XT

Digital Reverb

ALESIS

OWNERS MANUAL

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Introduction:

The ALESIS XT DIGITAL REVERBERATOR is a high quality digital signal processing system, specifically designed to simulate natural reverberation and special acoustic effects. It can be used in conjunction with a mixing console providing stereo reverb returns, or stand-alone with electric instruments and amplifiers.

The XT contains a large memory array and a high speed arithmetic processing circuit that executes special Alesis-developed algorithms. The result is reverberation typical of units costing ten times as much. Extra memory and high speed electronics give the XT a generous frequency response of 14KHZ, formerly found only in very expensive units. Excellent treble response preserves the delicate sibilance of vocals and the brilliance of certain percussion instruments. Large memory capacity gives the XT a remarkably flat and uniform frequency response rarely found in even the best acoustic chambers.

The arithmetic processor in the XT has special overflow handling circuitry that avoids the abrupt output transients caused by clipping in many audio digital processing products. Overdriving the XT is not recommended, but due to its soft clipping characteristic, output saturation often goes unnoticed with no adverse effect.

The XT has the ability to generate extremely high echo density. Controlled from the front panel, a single impulse can be turned into hundreds or many thousands of discreet output pulses, all distributed in full stereo. High echo density gives the XT particularly smooth decay, even with the most difficult percussive material.

Front panel controls allow variation of delays, frequency response, echo density and decay times. The controls are organized in a logical, easily understood way to allow for quick setup and change. For those not familiar with digital reverberation, the top of the unit is screened with flowcharts and descriptive control information.

Rear panel connections interface easily to other equipment. A loop in the reverberator input circuit is provided for additional equipment such as equalizers and digital delays. The delay and frequency response options available at the front panel make the loop necessary only in special effect situations.

Rear Panel Diagram

Installation:

The XT draws very little power and consequently creates little heat. Precautions in mounting are therefore limited to common sense. Avoid excessive moisture and extreme vibration. If rack is mounted in a touring rack case, consider shock stress to any single-high rack gear, the XT included. Sufficient room exists within the case at the rear for brackets to be conveniently attached.

In studio applications, consideration should be given to installation with respect to accessibility. Location in the board patch bay if not in the board itself is desirable in order to give ready access to controls.

The case of the XT is grounded to the mains plug, in accordance with local regulations. The circuitry is not internally connected to the case to avoid ground loops. Hum and noise may therefore be a problem if the ground prong of the mains plug is not connected.

Rear Panel Connections:

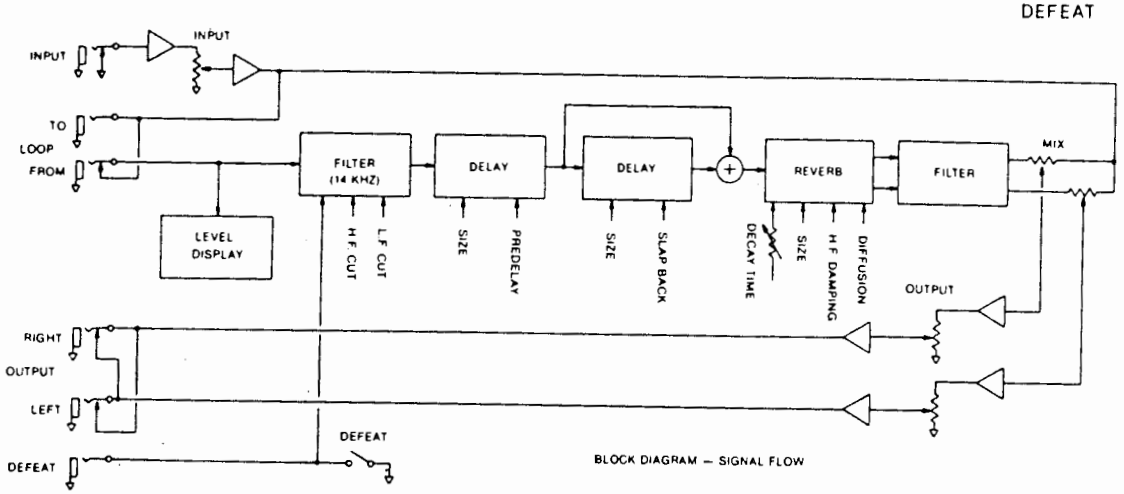
Input: ¼" phone jack, 500K OHMS input impedance, maximum input level = +20 dBV. Distortion will result if driven harder. The range of the front panel input control allows the XT to be driven directly from electronic instruments such as guitars and synthesizers, or the reverb sends of a mixing console.

Output: Stereo, ¼" phone jacks, 600 OHM impedance. Maximum level = +12dBM. Connectors are internally switched together so that mono output (both channels in parallel) will result if only one output jack is used.

To Loop: Output, after input control (see flow chart) ¼" phone jack, 600 OHMS output impedance. Nominal level approximately 0dBV.

From Loop: Input, prior to digital conversion filter and level meter, ¼" phone jack, 20K OHMS input impedance. Clip level of From Loop input is +12dBV.

Defeat: ¼" phone jack for connection to external switch. Allows reverb input to be defeated by shorting tip to sleeve. Connection to a normally closed or alternate action switch allows control of reverberation from on stage.



BLOCK DIAGRAM — SIGNAL FLOW

DEFEAT LEFT RIGHT FROM TO INPUT
OUTPUT LOOP

INPUT	500K OHMS, + 20 DBV MAXIMUM, UNBALANCED
OUTPUT	600 OHMS, + 12 DBM MAXIMUM, UNBALANCED
LOOP	20K OHMS (FROM) 600 OHMS (TO) 0 DB, NOMINAL
DEFEAT	FOOTSWITCH TO GROUND OPEN: NORMAL CLOSED: DEFEAT

DIFFUSION: FILLS IN SPACES BETWEEN INDIVIDUAL ECHOES. EXTENDS MINIMUM DECAY TIME. MOST NOTICEABLE WITH PERCUSSIVE SOUNDS.

SLAP BACK: IN = LONG, OUT = SHORT. ADDS TO ILLUSION OF SPACE. EXTENDS MINIMUM DECAY TIME. ACTUAL DELAY IS A FUNCTION OF SIZE.

SIZE: IN = LARGE, OUT = SMALL. BASIC PROGRAM SELECT. SMALL FOR PERCUSSION, SMALL ROOM SIMULATION AND SPECIAL EFFECTS. LARGE FOR GENERAL PURPOSE. SMOOTH REVERBERATION.

PREDELAY: SETS REVERB APART IN TIME FROM DRY SIGNAL. ADDS TO ILLUSION OF SPACE. ENHANCES CLAIRITY.

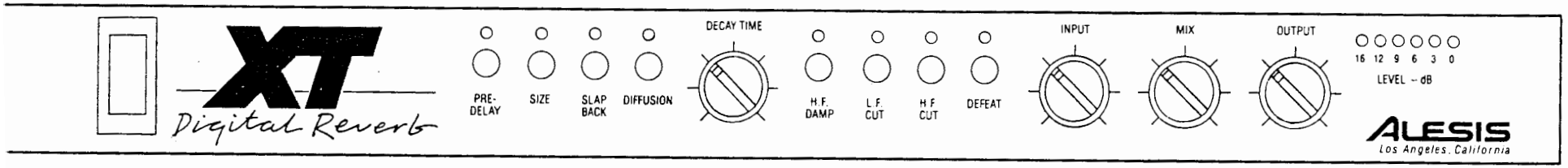
DECAY TIME: VARIABLE FROM .05 TO 10 SECONDS (DEPENDS ON SIZE, SLAP BACK, AND DIFFUSION). USE LARGE PROGRAM FOR VERY LONG DECAY TIMES. SHORTER DECAY TIMES LEAD TO MORE CLARITY AND LESS CONFUSION. MINIMUM DECAY TIME FOR FATTENING DRUMS.

H.F. DAMPING: REDUCES DECAY TIME OF HIGH FREQUENCIES. SIMULATES AIR ABSORBTION IN NATURAL SPACES. UNLIKE H.F. CUT, H.F. DAMPING TEMPORARILY PRESERVES HIGH FREQUENCY PROGRAM SUCH AS SIBILANT SPEECH.

L.F. CUT: REMOVES BASS, WHICH ADDS TO ILLUSION OF SPACE BUT CLUTTERS MIX AT LONG DECAY TIMES.

H.F. CUT: REDUCES SYSTEM BANDWIDTH, LEAVING A SOFTER SOUND. USED IN SITUATIONS WHERE HIGH FREQUENCY CONTENT OF PROGRAM CAUSES A PROBLEM.

DEFEAT: TURNS OFF INPUT TO REVERB. ALLOWS EASY WITH/WITHOUT COMPARISON AND PROVIDES A MEANS FOR GATING SELECTED PROGRAM INTO REVERB. DEFEAT JACK ON REAR PANEL ALLOWS EXTERNAL CONTROL.



Operation: Refer to diagram or unit cover for quick reference.

Background:

Reverberation is the result of sound bouncing off walls within an enclosed physical space. Different spaces have different sounds, depending primarily upon their dimensions, architectural details and contents. If one dimension of a room is several times larger than the others, or if the walls are parallel and the room is empty, it often sounds repetitive and hard. If the room is varied in its dimensions, it sounds much smoother. Obviously the construction of odd rooms for recording purposes is expensive. Even specially built structures have the disadvantage of being inflexible and capable of only a limited range of sounds.

In the search for more realistic solutions to the need for reverberation, metal springs and plates were found to have vibrational delays and resonances vaguely similar to those found in acoustic spaces. Economics inspired the development of cheap spring reverbs and elaborate plate systems. Once again however, variability became a limitation, and the devices were sensitive to external vibration and shock.

High speed digital computers offer the programmer the ability to simulate model acoustic spaces to some degree of accuracy. The objective in the programming of a digital reverb is pleasing reverberation; in no way does the XT attempt to simulate a plate or a small spring. Just as rooms do not sound like plates or springs, the digital reverb is likewise unique. The XT programs provide high quality reverberation, with no regard to any specific older means of reverberation simulation.

Predelay, Size, Slapback:

The XT supports two basic programs controlled by the size switch. The primary difference between these programs is heard at short decay times. The human auditory perception facility has difficulty determining the size of two different reverberant spaces with similar reverb times, and continuous program material. The initial transient response, and the decay time, give the important cues to size. The XT offers a predelay control and a slap back control to add dimension to these initial echoes, greatly expanding the range of possible initial sounds.

Very small structures have less complex relationships between resonant peaks, leading to undesirably strong resonances like garbage cans and shower stalls. Long decay times with such structures are unnatural and are to be avoided. The small program in the XT is more medium sized than small and only slightly suffers from these aberations. However, in applications requiring long reverb times, the large program should be used if possible.

Diffusion:

The vast multiplicity of echoes returning from an impulse in a reverberant space is termed "echo density". Real spaces have a wide range of echo density values. Inadequate echo density leads to distinct echoes, an appealing sound for strings and smooth continuous instruments, but leads to a rough clicking sound for drums and sharp percussion. Excessive echo density lends coloration to sharp clicks while smoothing out the reverberant decay. The XT is provided with a diffusion control which directly affects echo density. Diffusion minimizes the natural effect of multiple reflections within a reverberant space, and provides adequate echo density for even the most transient program material.

Decay Time:

Variable decay time is probably the most valuable asset of a digital reverberator. The XT is capable of generating reverberation with decay times ranging from .05 to 10 seconds. Natural reverberation rarely exceeds 2 or 3 seconds and as a result, very long decay times are for special effect only. Excessive decay times tend to muddle a mix more than augment it. On the other hand, very open mixes with prominent lead instruments can benefit from the XT maximum decay time.

"Decay time" is defined as the period of time for the reverberant signal to fall to -60 dB. The XT delivers exponentially decaying reverberation to about -40 dB where it becomes increasingly linear. As a result, the XT maximum decay time will measure 7 to 8 seconds to -60 dB, but the first few seconds or so will be characteristic of a full 10 second decay time.

H.F. Damping:

As sound pressure waves propagate through air, molecular losses cause absorption of high frequencies, resulting in reverberant decay of the high end earlier than the midrange and bass. One important characteristic of digital reverberation is the ability to preserve high frequency response throughout the decay process. Although not natural, the effect can be outstanding with sibilant vocals. The XT is provided with a control, H.F. damping, to either preserve or shorten high frequency decay time. When in, H.F. damping reduces high frequency decay time in a manner similar to the natural process, through an analogous algorithm.

L.F. Cut:

One characteristic of large natural spaces is excessive, boomy bass response. While this may be desirable in some instances, often it leads to a muddy and confused bottom end. The L.F. cut control gently rolls off the bass driving the reverb and opening up most complex mixes nicely. When out, no bass attenuation occurs.

H.F. Cut:

The 14KHZ frequency response of the XT is a highly desirable feature in delivering crisp shiny highs, but may be objectionable with noisy or raspy textured instruments buried in the mix. The H.F. cut control applies a gentle filter attenuating some of the high end (but not removing it), therefore softening the reverb return. When out, the high end is not affected.

Defeat:

In most mixing situations, it is useful to remove the reverberation temporarily from time to time to gain perspective on the mix. The defeat control allows the engineer to punch out the effect without disturbing carefully set sends and returns. Additionally, the defeat feature appears at the rear panel for remote control. The defeat function is to discontinue signal from the reverb input, and therefore when defeated, the signal present in the reverb decays away normally.

Input, Mix, Output:

The XT, as a stand alone device, is equipped with input, mix, and output level controls. When used in conjunction with a mixing console, the mix control should be fully clockwise, where only reverberation appears at the output jacks. Adjust the input level control for proper operating level (OdB LED rarely lighting), and then adjust the output level control for desired output. Check the level meter occasionally as echo send levels tend to get pushed up as a mix progresses.

Applications:

The advent of digital reverberation has brought about a new range of music production technique. Variable decay time and options, like diffusion and filtering, offer the recording engineer more choices in developing unique sounds. Experimentation is unavoidable, and the following is offered as suggestion only.

Mixing Levels:

The fundamental control in any reverberation system is the means for mixing reverberant signal into dry program. Too much reverb can wreck a wonderful mix. It is not uncommon to mix the reverb back 20dB below program. Shorter decay times create less confusion and can be pushed up in a mix further, without causing a sonic mess. If long and lush ambient embellishment is desired, it is often useful to leave some instruments in the foreground to establish perspective.

Percussion:

Extending the sound of drums with short decay times has become popular and can take the form of bold, gated bursts to short, smooth ambience. Diffusion should be used if abrupt transients in the original recording cause undesirable clicking. The small program at near minimum decay time sounds like a moderately damped studio. The large program extends the decay time significantly and may be useful. More synthetic sounds may be had at minimum decay time and with predelay or slap back in. These functions extend the overall decay time in such a way that the initial sound continues for some time, then comes to an abrupt stop.

The large program with both predelay and slap back is about as big a sound as can conceivably be had without encountering problems. For special effect, delay time can be pushed to the limit. H.F. damping adds a more realistic contour to the decay.