack time and will safeguard against transmitter overloads. At the same time it affords all the advantages of compression.

ELECTRICAL CHARACTERISTICS

Gain:	57 db with 600 ohm input source
Input Source:	125 to 600 ohms balanced or unbalanced
Output Impedance:	150 - 600 ohms
Output Power:	+37 dbm when strapped for monitor, +27 dbm strapped for Leveline operation
Output Noise:	Unweighted, equivalent to an input signal of -110 dbm or less over the band 20-20,000 cps
Frequency Response:	±.5 db 20-20,000 cps
Distortion:	Less than 1% at +37 dbm operating levels including compression - Less than .5% at +27 dbm
Compression Ratio:	Adjustable from 1.1:1 to 5:1 over a 30 db range at input with 4:1 being optimum
Attack Time:	100 microseconds
Release Time:	For 63% recovery, .9 seconds in "dual" position; 1.5 seconds in "average" position
Tube Complement:	1 - 12AY7 select (Langevin Model TUS-12AY7) 1 - 6ES8 Variable Gain Input Amplifier (Langevin Model TUS-6ES8) 2 - 6005-5 Star Output Amplifiers (Langevin Model TUS-6005)
Bias Rectifier:	2 - Silicon Bias Rectifiers
Power Requirements:	6.3 volts ac or dc at 1.5 amperes; 300 vdc at 80 ma strapped for monitor; 50 ma strapped for Leveline operation

MECHANICAL SPECIFICATIONS

Finish:	Light gray baked enamel over 18 gauge bonderized (rustproofed) steel
Weight:	4 lbs. net, shipping 5 lbs.
Size:	Length 10-1/4 in., width 2-5/8 in., height 3 in.
Mounting Tray:	Langevin Model TRY-5017

DETAILED DESCRIPTION

COMPRESSION RATIOS

The Model AM-5301 Leveline Amplifier is an improved automatic level control device of compact design having a gain control characteristic over a 30 db range. When operated at an output level of +24 dbm the Leveline amplifier has a gain control characteristic over a range of 30 db with a rise in output level of only 7.5 db, which is a 4:1 compression ratio.

INTEGRAL CHASSIS THRESHOLD CONTROL

The chassis threshold control can be adjusted to determine the point at which compression starts. With the THRESHOLD SET control at 22.5 volts compression starts at an input level of -38 dbm with +19 dbm at the output. Increasing the input level to -18 dbm results in an output of only +24 dbm. With 20 db increase at the input, the output has increased only 5 db at a 4:1 ratio. The 4:1 ratio is the optimum point of operation. By adjusting input and output levels before and after the amplifiers, the amount of compression can be set as desired.

"DUAL" AND "AVERAGE" SWITCH SETTINGS

"Dual" Position - A switch is incorporated on the front of the chassis which changes the recovery time of the unit. When the switch is in DUAL position the recovery time is an automatic function of the nature of the program material. For short, single peaks, approximately .5 second is required for 63% recovery after the signal has dropped below the gain reducing level. For sustained peaks or rapidly recurring short peaks, approximately .5 second is required for 40% gain recovery, increasing to about 20 seconds for 90% recovery. Typical attack time for smooth sounding operation of the Leveline amplifier is 100 microseconds. This is the adjustment normally supplied by the factory.

"Average" Position - When the switch is in AVRG position the amplifier responds only to average program level changes, and operation is not affected by single short peaks. However, sustained increases in average program level or rapidly recurring short peaks will cause automatic gain reduction depending on the average amplitude of the incoming program material. Typical attack time is approximately 100 microseconds with 63% recovery in about 3 seconds, 90% recovery in 6 seconds. This position is especially useful in background music installations.

METERING OF GAIN REDUCTION

Gain reduction may be read on any standard VU meter, such as the Langevin Model VU-1332 ( ) Weston unity type 1332, or Langevin Models VU-862X and VU-962, Weston types 862-962. These last two types have a scale only slightly longer than the 1332 type, and because the meters serve only as an average indication of gain reduction, the decal furnished with the AM-5301 for the meter face serves for the several types of meters.

ACCESSORIES SUPPLIED

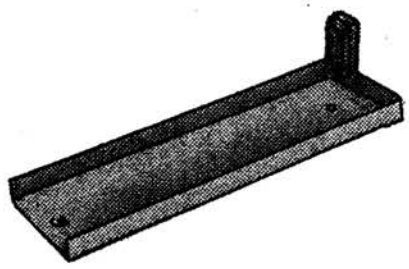
The AM-5301 Leveline amplifier is normally supplied with tubes, but can be ordered without tubes. Tube complement is as follows:

Number	Type	Function	Langevin Model
1	6ES8 (Select)	Variable Gain Input Amplifier	TUS-6ES8
1	12AY7	Driver Stage	TUS-12AY7
2	6005 5-star	Output Amplifier	TUS-6005

Included with each AM-5301 is a gain reduction (GR) scale in decal form for type 1332 or 862-962 series Weston meters. 2 Midget Jacks also are supplied for use with accessory (THRESHOLD-SET) meter MTR-507 and for connection to a VU meter to be used to indicate gain reduction (GR). A spare chassis plug is included for remoting the accessory controls.

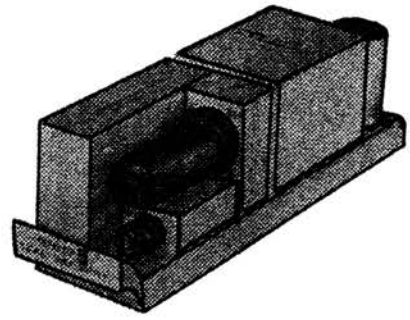
OPTIONAL ACCESSORIES

FIGURE 2



TRY-5017

FIGURE 3



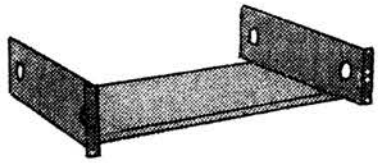
PS-5208-A

Model TRY-5017 Mounting Tray, complete with plug receptacle and mounting hardware. Formed of 18 gauge steel with Langevin light gray baked-on enamel finish. Size is 9-3/4 ins d x 2-3/4 ins w x 1-13/16 ins h. Weight, net 7-1/2 ozs, 2 lbs shipping.

Model PS-5208-A Power Supply, suitable for AM-5301 Leveline Amplifier. Uses TRY-5017 mounting tray as listed above. Input 105-125 vac. Output, 300 vdc at 90 ma continuous with less than 10 mv ripple at full load; 6.3 vac at 3 a continuous. Size is 10-1/4 ins l x 2-5/8 ins w x 3 ins h. Weight, net 6 lbs 5 ozs, 7 lbs shipping. With 5AR4 rectifier tube.

See other Langevin literature for power supplies up to 425 ma.

FIGURE 4



MF-5010

FIGURE 5

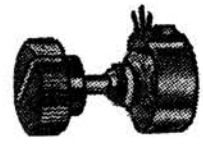
FP-5032

Model MF-5010 Mounting Frame, fits 3-1/2 in rack multiple; 1 AM-5301 Leveline Amplifier, 1 PS-5208-A Power Supply and 4 additional TRY-5017 Trays or 7 additional TRY-5016 trays for AM-5116-B preamplifiers. Size is 19 ins w x 13 ins d x 3-15/32 ins h. Finished in Langevin light gray baked-on enamel over bonderized (rustproofed) 16 and 18 gauge steel members. Takes FP-5032 Front Panel listed below. Weight, net 4 lbs 14 ozs, 6 lbs shipping. Mounting hardware is included.

Model FP-5032 Front Panel, for MF-5010 Mounting Frame; snaps into place. Finished in Langevin dark gray baked-on enamel over 16 gauge bonderized (rustproofed) steel. Upper and lower lips curve in for neat appearance. Size is 19 ins w x 3-15/32 ins h. Weight, net 1 lb 8 ozs, 3 lbs shipping.

FIGURE 6

MTR-507



VR-112

Model MTR-507 Bias Voltmeter, has special scale, white figures on black background; marked for optimum operating point of AM-5301 Leveline Amplifier at 22.5 volts. Small size permits mounting on dashboard of control console, only 1-13/16 ins round opening for rear panel mount, 1-7/8 ins square overall; depth is 1-5/8 ins. Reading is 0-70 vdc. Weight, net 3 ozs, 10 ozs shipping.

Model VR-112, 100k continuously variable molded composition resistor, used as extension bias control (THRESHOLD-SET) for AM-5301 Leveline amplifier, can mount on the control console. Manufactured especially by Allen-Bradley. Comes equipped with Model K-113 WE type instrument knob, normally supplied in black. Weight, net 4 ozs, 1/2 lb shipping.

Model TK-5301 Tube Kit, for Model AM-5301 Leveline Amplifier, consisting of 1 each 12AY7 select Langevin TUS-12AY7, 1 each 6ES8 (Langevin TUS-6ES8) and 2 each 6005 5 star (Langevin TUS-6005). Weight, net 1/4 lb, 1/2 lb shipping. (Amplifier is normally supplied with tubes.)

THEORY OF OPERATION

INPUT

The AM-5301 input is transformer isolated from the system in which it is employed. The secondary of the input transformer feeds the 6ES8 dual triode remote cut off tube. This ruggedized, stable tube acts as part of a push-pull variable gain input stage feeding a 12AY7 in the push-pull driver stage. The 12AY7 in turn drives the push-pull output stage consisting of a pair of 6005 5 star power tubes. These are ruggedized premium versions of the interchangeable 6AQ5.

The output stage includes an output transformer with a tertiary feedback winding. The transformer is of dual construction with 1/2 of each primary and secondary winding on each bobbin. This results in lower leakage and affords hum bucking without additional weight. The driver stage has feedback from the tertiary winding directed to the cathodes. This section is very stable and gain is not affected by variations in B+ voltage. The frequency response is ± .5 db 20 cps to 20 kcps. The 6005 screens are connected to pin 5 on plug P-2 with a 47 K resistor connected to B+. This results in a lower power drain of 50 ma with maximum output of +27 dbm (1/2 watt) for normal limiter or program amplifier use. For monitor use (6 watts or +39 dbm) strap pin 5 to B+ pin 3 (80 ma drain).

The input stage consists of a variable mu tube type 6ES8. The eg ip curve (grid voltage vs plate current) of this tube shows a large variation in gain with change of grid bias. The feedback stage supplies this bias, the amount depending on the amplitude of signal on the output tube plates. The two silicon diodes rectify the signal to negative dc. The filter section R-29 - C-10 - R-28 - C-9 serve to remove audio portions of the dc and to control attack and recovery time. A compromise between shortest attack time and filtering of audio is necessary or oscillation will result. Attack time is approximately 100 microseconds.

The recovery time is .9 second. This time is determined by the network C-10, R-32 and C-9. This network has little effect on attack time as the output impedance of the rectifier is very low. The resistor R-32 determines discharge time. SW-5 (DUAL-AVRG) switch, when in the dual position, has a 6.8 megohm resistor in series with the 1 mfd capacitor C-9. This broadens the knee of the discharge curve. In the average (AVRG) position the recovery time is 1.5 seconds. This position is used primarily in background music applications where the dynamic range desired is small (8 to 12 db).

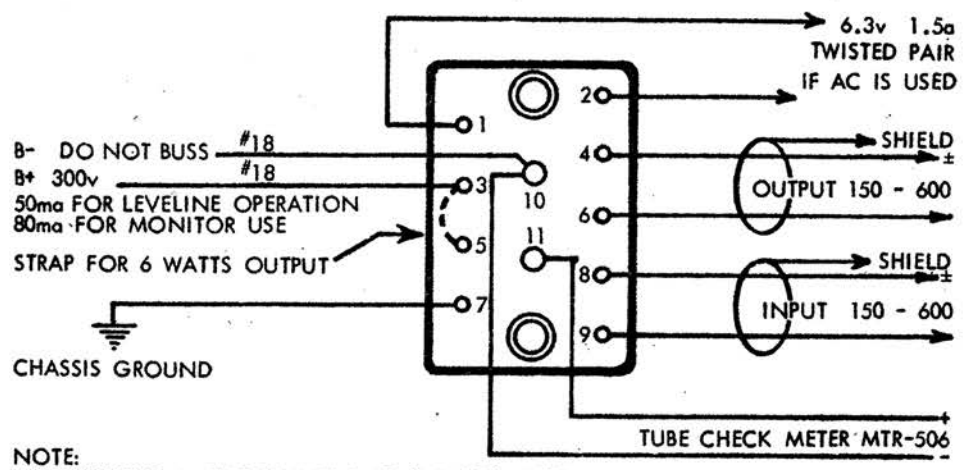
The diodes are reverse biased to control the point at which they conduct. This bias voltage is set by the THRESHOLD-SET control; the amplifier will have a linear gain up to this point.

After the peak amplitude on the output plates exceeds this threshold setting the diodes conduct and a negative voltage is applied to the grids of the input stage through the input transformer secondary. This negative voltage controls the gain of the first stage over a 30 db range.

Applying the control voltage to the input transformer center tap eliminates thump due to unbalance in the feedback voltage common to most gain reduction circuits. The input transformer primary is 600 ohms split for 150 ohms. Maximum input level permissible before the transformer begins to saturate is -6 dbm; this is also the point where the output rises from +24 dbm to +27 dbm. Clipping with resultant distortion occurs past -6 dbm input because of transformer input overload.

INSTALLATION

FIGURE 7



NOTE:
THE LEVELINE AMPLIFIER, WITHOUT CHANGE, WILL PLUG INTO EXISTING TRAYS AND CIRCUITS NOW EMPLOYING THE LANGEVIN AM-5117 BOOSTER - PROGRAM - MONITOR AMPLIFIERS.

The AM-5301 Leveline amplifier requires the TRY-5017 Mounting Tray with integral plug receptacle. The tray may be mounted on a wood shelf, but standard practice requires the MF-5010 Mounting Frame and FP-5032 Front Panel which occupies 3-1/2 inches of rack space. The schematic drawing shows pin connections for cabling.

AUDIO INPUT CONNECTIONS

For 600 ohm loads connect to terminals 6 and 4 on TRY-5017 tray plug receptacle (green and orange strapped as shipped by factory). For 150 ohm loads strap yellow to green and black to orange; connect to terminals 6 and 4 on TRY-5017 tray plug receptacle.

To increase output capabilities to 6 watts, strap pins 3 and 5 on TRY-5017 tray plug receptacle.

POWER CONNECTIONS

The AM-5301 Leveline unit is designed to operate from any power source supplying 6.3 vac or dc at 1.5 a and 300 vdc at 50 ma. When alternately used at 6 watts output 80 ma is required. Connect 6.3 vdc or ac at 1.5 a to pins 1 and 2 on TRY-5017 tray plug receptacle. If ac is used run leads from power supply as a twisted pair to minimize hum radiation.

Connect +300 vdc to pin 3 for normal Leveline operation at only 50 ma drain. For 6 watts output at 80 ma drain strap between 3 and 5. Connect B- to pin 10. For elimination of ground loops and consequent hum, it is recommended that a separate wire of heavy gauge be run from the B- terminal of the power supply to the ground bar in the system and that no ground be used on the B- terminal at the TRY-5017 tray plug receptacle.

CHASSIS GROUND

Connect chassis ground to pin 7. This ground may be bussed to other chassis grounds in the system, eventuating at the system ground bar.

FIGURE 8&8A

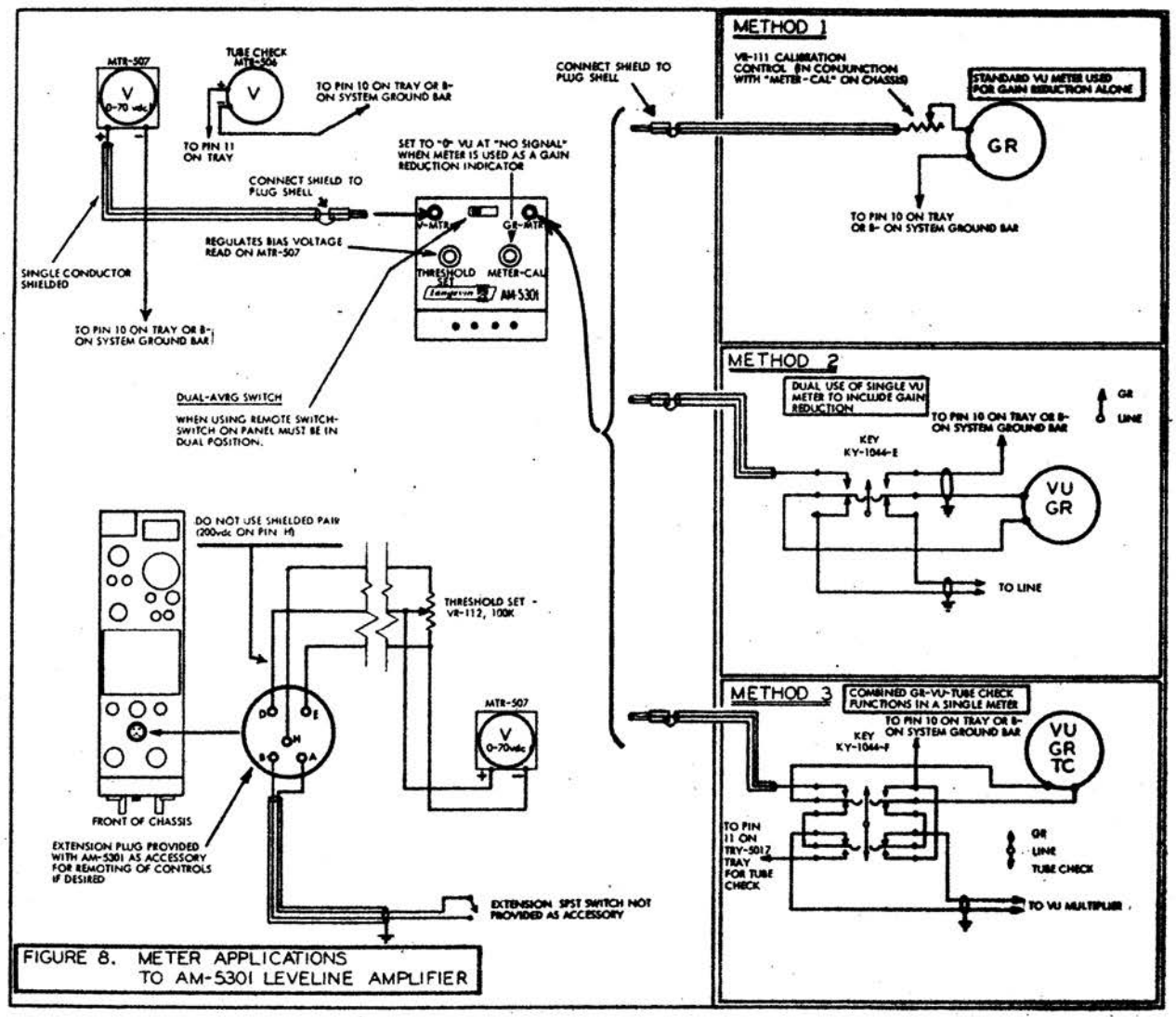


FIGURE 8. METER APPLICATIONS TO AM-5301 LEVELINE AMPLIFIER

GAIN REDUCTION METER WIRING

A separate meter is recommended for use in reading the amount of gain reduction, although the VU meter can be wired as shown in the diagram to serve both functions. Psychologically, the operator feels easier at his task if he correlates the action of the separate gain reduction meter with the reading of the VU meter as he mixes the program.

The Gain Reduction meter (GR MTR) plugs into J-2 on the control panel of the AM-5301 Leveline Amplifier. When the remote accessory meter MTR-507 and VR-112 100K remote bias control (THRESHOLD-SET) are used, substitute for the chassis controls by unplugging the chassis controls from the chassis and solder the remote control wires to the plug provided. This wiring is shown in the figure.

APPLICATION OF GAIN REDUCTION DECAL TO VU METER FACE

Remove the VU meter from its case. Prepare the decal for application by soaking for 5 minutes in lukewarm water. Slide the decal from its backing and align the right hand line under the "0" VU mark on the meter scale. "Squeegee" the excess water and air bubbles from beneath the surface of the decal, dry the area with cotton and reassemble the meter.

The decal indicates only average readings, and serves equally on Weston meters type 862-962 and 1332. Other meters having a scale of approximately the same radius may be used.

BIAS METERING

An integral control (THRESHOLD-SET) is provided on the chassis control panel for setting the compression ratio. This control may be set for optimum operation of 4:1 compression, by metering through Jack J-3, to 22.5 volts. Control panel metering is offered by a 0-70 vdc accessory meter, MTR-507, with scale marked at 22.5 volts. Control VR-112 (THRESHOLD-SET) is also available as an accessory. The chassis plug should be wired as in figure 8 for quick disconnect, service and test of the amplifier.

CAUTION: Do not use an ordinary test probe to measure bias voltage in J-3. Use midget plug provided. Use of test probe will burn out Resistors R-26 and R-27.

OPERATION

The AM-5301 Leveline Amplifier is unique, in that in a small, economical assembly it combines the important features of a peak limiter with the simple compression action found in usual units of this size and cost. A pleasant listening characteristic is found in the gradual shoulder of the curve leading into limiting action as opposed to the abrupt limiting of typical, more costly limiters. This virtue of the Leveline unit makes it highly suitable for recording, while retaining the peak limiting feature so necessary for broadcast work to prevent transmitter overload.

A high advantage to the user is the freedom from thumping and necessity for critical adjustment and balance. Further, the minimizing of "breathing" action afforded by the curve characteristic diminishes most of the objectionable traits of a limiter or compressor. Usual limiting or violent compressing action causes a dimunition of high frequencies because of phase change; an additional stage of isolation between circuits, the use of silicon diodes for control bias rectification and other refinements give Leveline units a brilliance ordinarily lost.

The Leveline amplifier is fitted with a threshold control (THRESHOLD-SET) on its control panel. This control adjusts the point where gain reduction begins for a given input level. The voltmeter jack (V-MTR) allows insertion of one of the midget plugs provided which permits a voltmeter to be used to indicate bias for adjusting the threshold control. GAIN REDUCTION SET, Bias Meter MT-507 is provided as an accessory by Langevin for panel mounting if desired. The following table lists the operating condition for typical input levels.

Input DBM	Output DBM	Compression DBM
-59	0	
-50	7	
-38*	19	
-30	20	7
-24	21	12
-20	23	16
-15	25	23
- 6	26	25

*Optimum Compression ratio of 4:1 (Bias at 22.5V)

The optimum point for smoothest operation is with the threshold set for an output level of +24 dbm. If this level is too high, a fixed pad may be inserted in the input or the output, or both, of the amplifier.

When the threshold for compression is set properly to include the normal range of input signals the output will not vary in the same proportion as the level at the input. For example, with 22.5 volts of bias (4:1 ratio) as regulated by the threshold-set, if it is desired to have the output vary only 2 db, the input must change 8 db.

If the rise in input level is sufficiently great, the unit will go into limiting action. At the point where true limiting begins, rather than just compression, a further increase in input level results in less than 1 db change of output level. This action is unique in this class of device, and exclusive with the Leveline, along with the fact that distortion is actually less at full limiting than when operating as a normal amplifier.

RECOVERY TIME

The normal recovery time is .9 seconds in DUAL position and 1.5 seconds in AVRG position; this recovery time is deemed proper by Langevin through experience. To change the recovery time, a change in condenser C-10 from .22 mfd to a value of .047 mfd, for example, reduces the recovery time to .2 seconds.

It is not recommended that a change be made in recovery time as the limiting action will become noticeable as apparent intermodulation distortion. The stronger low frequency signals will modulate weaker high frequency signals.

ATTACK TIME

The choice of attack time is governed partly by the high frequencies it is desired to compress or limit. An attack time of 15 milliseconds will pass a 16 kcps signal; 100 microseconds incorporated in the Leveline as shipped from the factory, will cause compression or limiting operation on the first 1/2 cycle of a 15 kcps tone.

OPERATION AS A PEAK LIMITER IN RADIO STATIONS

It is necessary to protect radio transmitters from very high frequency transients leading to overload. Present day circuit breakers work into the microseconds. To limit peak signals of this nature over 15 kcps the attack time of the Leveline is set at 100 microseconds.

OPERATION OF GAIN REDUCTION METER

Step 1 - When a transfer switch has been employed to allow the VU meter to be used also as a Gain Reduction meter, set the switch to GR position.

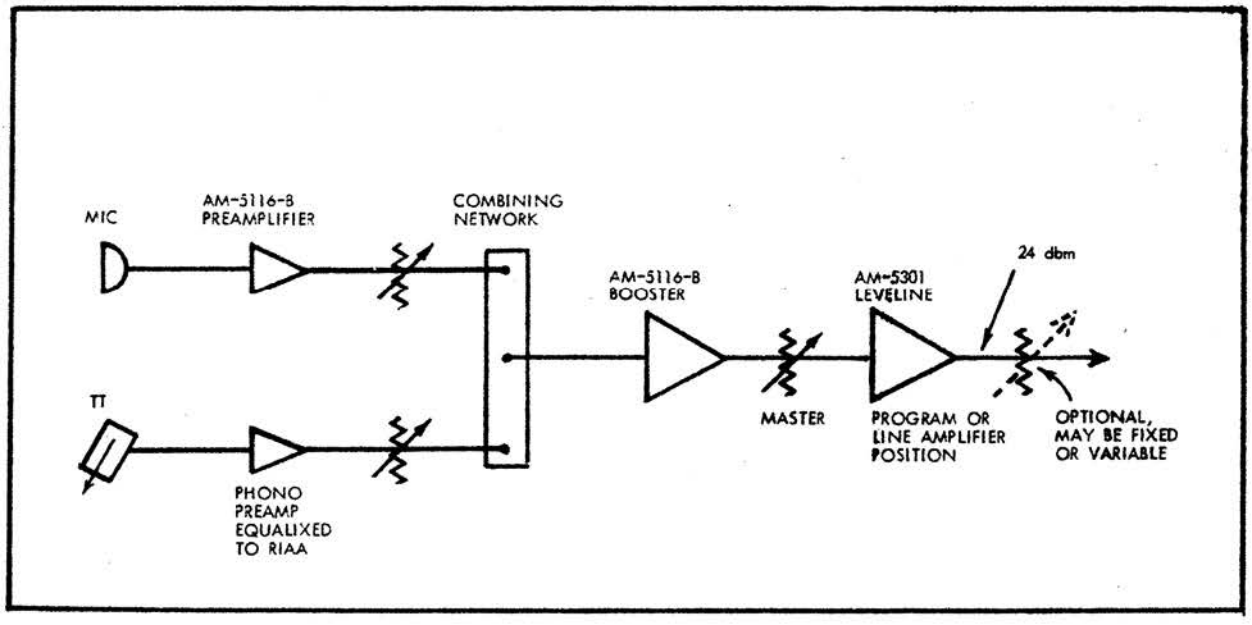
Step 2 - Make certain that the input signal is well below the threshold of the amplifier.

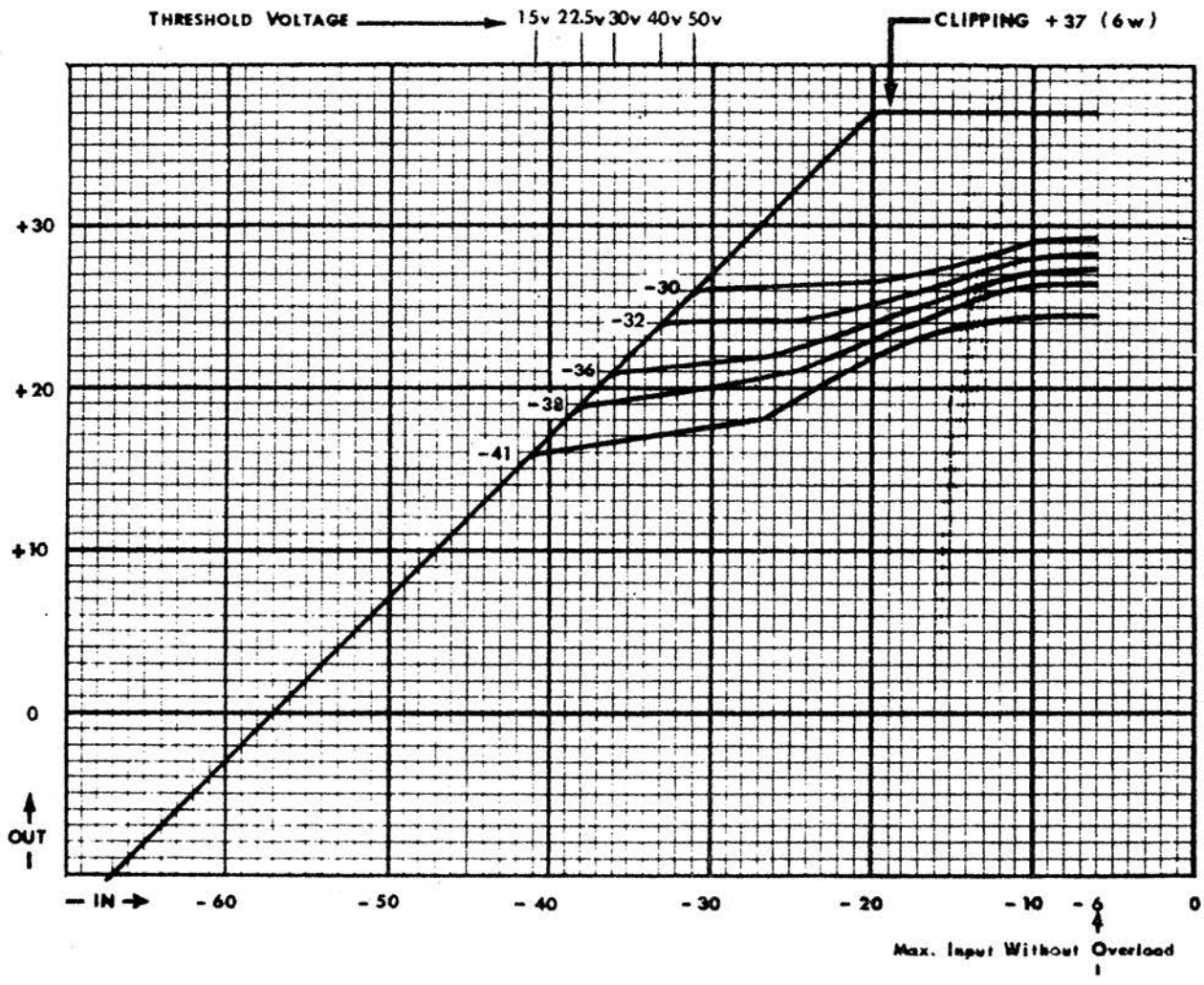
Step 3 - Adjust the meter calibration control (METER-CAL) so that the GR meter reads "0" VU.

Step 4 - The GR meter will indicate correctly for a threshold setting of 22.5V. The scale on the Gain Reduction decal does not indicate actual gain reduction but designates the average signal level in db above the threshold point.

OPERATION OF THE LEVELINE AS AN AUTOMATIC FADER CONTROL, OR "DUCKER"

FIGURE 9





Observe the accompanying illustration. The turntable position could be an incoming network line also, or any other program material. By simply adjusting the announce microphone gain control high enough to drive the Leveline into 8 db of compression, the program line will automatically be lowered the recommended one-half subjective loudness without movement of the controls. This 8 db differential has been established as the most effective and least obtrusive adjustment by the motion picture industry for many years, and in operation is colloquially known as "ducking".

In some operations it may be desireable to have the program material compressing 3 to 5 db, and to have the announcer override by more than 8 db, or as much as 25 db. By higher adjustment of the announce microphone level the Leveline amplifier will go directly into limiting rather than just compression and no increase past +27 dbm output will be noted. This action is automatic and no manipulation of the gain controls is required after initial setting.

UNATTENDED REMOTE OPERATION

The Leveline amplifier permits practically unattended operation of a remote line. If the remote location is a permanent installation, the Leveline can be installed on location to allow an average higher level to feed the telephone lines. If the remote pickup is temporary the Leveline unit should form part of the studio equipment.

For unattended remote use the Leveline should be set for about 15 db of gain reduction; the output will then expand for signals under 15 db of threshold and compress over this point. For this reason it is possible to operate the Leveline at high compression with no audible degradation of signal.

MAINTENANCE

When operated under normal conditions of heat and line voltage, maintenance will be negligible, other than a periodic inspection for dusting and occasional tube replacement.

It is not necessary to select matched tubes for the amplifier, inasmuch as the circuit characteristic prevents pumping or thumping from this cause. Tubes may be checked under operating conditions by the metering pushbuttons which connect to the common MTR-506 tube check meter.

Voltages for maintenance purposes are shown on the diagram. A large, hot iron should be applied and withdrawn quickly to avoid damage. Small "pencil" type irons are not recommended because they must contact the solder joint longer and consequently communicate excess heat to the surrounding area.

REPLACEABLE PARTS LIST

SYMBOL	DESCRIPTION
R-1, R-2	Resistor 270K 1/2W 10%
R-3, R-4	" 15K 1/2W 5%
R-5	" 270 1/2W 5%
R-6	" 150 1/2W 5%
R-7, R-8	" 1.5 Meg 1/2W 10%
R-9, R-10	" 2.7K 1/2W 5%
R-11, R-12	" 10K 1/2W 5%
R-13, R-14	" 6.8K 1/2W 5%
R-15, R-16, R-21, R-22	" 100K 1/2W 5%
R-17, R-18, R-30, R-31	" 470K 1/2W 10%
R-19, R-20	" 500 3W-WW Axial Leads
R-23, R-25	" 47K 1W 10%
R-24	" 22K 1W 10%
R-26	" 47K 1/2W 10%
R-27	Potentiometer 100K 2W Line Taper AB CLU 1041
R-28	Resistor 6.8 Meg 1/2W 10%
R-29	" 39K 1/2W 5%
R-32	" 4.7 Meg 1/2W 10%
R-34	Potentiometer 1K 2W Line Taper AB CLU-1021
C-1, C-2	Capacitor .015-400V SST-4S15 C.D.
C-3, C-4, C-7, C-8	" .1 400V SST-4P1 C.D.
C-5, C-6	" 25mfd 25V ECPB611 C.D.
C-9	" 1 mfd 75V ECPB901 C.D.
C-10	" .22 400V BCF 4P1 C.D.
C-11, C-12, C-13, C-14	" 30-20-40-20 350V Sprague PCL-4708-5
C-15	" .22 400V SST-4P22 C.D.
D-1, D-2	Silicon Diode IN-646 TI
SW-1-2-3-4	Switch Grayhill 39-1
T-1	Input Xformer TF 132-B
T-2	Output Xformer TF 322-B
SW-5	Dual Avgr Switch Specialty Mfg. 1180

Replaceable Spare Parts List (continued)

SYMBOL	DESCRIPTION
P-1	Remote Plug Amphenol 126-010
P-2	Power Plug Amphenol 126-804
J-2, J-3	Mtr Jacks Carter J 5-1
V-1	Tube 6ES8
V-2	Tube 12AY7
V-3, V-4	Tube 6005

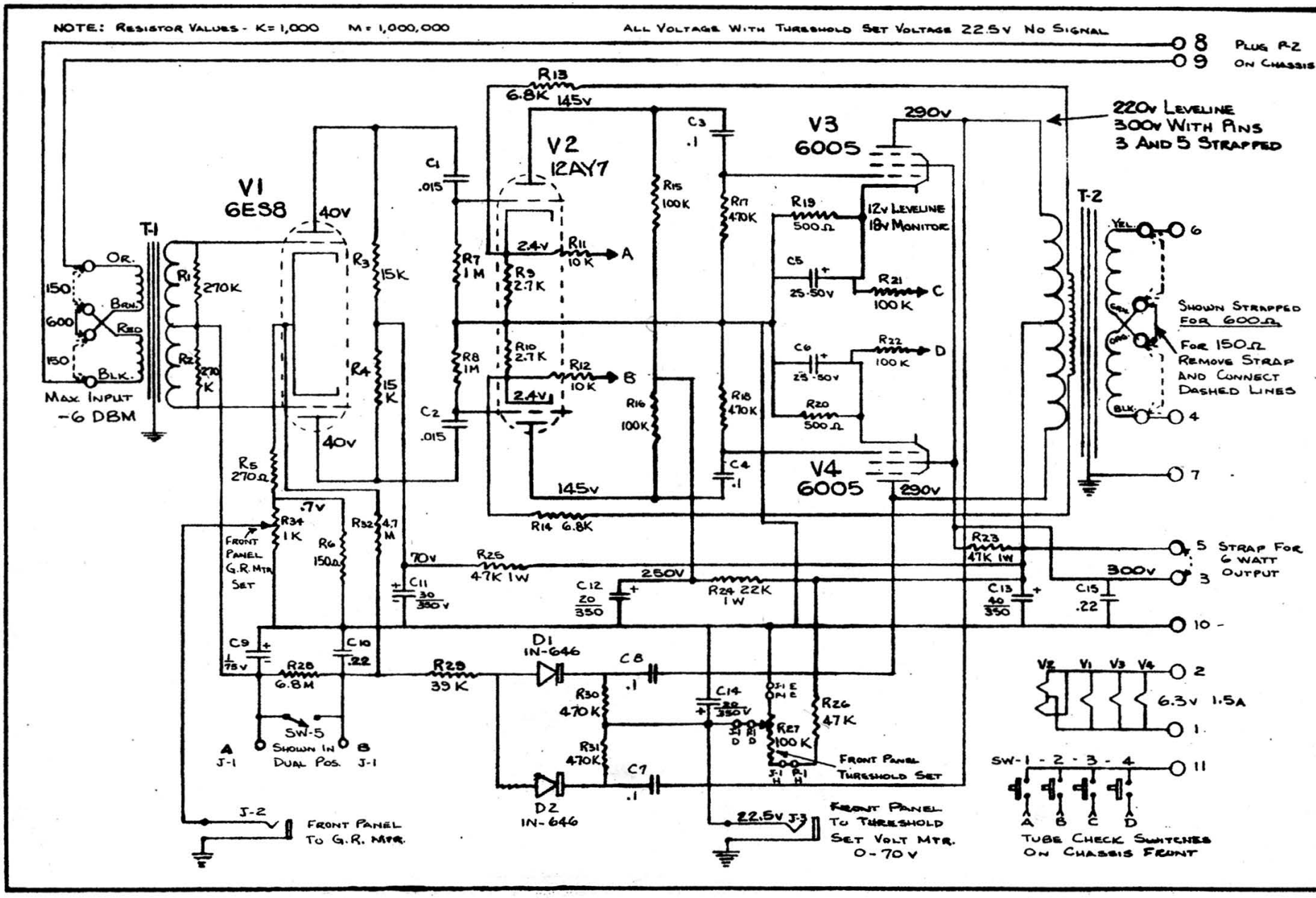


FIGURE 10 SCHEMATIC DIAGRAM LANGEVIN "LEVELINE" AM-5301