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EMT 251

Digital Reverberation System

- Highly natural reverberation with up to nine individual reflections.
- Time and amplitude of the reflections adjustable individually or as a group
- Reverberation over the entire audio frequency range
- Frequency response of the reverberation adjustable in four separate bands
- New sound-effect programs
- Wideband delay of more than 400 ms
- High-resolution 16-bit analog/digital conversion

General Description

The EMT 251 Digital Reverberation System expands and surpasses the capabilities of its predecessor, the EMT 250 Electronic Reverberator Unit, in every respect. The total storage time has been increased so that in addition to pure reverberation a number of discrete reflections with a combined time of up to 120 ms are possible; the time and amplitude of three of these may be individually adjusted and are assigned to the left output, to the right, and to both through a panorama potentiometer. The fourth delay simultaneously determines the commencement of reverberation; the attendant adjustment elements control a group of six individual reflections which are programmed in a fixed relationship to one another and control the transition from discrete reflections to the initiation of reverberation in appropriate form. The associated amplitude fader establishes the relationship between the direct and the reverberant portions at the beginning of reverberation and thus determines the reverberation radius. A parameter has thereby been made accessible to the recording engineer which had not previously been under his control despite its importance in a recording.

Circuitry

The EMT 251 Digital Reverberation System employs a balanced audio input designed to meet conventional studio requirements. The signal is digitized in a 16-bit converter and fed to a hybrid processor.

In this processor, the necessary information is produced not only for the reverberation itself but also for the individual reflections.

The reconversion to an analog signal takes place at the output of the processor, after which two output amplifiers are normally fed. However, the unit can also be delivered optionally with four outputs.

Improvements in Technical Data

The frequency response of the unit has been extended to 15 kHz, whereby the reverberation times at low, medium, and high frequencies are individually adjustable. The digital word length in the analog/digital converter and that of the reciprocal conversion have been increased to 16 bits, resulting in a further reduction of modulation noise. The increased audio bandwidth is of particular advantage when the unit is employed for signal delay applications.

Indicators

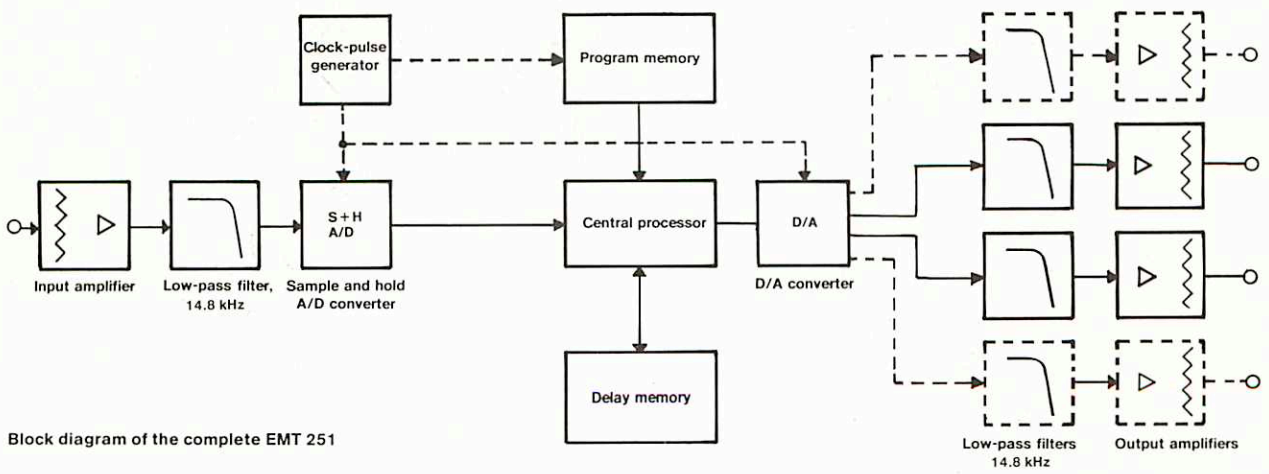
An additional new feature is the comprehensive visual indication of all selected parameters using a liquid crystal display. The frequency spectrum of the reverberation time as well as the amplitude-to-time distribution of the first reflections are depicted in two overlapping curves. Thus the user can inform himself of the selected values at a glance.

Remote Control

All parameters of the unit may be varied by remote control using DC voltages.

In addition, all selected values can be entered through a DC interface (e.g., HARRISON) into a computer or recorded simultaneously by an audio tape machine together with the values for the channel level controls. The EMT 251 Digital Reverberation System can then be controlled directly by the computer or from magnetic tape during mixdown.

The same remote control connections may also be used in conjunction with a bank of potentiometers adjusted to certain, frequently recurring settings, which may then be conveniently selected whenever required.



Block diagram of the complete EMT 251

Programs

Reverberation

This program is used for generating extremely natural reverberation with variable reverberation decay times of 0.4 to 4.5 seconds. In addition, the relationship of reverberation time to frequency can be varied to a wide extent, expressed in each frequency range as a corresponding factor of the basic reverberation time:

for bass frequencies (300 Hz)	factor of 0.5 to 2
for mid-range frequencies (4 kHz)	factor of 0.2 to 0.85
for treble frequencies (8 kHz)	factor of 0 to 0.85

Three discrete first reflections can also be adjusted: one is permanently assigned to the left output channel, the second to the right, and the third variably to both through a panorama potentiometer. The delay time for each reflection can be set between 0 and 80 or 40 and 120 milliseconds and the level between 0 and 100 %.

Immediately at the commencement of natural reverberation (the time of which is set in the unit with a fourth control), a certain number of discrete reflections occurs. This phenomenon is simulated by a cluster of six reflections fixed in their relationship to one another. The amplitude of this cluster is separately adjustable; if it be set to zero, the initiation of reverberation sounds soft and diffused, if set to 100 %, then direct and present. This adjustment thus permits the reverberation radius to be influenced.

Space I

This effect program exhibits a maximum reverberation time of 15 seconds. Its frequency distribution can be influenced by the treble control, thus changing the coloration. In other respects, its properties correspond to those of the Space Program in the predecessor model, the EMT 250.

Space II

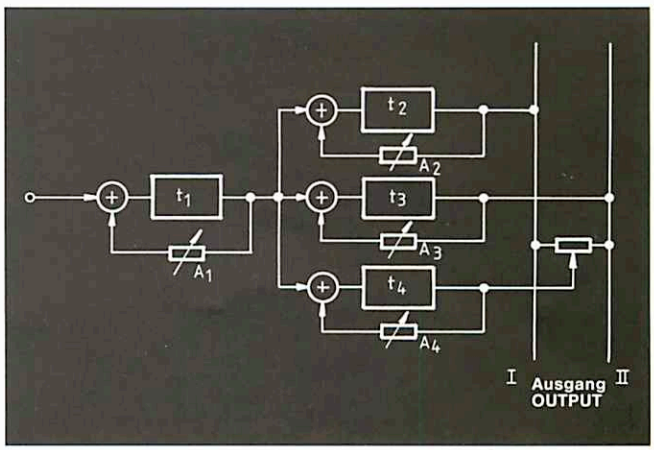
With this program, the pitch of the perceived reverberant signal can be changed dramatically. The illusion is thus produced that the reverberation is moving about in space; the impression of distance is achieved by utilizing the Doppler effect.

Non-Lin

By establishing a non-linear reverberant delay-time characteristic, a substantial concentration of individual voices can be achieved without producing the impression of excessive reverberation. Two reverberation processes are superimposed to prevent substantial decay in a time of less than 0.5 seconds; that is, the original signal is first highly concentrated and then rapidly decaying.

Echo

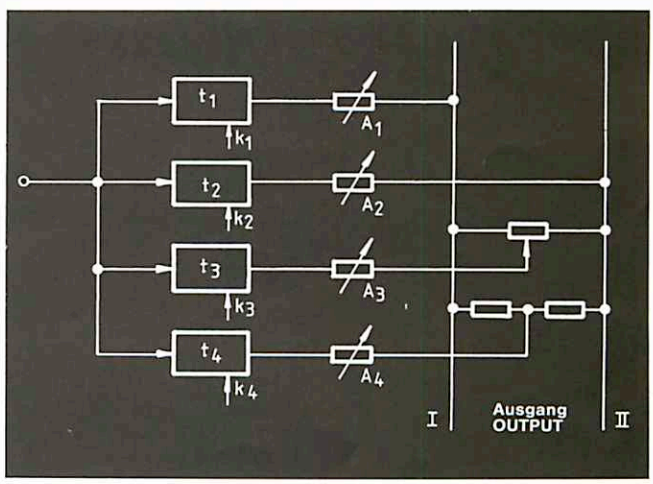
The Echo program is implemented using loops, the lengths of which can be programmed and the feedback factors adjusted. A main loop is situated ahead of three auxiliary loops, permitting different adjustable effects in both channels.



Block diagram "ECHO"

Chorus

The Chorus program is employed to multiply voices or groups of instruments. The intensity of the effect as well as its variation speed can be separately controlled.



Block diagram "CHORUS"

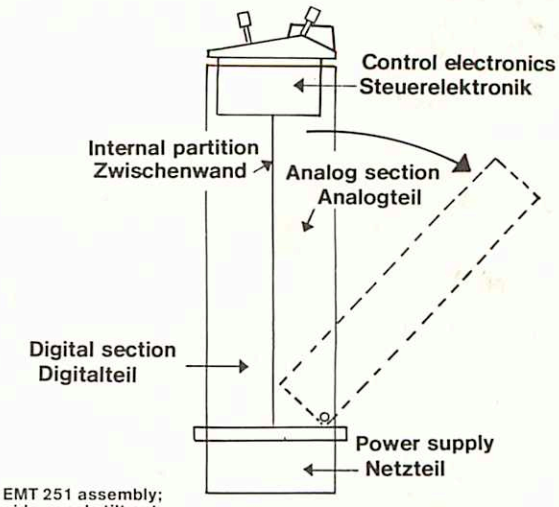
Delay

Up to nine individual delays (six of which, as in the case of reverberation, are grouped with a fixed relationship to one another) can be programmed with respect to time and amplitude.

Physical and Mechanical Arrangement

The EMT 251 Digital Reverberation System is constructed as a free-standing unit. The power supply is located in a chassis at the bottom of the unit, thereby avoiding a proximity between the AC power leads and sensitive circuitry. At the center of the unit, separated by an internal partition, the analog section is located at one side and the digital section on the other side. Both side panels can be tilted out for servicing purposes, thus affording excellent access to all electronic components. The four panels of the EMT 251 are made of black anodized extruded aluminum to guarantee perfect heat-sinking for the power stages.

At the upper part of the unit, the control electronics with operating panel are located.



Sketch of EMT 251 assembly; both side panels tilt out.

Technical Data

Operating Modes (Programs)

a) Reverberation program	
Reverberation time (f = 1 kHz)	0.4 s to 4.5 s, controllable in 16 steps
Reverberation time at bass frequencies (f = 300 Hz)	factor of 0.5 to 2, referred to the basic reverberation time; controllable in 8 steps
Reverberation time at mid-range frequencies (f = 4 kHz)	factor of 0.2 to 0.85, referred to the basic reverberation time; controllable in 8 steps
Reverberation time at treble frequencies (f = 8 kHz)	factor of 0 to 0.85, referred to the basic reverberation time; controllable in 8 steps
Initial delay	0 to 80 or 40 to 120 ms
Number of discrete reflections	3
Reflection cluster	1, a group of six individual reflections with a fixed relationship to one another
b) Delay program	
Delay time ranges	0 to 4 ms 0 to 16 ms 0 to 80 ms 0 to 440 ms
Taps	4, each programmable with freely selectable delay times
c) Special programs	
NON-LIN	reverberation program for increasing sound concentration
CHORUS	sound multiplication
SPACE I, SPACE II	very long reverberation time of 15 s
ECHO	repeated reflections at intervals between 0 and 440 ms with attenuation of between approx. 0.5 dB and approx. 6 dB per reflection

Digital Coding

a) A/D and D/A converters	16 bit
Sampling frequency	approx. 34 kHz
b) Processor	16 bit
Processing speed per instruction	approx. 40 ns
c) Memory capacity	
RAM storage	256 kbits
ROM storage	32 kbits

Analog Section

a) Input	balanced input impedance ≥ 5 kohms nominal input level + 6 dB, adjustable from − 10 dB to + 15 dB
b) Outputs	2, balanced output impedance ≤ 60 ohms nominal output level + 6 dB, adjustable from − 10 dB to + 15 dB
c) Overload margin (headroom)	6 dB above nominal level, max. + 21 dB
d) Signal-to-noise ratio of reverberation program (for reverberation time of 2 s)	70 dB_{RMS} unweighted, referred to nominal level 76 dB_{RMS} unweighted, referred to the peak driving level of the digital register
of delay program	75 dB_{RMS} unweighted, referred to nominal level 81 dB_{RMS} unweighted, referred to the peak driving level of the digital register
e) Frequency response 30 Hz − 14.8 kHz	+ 1/ − 3 dB
f) Harmonic distortion of delay program	≤ 0.5 % at nominal level (f = 1 kHz)
Remote Control	possible through 24 conductor DC cable
Dimensions	53.5 × 83 × 28 cm (w × h × d) (21" x 32.6" x 11")
Weight	approx. 45 kg
Power Consumption	200 VA

Subject to change

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