



### LEVEL DEVIL

Today, the widely used Gates *Level Devil* is accepted as the industry standard in automatic gain control amplifiers. The *Level Devil* accepts varying input signals and holds the output constant. Depending on input signal level, the *Level Devil* operates as (1) a linear amplifier, (2) a volume expander, or (3) a limiting amplifier. Unlike usual expander-compressors, however, the *Level Devil* does not expand or "pump" background noise.

**PERFORMANCE:** *Level Devil* accepts input signals over a 30 db. range and holds a constant output  $\pm 3$  db. The expander threshold is  $-10$  db. relative and below this the amplifier operates as any other good linear amplifier. At  $-10$  db. or above the amplifier will expand to 0 db. Above 0 db. it will limit.

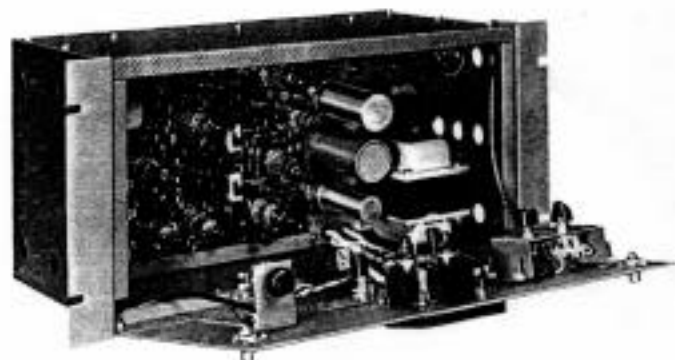
**OPERATIONAL FEATURES:** With average program content at normal input level, the *Level Devil* operates as a linear amplifier. With above normal audio input level it operates as a limiting amplifier, and maintains the desired output level. If the average input level should drop below normal by as much as 10 db., the *Level Devil* functions as a volume expander. But, when there is no signal for a period of 1 to 4 seconds, the *Level Devil* returns to the linear amplifier mode of operation, and does not emphasize or increase background noise. This is ideal for controlling the audio of a dramatic show in which there are long periods of silence enhanced only by the background of soft music or the rustling of leaves. To expand this background would destroy the desired audio effect.

**VERSATILITY:** When selected by the operator, two switches are provided so that *Level Devil* may be used for expansion only, without limiting; or vice versa, for limiting only, without expansion. Though *Level Devil* is particularly

adaptable to TV and FM broadcasting, it is equally suitable for AM where the exclusive features of *Level Devil* are preferred.

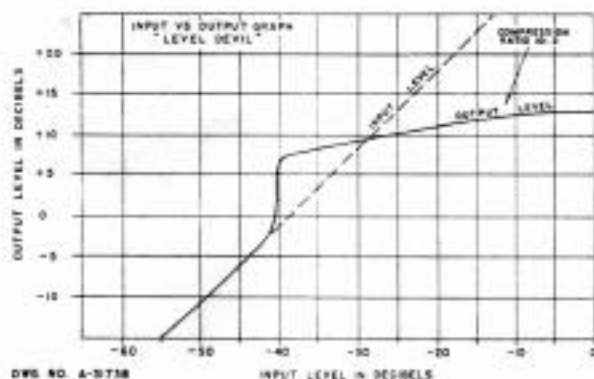
**APPLICATION:** In most instances a peak limiting amplifier should be used with *Level Devil*. The limiter, often at the transmitter location, is the over-all guardian against over-modulation as well as permitting higher average audio levels. *Level Devil*, usually at the studios, preferably operates independent of other total equipment functions to obtain the fullest benefit of its outstanding capabilities.

Radio and television stations alike have reported an increase in coverage with a louder sound, minimum background noise in absence of a signal, and constant output level as salient operating advantages obtained from *Level Devil*.

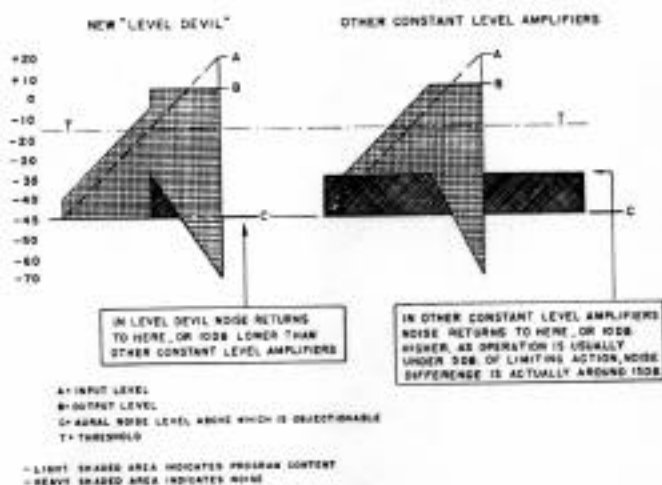


The *Level Devil* front panel hinges down for fast access to tubes and controls. As controls once adjusted are seldom changed, this feature prevents accidental changing of the important automatic gain control functions. The controls accessible with front panel closed include on-off switch, pilot light and fuse.

# The Level Devil—Program Gated Amplifier



Above: Graph shows compression or limiting curve as related to input.



Above: Graphically illustrates the difference between Level Devil and all other leveling amplifiers. Noise referred to in graphs is defined in this instance as lower level program content.

## SPECIFICATIONS

**MODE:**  
Monaural.

**CONTROLS:**  
Input and output levels. Switches to select operating modes.

**METER:**  
Reads direct in (a) limiting, (b) normal, and (c) expansion.

**IMPEDANCES:**  
500/600 ohms input and output.

**INPUT LEVEL:**  
-35 VU to +27 VU (10 db. and 20 db. input pads incorporated).

**OUTPUT LEVEL:**  
+8 VU after 6 db. line isolation pad.

**GAIN:**  
50 db. without limiting or expansion.

**RESPONSE:**  
 $\pm 1$  db. 30-15,000 cycles.

**DISTORTION:**  
1% or less 50-10,000 cycles to 10 db. limiting, 2% or less to 25 db. limiting.

**MAXIMUM VOLUME EXPANSION:**  
10 db. Note that Level Devil can release 5 db. of compression and expand 10 db., giving effective signal increase of 15 db.

**EXPANSION RISE TIME:**  
2 seconds.

**EXPANDER RECOVERY TIME:**  
4 seconds.

**MAXIMUM LIMITING:**  
25 db.

**LIMITER ATTACK TIME:**  
10 milliseconds.

**LIMITER RELEASE TIME:**  
1.5 to 2.0 seconds.

**NOISE:**  
-60 db. or better below 10 db. limiting.

**POWER:**  
117 volts, 50/60 cycles, 55 watts.

**SIZE:**  
19" x 8 $\frac{3}{4}$ " x 8 $\frac{1}{2}$ " deep.

**WEIGHT:**  
Domestic packed 35 lbs.; export packed 45 lbs. Cubage: 2 cu. ft.

**FINISH:**  
Medium gloss gray and black.

**TUBES:**  
(2 each) 5749, 12AU7, 12AT7, 12AX7, OB2. (1 each) EF86, 5V4G.

## ORDERING INFORMATION

Level Devil with tubes ..... (Cat. No.) 5546A  
Spare 100% tube kit ..... TK-331

## DID YOU KNOW?

*Did you know* that Gates manufactures more radio broadcasting equipment than any other manufacturer in the world? *Did you know* that three of the four major United States networks have their key originating studios for either radio or television equipped with Gates manufactured audio equipment? *Did you know* that Gates short wave 50,000 watt transmitters are used by Voice of America for world-wide broadcasting? *Did you know* that the world's largest radio studios are Gates manufactured (VOA in

Washington, D.C.)? *Did you know* that the Harris-Intertype Corporation, by whom Gates is wholly owned, is a world leader in the graphic arts industry and manufactures the presses that print Life, Saturday Evening Post and National Geographic among many others? *Did you know* that Gates, established in 1922, and enjoying its 43rd year, is one of the very few electronic equipment manufacturers in the world with such lengthy seniority. And most important—*Do you know* that 100% of our effort is directed to you our customer.

# INSTRUCTION BOOK

Level Devil - M5546A Compressor Expander Amplifier

No. IB-888 0782 001

Level Devil is an extended version of the automatic gated amplifier. It will function in all places as the Gates Sta-Level but has the added feature that at "no signal" condition the amplifier does not return to full gain, but instead, returns to its expanded gain. Because of this, it is particularly adapted to television where there are often sustained periods of near silence between dialogue. When properly adjusted, these non-dialogue periods will not expand to increase background noise.

## IMPORTANT

— In case of damage in transportation, notify the delivering carrier at once. After he has approved the damage report, which indicates he will accept your billing for the damage — order new part/s from Gates. Our billing for these parts, plus transportation expense, will be your claim to the transportation company.

## INSTALLATION

Locate the amplifier for easy vision of the meter. Provide at least 1-3/4" free space between the top and the next unit mounted in the rack to assure heat release. Level Devil has been carefully tested and is ready to use.

Connections are made to the rear and are:

500/600 ohms input; 1 and 2 on TB 1  
Ground; 3 on TB 1  
500/600 ohms output; 1 and 2 on TB 2  
Ground; 3 on TB 2  
115 volts 50/60 cycles; AC receptacle

All audio wiring should be shielded and input cable should not run in same laced cable or conduit with output cable. AC should also be separate. Be sure and ground shields to ground terminals provided.

## OPERATION

These general specifications will aid in determining proper operation:

Gain: 50 db. without input or output pads inserted.

Response:  $\pm 1$  db. 30-15,000 cycles.

Distortion: 2% or less up to 25 db. compression.

Input Levels: -35 VU to  $\pm 27$  VU (see pads).

Output Level:  $\pm 14$  VU (see pads).

Maximum Expansion: 10 db.

Maximum Compression: 25 db.

Compression Attack Time: 10 milliseconds

Compression Release Time: 1.5 to 2.0 seconds

Expander Rise Time: .20 seconds

Expander Release Time: 4.0 to 5.0 seconds

Tubes: (2 each) 5749, 12AU7, 12AT7, 12AX7, OB2  
(1 each) EF 86, 5V4G

This amplifier has two fixed input pads and a variable output attenuator so that any practical input or output level may be accommodated. The input pads should be connected so that about -20 dbm. level is available at the primary of the input transformer. For instance, if  $\pm 8$  dbm. is connected to the input terminals and both the 10 db. and 20 db. pads are connected, -22 dbm. will appear at the input transformer primary. This input level will allow the variable input control (AT3, behind front panel) to operate at about the middle of its range. Input levels as high as  $\pm 27$  dbm. may be accommodated with both the 10 db. and the 20 db. pads connected. If a lower than 0 dbm. level is anticipated, one or both of the pads should be disconnected (by-passed). For an input level of -35 dbm., the input terminals should be connected directly to the input transformer. The input control (AT3) should be adjusted so that the meter reading remains in the green portion of the scale (average reading), with normal "complex wave" programming. If the input signal is reduced, the pointer should move to the right (up scale), indicating a rise in amplifier gain to compensate for the loss in signal level. If the input signal is increased, the pointer should move to the left, indicating a decrease in amplifier gain.



The variable output pad (AT4) is located inside the back cover at the top of the amplifier board. Since the output level of the amplifier is constant, this control serves only to adjust the level after the output of the amplifier. The level may be adjusted from  $\pm 14$  dbm. to about -30 dbm. Once this control is properly adjusted, it should not be necessary to change its setting during normal operation.

#### HELPFUL OPERATING DATA

1. Tracing the signal from input to output, two pads will be found between the input terminals and the input transformer, a 10 db. pad and a 20 db. pad. These pads, when used singly or together, will furnish 10 db., 20 db., or 30 db. loss. This will be enough range for most input levels. The input transformer (T1) furnishes a push-pull signal to the grids of V1 and V2 and a shunt type volume control is connected between the grids. This volume control (AT3), together with R1, R2, R4 and R5, comprise a network which has a 5 db. minimum loss. Since it is desirable to operate this control near mid-range, the input pads (AT1 and AT2) should be used to adjust the input level (to the input transformer) to about -20 VU. The amplifier will accept signal levels between -35 VU and  $\pm 27$  VU. AT3 is located behind the front panel so that it cannot be accidentally moved by operating personnel. Once adjusted, this control will require no attention for long periods of time.
2. If it is desired to disable the expander circuit for certain unusual types of broadcasting sometimes encountered in TV, this may be done by placing switch S3 to the "OFF" position.
3. Because of the difference in average power between complex waves and sine waves, the expansion cannot be accurately checked with a sine wave signal.
4. Field testing has shown that, when the amplifier is used to feed a TV transmitter directly (no limiter amplifier following the Level Devil), an over-shoot of not more than 1 db. can be expected with the application of a 10 db. overload of complex wave signal.

#### MAINTENANCE

DC voltages and signal voltages (AC) have been tabulated on the schematic diagram. Since these voltages are an average of many units, allow  $\pm 20\%$  tolerance in all readings.

If it becomes necessary to replace the tubes in the first stage (V1 and V2), it is recommended that both 5749 tubes be replaced. Tubes of a similar age (hours of operation) will need re-balancing at less frequent intervals than tubes of different ages. When tubes are replaced in the first stage, it is necessary to re-balance them. This procedure is set forth in steps:

1. Apply power to the amplifier and allow it to warm up for at least 15 or 20 minutes. If possible, perform this balancing at the end of the first day of operation before turning the amplifier "OFF".
2. Turn the input gain control (AT3) all the way down (OFF).
3. Connect a vacuum tube voltmeter to the amplifier output.
4. Switch the limiter (S2) and expander (S3) switches "ON".
5. Place the function switch (S1) in the "Balance 1" position (center). Adjust R67 (in the power supply) until an adequate reading is obtained on the "1 to 10 volt" scale of the vacuum tube voltmeter.
6. Switch the function switch (S1) to the "Balance 2" position (up). Adjust R14 for minimum output.
7. Repeat steps 5 and 6 until no further improvement is noted. The voltmeter sensitivity may have to be increased as the null is approached.
8. Place the function switch in the "#2" (center) position and adjust R12 (on back of meter) until the meter reads full scale.
9. Return the function switch (S1) to the "Operate" (down) position.

The first stage has now been balanced and is ready for use. It should be remembered that the expansion characteristics cannot be checked accurately with tone. The amplifier has been adjusted to operate with complex wave signal.

Keep clean both inside and out. About every three months, remove tubes from sockets several times, pushing in and out, to clean socket contacts. Level Devil is a carefully designed equipment after nearly a year's research. We suggest no change in circuit constants without first inquiring of the Gates Engineering Department.

If it is necessary to replace any component on a printed wiring board, write the Gates Engineering Department for the bulletin entitled, "Replacing Components On The Printed Chassis".

PARTS LIST

Symbol No.	Gates Part No.	Description	Symbol No.	Gates Part No.	Description
A1	396 0045 000	Lamp, #47	<b>CONTROL SECTION</b>		
AT1	994 5734 002	20 db "H" Pad, 600/600 ohms	C11, C20	506 0031 000	Cap., 25 uf., 200V
AT2	994 5733 002	10 db "H" Pad, 600/600 ohms	C12, C19	508 0032 000	Cap., .1 uf., 200V
AT3	550 0189 000	Potentiometer, 50K ohm, 2W	C13, C15,		
AT4	554 0255 000	Output attenuator, 500 ohms	C18	508 0048 000	Cap., .047 uf., 400V
F1	398 0017 000	Fuse, 1 amp., 3 AG	C14, C16,		
(J1, P1, & P2)	250 0025 000	Chassis receptacle & AC line cord	C17, C21	506 0028 000	Cap., .1 uf., 400V
M1	913 1412 000	Level Meter	C22	506 0026 000	Cap., .47 uf., 200V
R12	550 0021 000	Control, 500 ohm, 2W	C28	502 0170 000	Cap., 200 uuf., 500V Silver Mica
S4	604 0005 000	Switch	R33	540 0079 000	Res., 18K ohm, 1/2W
TB1, TB2	614 0214 000	Terminal Board	R34	540 0025 000	Res., 100 ohm, 1/2W
XA1	406 0136 000	Pilot Light (red)	R35	540 0075 000	Res., 12K ohm, 1/2W
XF1	402 0021 000	Fuseholder	R36	540 0094 000	Res., 75K ohm, 1/2W
<b>AMPLIFIER SECTION</b>			R37	540 0218 000	Res., 2.2 Megohm, 1/2W
C1	508 0033 000	Cap., 15 uf., 200V	R38, R41,		
C2, C3,			R42, R44,		
C5, C8	508 0048 000	Cap., .047 uf., 400V	R46	540 0214 000	Res., 1 Megohm, 1/2W
C4	508 0032 000	Cap., .1 uf., 200V	R39	540 0142 000	Res., 7.5 Megohm, 1/2W
C7	522 0314 000	Cap., 40 uf., 350V	R40, R52	540 0097 000	Res., 100K ohm, 1/2W
C9	506 0028 000	Cap., 1 uf., 400V	R43, R60	540 0090 000	Res., 51K ohm, 1/2W
C10	522 0289 000	Cap., 25 uf., 25V	R45, R49	540 0202 000	Res., 100K ohm, 1/2W
C27	508 0144 000	Cap., .0056 uf., 600V	R47	540 0196 000	Res., 330K ohm, 1/2W
C6	506 0031 000	Cap., .25 uf., 200V	R48, R59	540 0184 000	Res., 3300 ohm, 1/2W
R1, R2	540 0077 000	Res., 15K ohm, 1/2W	R50	540 0191 000	Res., 12K ohm, 1/2W
R3	540 0149 000	Res., 15 Megohm, 1/2W	R51	540 0204 000	Res., 150K ohm, 1/2W
R4, R5,			R53	540 0054 000	Res., 1600 ohm, 1/2W
R24, R26	540 0101 000	Res., 150K ohm, 1/2W	R54	540 0104 000	Res., 200K ohm, 1/2W
R6	550 0019 000	Potentiometer, 250 ohm	R55	540 0220 000	Res., 3.3 Megohm, 1/2W
R7	540 0329 000	Res., 750 ohm, 1W	R56	540 0228 000	Res., 15 Megohm, 1/2W
R8, R9,			R57, R58	540 0210 000	Res., 470K ohm, 1/2W
R69	540 0090 000	Res., 51K ohm, 1/2W	S1, S2	913 1502 001	Switch, D.P.D.T.
R10, R13	548 0076 000	Res., 100K ohm, 1/2W	V6, V9	370 0112 000	Tube, 12AT7
R11	540 0191 000	Res., 12K ohm, 1/2W	V7, V8	370 0116 000	Tube, 12AX7
R14	550 0029 000	Potentiometer, 10K ohm	XV6, XV7,		
R15, R20	540 0202 000	Res., 100K ohm, 1/2W	XV8, XV9	404 0059 000	Socket
R16, R17	540 0114 000	Res., 510K ohm, 1/2W	<b>POWER SUPPLY SECTION</b>		
R18, R19,			C23	524 0079 000	Cap., 15-15-10 uf., 450V
R22, R31	540 0066 000	Res., 5100 ohm, 1/2W	C24	524 0013 000	Cap., plug-in, 30-30 uf., 525V
R21	540 0198 000	Res., 47K ohm, 1/2W	C25	508 0162 000	Cap., 1 uf., 600V
R23, R68	540 0190 000	Res., 10K ohm, 1/2W	C26	524 0036 000	Cap., 3000 uf., 15V
R25	540 0051 000	Res., 1200 ohm, 1/2W	CR1, CR2,		
R27	540 0214 000	Res., 1 Megohm, 1/2W	CR3, CR4	384 0018 000	Diode Rectifier, 1N2069
R28	540 0166 000	Res., 100 ohm, 1/2W	L1, L2	476 0009 000	Filter Choke
R29	540 0205 000	Res., 180K ohm, 1/2W	R61	540 0191 000	Res., 12K ohm, 1/2W
R30	540 0044 000	Res., 620 ohm, 1/2W	R62	540 0190 000	Res., 10K ohm, 1/2W
R70	540 0464 000	Res., 470 ohm, 1W	R63, R63A	540 0751 000	Res., 8200 ohm, 2W
S1	602 0005 000	Lever Switch	R64	542 0088 000	Res., 5K ohm, 10W
T1	478 0144 000	Transformer, input	R65	542 0801 000	Res., 2.2 ohm, 1W
T2	478 0120 000	Transformer, output	R67	550 0057 000	Control, 250 ohm, 2W
V1, V2	370 0153 000	Tube, 5749	T3	472 0054 000	Transformer, Power
V3, V5	370 0195 000	Tube, 12AU7	V10, V11	370 0002 000	Tube, OB2
V4	370 0144 000	Tube, EF86/6267	V12	370 0018 000	Tube, 5V4G
XV1, XV2	404 0058 000	Socket	XC24, XV12	404 0016 000	Socket
XV3, XV4,			XV10, XV11	404 0032 000	Socket
XV5	404 0059 000	Socket			

Please order replacement parts by stock number to assure fast handling.

