Georg Neumann GmbH | Berlin

U 473 Compressor-Limiter-Expander

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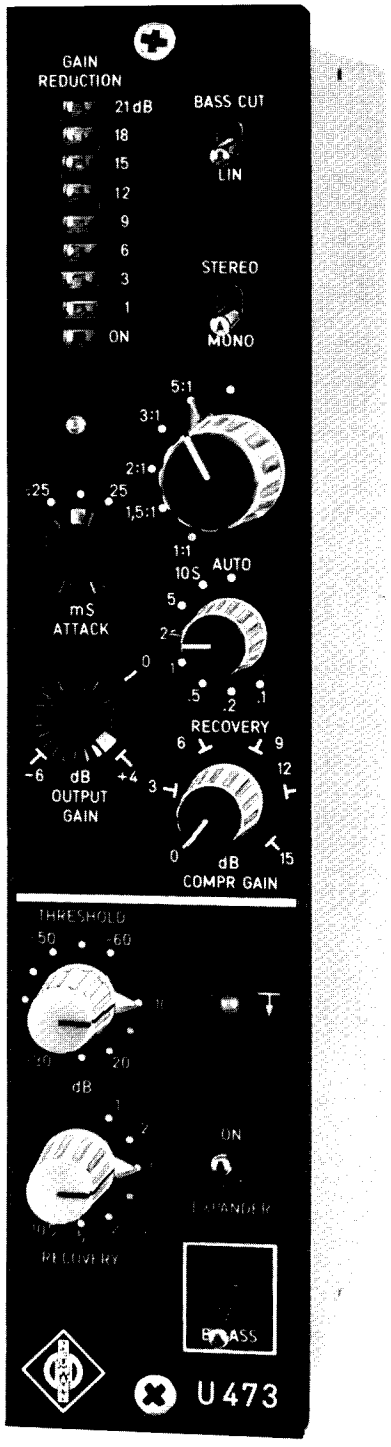

The U 473 is an extremely compact and flexible control amplifier. Compressor, limiter and expander as well as an additional "spike limiter" all fit into a size A1 cassette. The new Neumann VCA 101 Voltage Controlled Amplifier serves as the control element and has greatly improved the signal-to-noise specifications when compared to similar devices.

The unit is highly flexible in both its static and dynamic parameters, making it ideally suitable both as an inaudible dynamics reducer and an effects device. The compression ratio may be varied from 1.5:1 to 5:1 in small, discrete steps, while the attack time may be set to either 0.25 ms, 2.5 ms or 25 ms. The limiter has a fixed attack time which was selected to optimize the click suppression for critical program material. Even shorter duration spikes are controlled by an additional "spike limiter" which may also be in use when the unit is used as a compressor.

The recovery time may be selected in 7 steps between 0.1 seconds and 10 seconds. In the AUTO position the recovery is program dependent, with two time constants. The expander may be operated independently of both the compressor and limiter. It has an expansion ratio of 1:1.5 and a gain of 12 dB. The threshold may be selected in 5 dB steps between −10 dB and −60 dB. The attack time is about 20 μs and the recovery time is selectable between 0.1 and 10 seconds.

A low frequency filter may be inserted into the control circuit of the compressor or limiter, and prevents gain control of the entire program caused by low frequency sounds at high level but little loudness. A simple external strap furthermore provides a second time constant used for de-essing. This takes into account pre-emphasized circuits as found in FM broadcasting as well as tape and disk recording.

To prevent a perspective shift of point source sounds in stereo transmissions, the control signals of two or more units may be coupled by means of a front panel switch.

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U 473 Operation

The U 473 is designed for an input and output nominal level of +6 dB. Its basic gain may be varied from −6 dB to +4 dB by means of the OUTPUT GAIN (8) control, thus providing a nominal output level of 0 dB to +10 dB.

Activation

The BYPASS position of switch 14 disables the control circuit but maintains the U 473 in the circuit together with its input and output impedances. Operating the bypass switch (14) activates the control function and lights the lower (yellow) LED in the LED chain (2).

Selecting operating parameters

1) Limiter

Switch 5 in its LIM position selects the limiting function. The limiter affects only levels which exceed a certain threshold and brings those back to the threshold level. In the zero position of the COMPR GAIN (9) control, this threshold is set for +6 dB. This setting is recommended when the U 473 is used as a protective limiter to prevent the overload of ensuing equipment. The input sensitivity of the control element may be increased by up to 15 dB by means of the COMPR GAIN (9) control (Fig. 1). This leads to an increase in the mean loudness but at constant level, since the level is determined by the peaks which are suppressed by the limiter. The LED string GAIN REDUCTION (2) shows by how many dB the peaks are being reduced.

The attack time of the U 473 limiter was chosen to prevent clicks during critical program material. It is 2.5 ms regardless of the position of the ATTACK (6) switch which permits selection of different attack times for the compressor function. Even shorter duration spikes are caught by the additional "spike limiter" which becomes operative in the LIM position of switch 5 (Exception: see BASS CUT). This "spike limiter" has an extremely short attack time and its threshold has been set at +9 dB, or 3 dB higher than the normal limiter. Every gain reduction resulting from operation of the "spike limiter" is indicated by the LED PEAK LIM (4).

The recovery time of the limiter may be selected by the RECOVERY (7) switch between 0.1 and 10 seconds. The AUTO position of this switch selects a program dependent recovery characteristic.

2) Compressor

Switch 5 selects the desired compression ratio and the COMPR GAIN (9) control the gain of the compressor. This amount of gain is only effective for low levels and decreases for rising input levels according to the compression ratio. At +6 dB the gain becomes unity (Fig. 2). The "spike limiter" may also be activated during compressor operation by linking pins 20 and 21 at the connector. One then obtains the characteristics according to Fig. 3. The attack time for the compressor may be selected by the ATTACK (6) switch. For long attack times the signal's rising flank behavior is over emphasized, which may well be a desired effect. Short attack times will provide better agreement between input and output. These, on the other hand may lead to distortion at low frequencies, and to clicks for certain kinds of modulation. The recovery time is selected using the RECOVERY (7) switch. Short times alter the decay or the reverberation of the signal and are therefore mostly used for the production of effects. The agreement between input and output improves for long recovery times. However recovery times which are too long lead to a constant gain situation where short duration variations in dynamics are no longer affected. In the AUTO position of the RECOVERY (7) switch, the recovery time is program dependent.

3) Expander

The expander is operational in the ON position of switch 12. If the compressor or limiter function are not wanted, switch 5 must be in its 1:1 position. The COMPR GAIN function, however, remains in effect (Fig. 6). The expander is normally used in conjunction with the compressor, to prevent noise from being increased during modulation pauses by virtue of the compression gain. The expander reduces the gain of signals below its threshold according to its expansion ratio of 1:1.5 by up to 12 dB (Fig. 4). This gain reduction is indicated by the green LED (10). The threshold may be selected in 5 dB steps between −10 dB and −60 dB with the THRESHOLD switch (11). The attack time is about 20 μs and the recovery may be selected by the RECOVERY (13) switch between 0.1 and 10 seconds. When using the compressor and expander simultaneously (the usual application), they should be so adjusted that the expander recovery time is always shorter than that of the compressor, since otherwise, during a pause, the compressor would become active before the expander has a chance to reduce gain.

Additional functions

1) Bass cut

The BASS CUT (1) switch inserts a low frequency cut-off filter (300 Hz and 6 dB/octave) in the control circuit during compressor or limiter operation, while at the same time disabling the "spike limiter". This operation is useful to prevent low frequency, high amplitude signals such as bass drum or plucked string bass, from controlling the entire program. See Fig. 5.

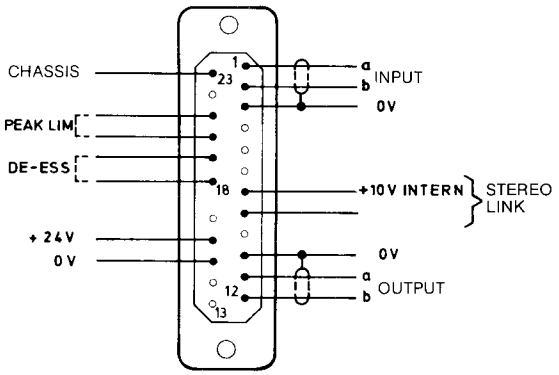
2) De-essing

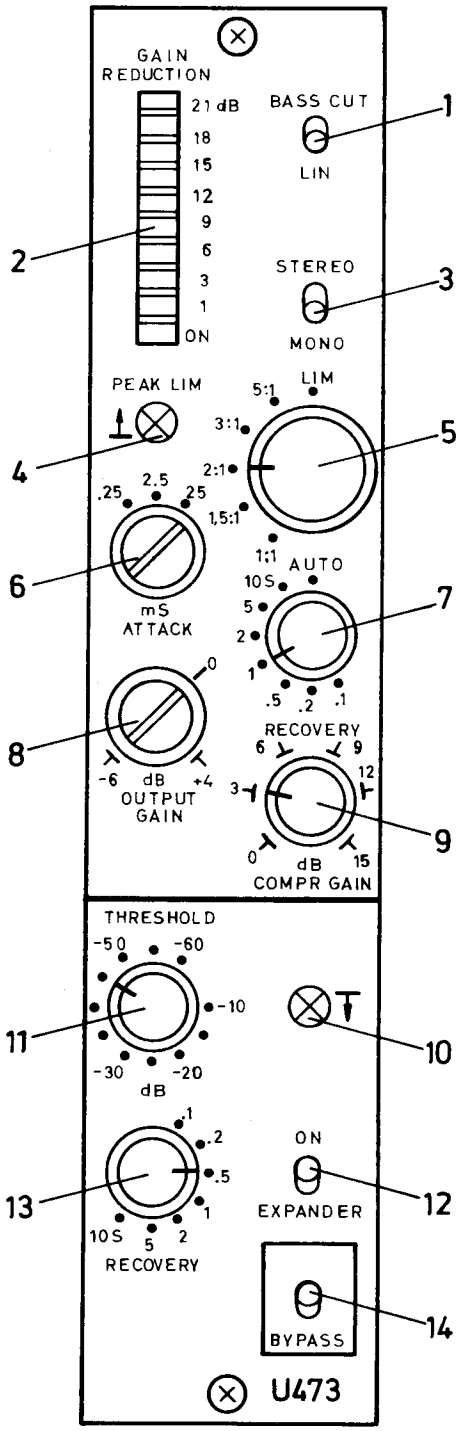
Connecting pins 18 and 19 on the connector inserts a pre-emphasis circuit (3180 Hz at 6 dB/octave) into the control circuit. The time constant may be shortened by substituting a capacitor for the strap between pins 18 and 19. This permits the inverse of various standard pre-emphasis curves to be selected, and makes the U 473 an ideal protective limiter at the inputs of such pre-emphasized equipment as FM transmitters and tape and disk recorders (Fig. 5).

3) Stereo

The STEREO position of switch 3 couples the control voltage of two or more units, thus preventing a shift in the balance between channels resulting from their gain control. The control of all such coupled units is performed by the one in the channel with the greatest instantaneous control signal, so that it must be observed that all such coupled units are set to identical attack, recovery and compression ratio settings. In the BYPASS position of switch 14 this coupling is automatically cancelled.

Connecting diagram for U 473





Technical data:

0.775 V≙0 dB

Input data:

Input	balanced and floating
Effective input impedance in the pass band	≧5 kOhms
Input common mode rejection at 15 kHz	≧60 dB
Max. input level	+22 dB

Output data:

Output	balanced and floating
Output source impedance in the pass band	≦40 Ohms
Output common mode rejection at 15 kHz	≧60 dB
Max. output level into 300 Ohms	+22 dB
Min. terminating load	≧300 Ohms
Frequency response re 1 kHz:	40 Hz to 15 kHz ±0.3 dB

Compressor/Limiter:

Compression ratio	settable to 1:1, 1.5:1, 2:1, 3:1, 5:1
Position LIM ratio	approx. 20:1
Nominal output level in "LIM" position	+6 dB
PEAK LIM threshold	+9 dB (for program spikes ≦2.5 ms)

Attack times:

Compressor	0.25, 2.5, 25 ms
Limiter	2.5 ms
Recovery time	0.1, 0.2, 0.5, 1, 2, 5, 10 sec
AUTO position	program dependent; dual time constants
Input gain (COMPR GAIN)	0...15 dB; stepless adjustment
Output gain	−6 dB...+4 dB; stepless adjustment
Bass cut:	3 dB point at 300 Hz; 6 dB/oct
De-Esser: (linking pins 18-19)	3 dB point at 3180 Hz; 6 dB/oct

The De-Esser is activated by connecting pins 18-19 on the connector. The De-Esser time constant may be altered by substituting a condenser instead of this bridge. Recommended values are between 560 pF and 3300 pF.

Expander:

Threshold	adjustable in 5 dB steps from −10...−60 dB
Expansion ratio	1:1.5
Expansion gain	11 dB
Attack time	approx. 20 μs
Recovery time	0.1, 0.2, 0.5, 1, 2, 5, 10 sec
Distortion in pass band	THD ≦0.3%
S/N ratios re nominal output level at 0 dB gain	
BYPASS position	Wtd per CCIR ≧96 dB Unwtd rms DIN ≧102 dB
Compr/Lim positions (no Exp)	Wtd per CCIR ≧87 dB Unwtd rms DIN ≧94 dB
Compr/Lim/Exp position	Wtd. per CCIR ≧93 dB Unwtd rms DIN ≧100 dB

Powering requirements:

Nominal voltage	24 Vdc; (−3 +6 V)
Current consumption at 24 V	160 mA max (300 ohms termination; +22 dBm)
Connector and mate	T 2700 and T 2701 respectively
Housing	A1 standard cassette (40 x 190 mm panel)
Weight	1 kg (2.2 lbs)
Operating temperature	0°...50 °C (32°...122°F)

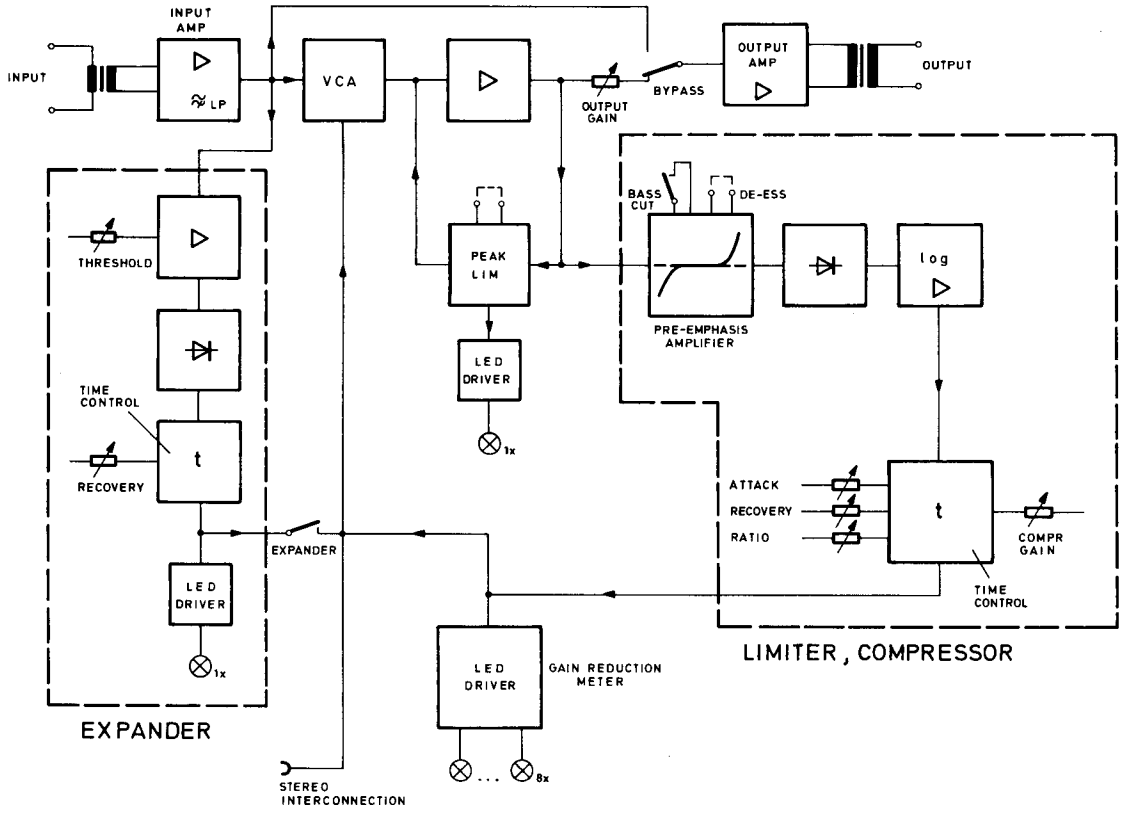
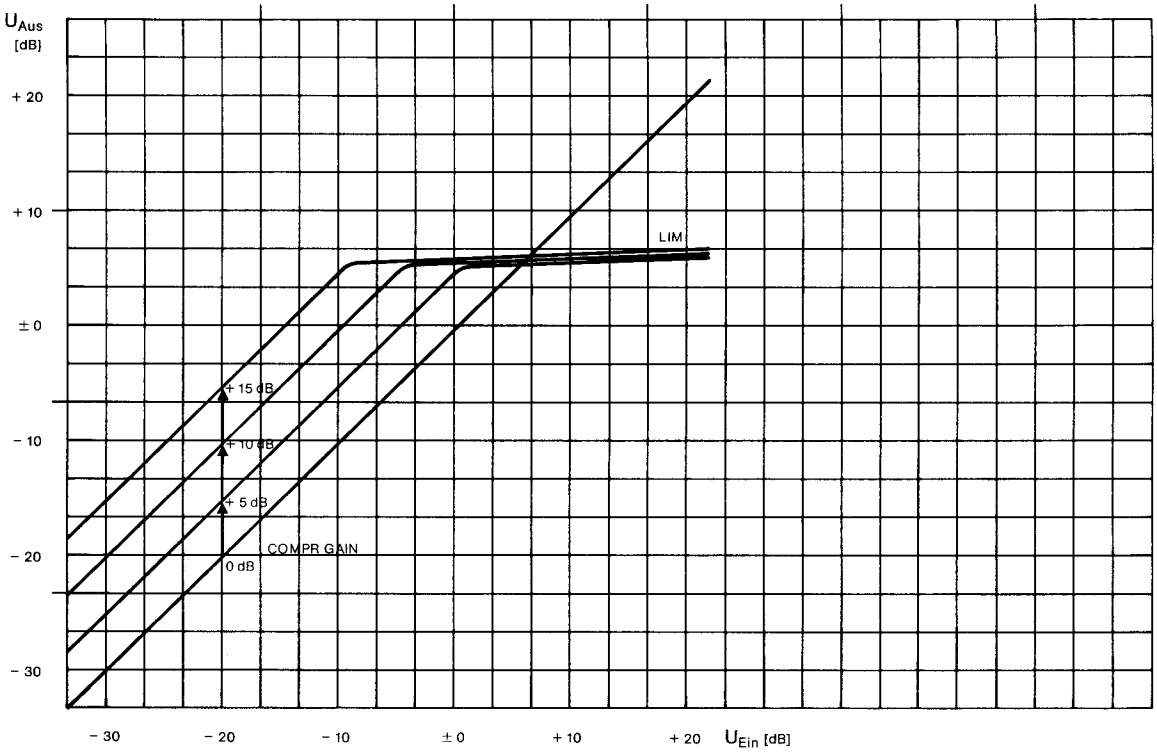
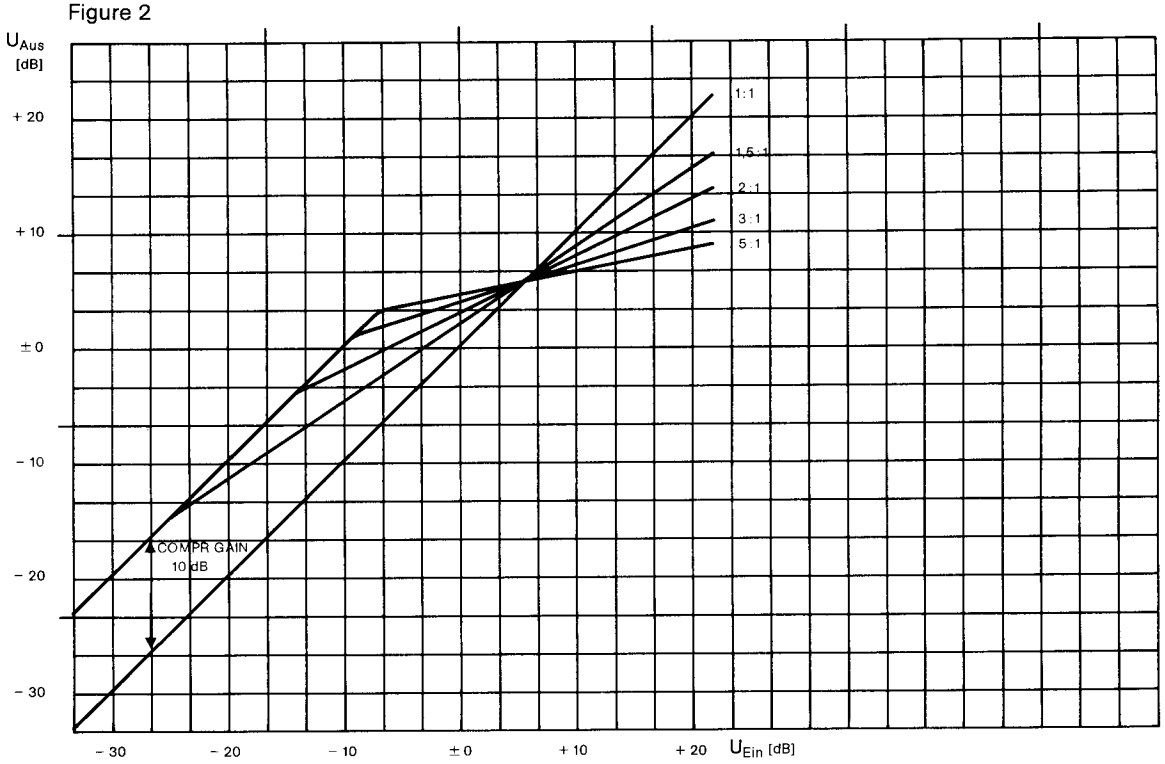


Figure 1



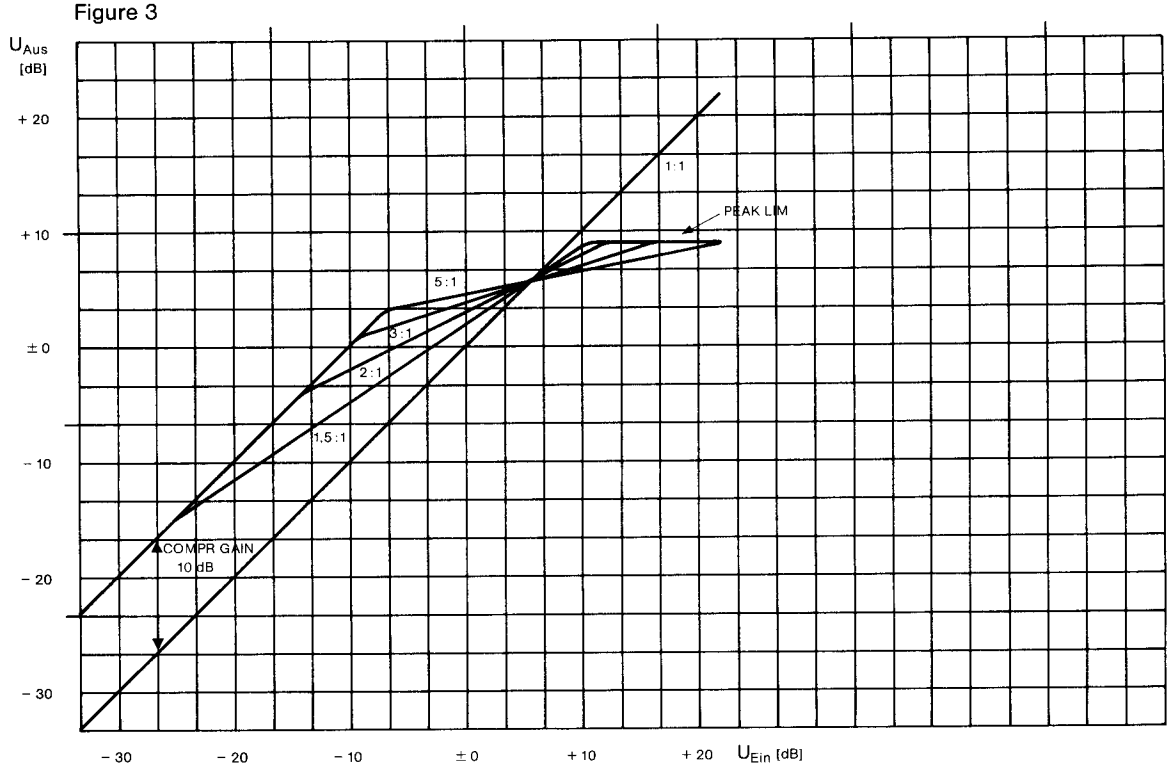
Limiter characteristic
Expander: off; output gain: 0 dB; switch 5: position LIM

Figure 2



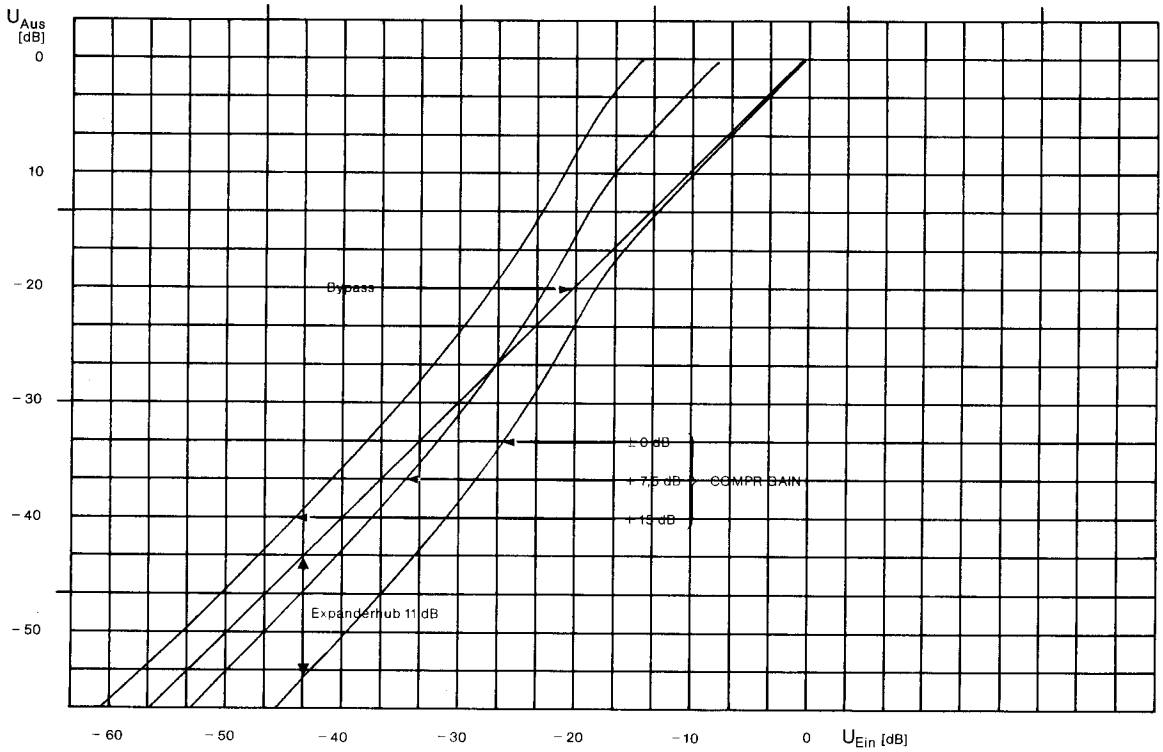
Compressor characteristic
Expander: off; output gain: 0 dB

Figure 3



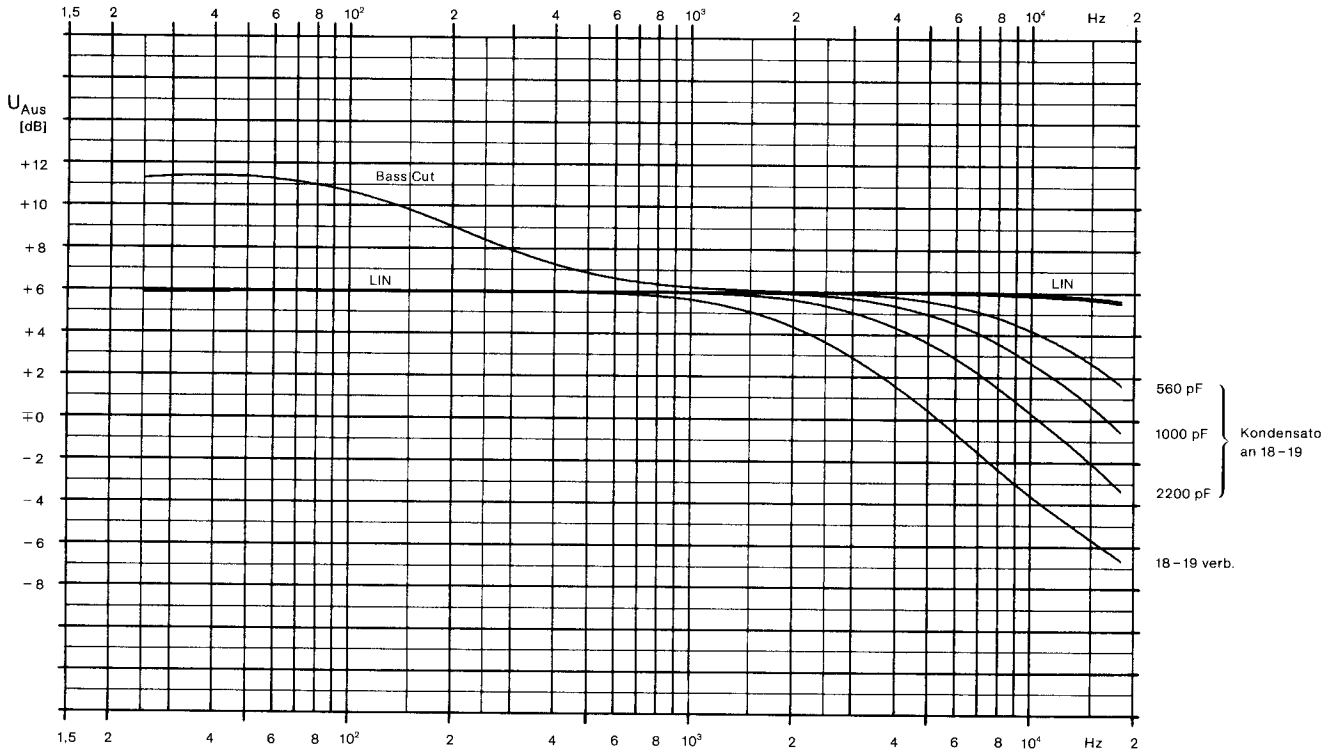
Compressor characteristic as fig. 2
Peak limiter active pins 20-21 connected

Figure 4



Expander characteristic
Switch 5: position 1:1
Threshold: – 20 dB

Figure 5



Bass cut and De-Ess function
Switch 5: LIM; output gain: 0 dB; compr gain: 0 dB; U_{IN}: + 16 dB