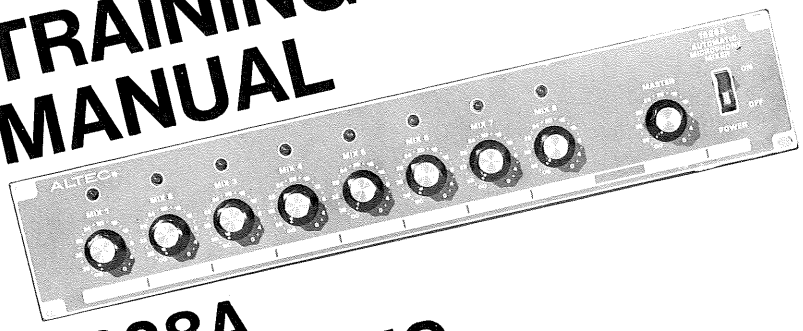
ALTEC

ALTEC TRAINING MANUAL



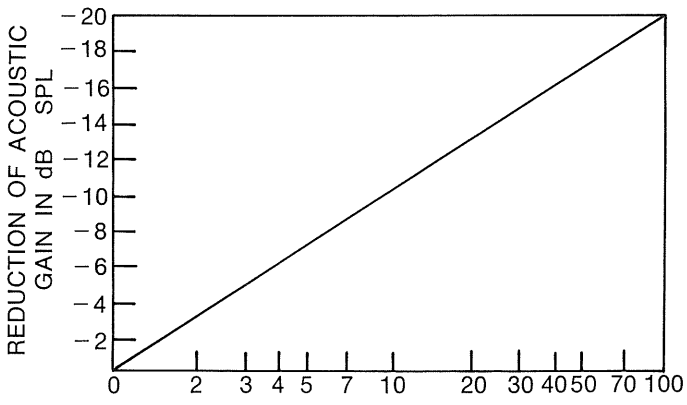
1628A AUTOMATIC MICROPHONE MIXER

THE ALTEC 1628A AUTOMATIC MICROPHONE MIXER

Since the beginning of sound reinforcement, one of the basic problems which has plagued the audio professional has been that phenomenon called feedback. The technical literature is filled with descriptions of, and solutions for, feedback. The attention given to the problem is evidence enough of the sound man's "howling horror".

Professional sound people know that when you set up a microphone, amplifier and loudspeaker in a room, you can turn up the gain only to a certain point, and no further, or the system will go into feedback. At that point, system loudness is dependent upon (all other factors remaining the same) the distance between the talker and his microphone. Halving the distance between the talker and his microphone will cause the system gain to be increased by 6 dB SPL. Doubling the distance between the talker and his microphone will cause the system gain to be reduced by 6 dB.

The potential acoustic gain is further reduced when more than one open microphone is required in operation. For every doubling of open microphones, the potential system gain is reduced by 3 dB. See Figure 1.



0 = Unity Gain With One Open Microphone.

Figure 1

For example, consider a panel discussion in which eight open mics are required. With all eight mics adjusted for the same gain as a single microphone (adjusted for maximum gain below feedback), the system would feed back, unless the master gain was reduced by 9 dB. The reason is simple. Eight microphones will pick up eight times as much sound from the loudspeakers as will one microphone. One solution would be to have all talkers move closer to their microphones. However, such a solution becomes unreasonable in actual in-use situations. If the optimum distance for one talker, one open mic, was 2 feet, then the required distance for eight talkers, eight open mics, would be 3 inches. Possible, but usually unadministratable.

In the past, the earliest solution to this problem was to use a microphone mixer equipped with an operator, or vice versa. (In actual use, it was sometimes difficult to tell just which was exerting the greater influence.) However, in defense of both parties, neither the operator nor the mixer could anticipate who was going to speak, when someone would speak, how many would speak simultaneously or when golden silence would solve the problem.

Then, along came VOX (voice-operated switching). It was a reasonable attempt to solve the multi-open-microphone problem. And, in fact, VOX was found to be workable under very controlled acoustical, environmental and geometric conditions. However, there was one major drawback. The threshold was only manually adjustable. When the threshold was set for, for example, 55 dB, any sound above 55 dB appearing at any microphone would operate the switch and turn the microphone ON.

A number of difficulties are encountered here. Should a sound above 55 dB appear at all microphones, all mics would be turned ON. A door slamming could open all mics and send the system into feedback. If the feedback was above 55 dB, all mics would stay locked ON. Then the solution would be to turn down the master gain or pull the AC plug (whichever is closer), after which one can check the loudspeakers and, as required, replace those which have been dismembered.

A second difficulty has been recorded in audio history. Occasionally, in a church, a pipe organ can suddenly become the victim of VOX (or VOX the victim of the pipe organ). If the pipe organ places sound at the microphones which exceeds VOX's threshold setting, the pipe organ is amplified over the sound reinforcement system. This situation can cause much aesthetic anguish to a pipe organ purist who then states, "if we had wanted an electric organ, we would have bought one"!

A third difficulty is the well known chattering or syllable clipping sometimes caused when VOX receives signals intermittently above and below the threshold setting.

The VOX has had modifications and improvements in recent history. Frequency discrimination and fast attack/slow decay techniques have been employed. However, there is still one basic problem with VOX. It usually cannot distinguish between signal and noise. To VOX, most any noise above threshold is still signal and the mic or mics are turned ON.

In the early 1970's, Dan Dugan, an independent electro-acoustical consultant in the San Francisco Bay area, recognized the problems still unsolved and set about to find solutions. Mr. Dugan's pursuits resulted in a system of automatic microphone mixing utilizing what is called "adaptive threshold audio gating". At a point in 1975, Altec entered into agreement with Mr. Dugan to refine, manufacture and distribute a new system called The Altec 1628A Automatic Microphone Mixer.

The 1628A is an 8-channel, solid-state mixer/amplifier with provision for plug-in input accessory modules. Total system mix gain is held constant by the automatic adjustment of the signal level in each channel, dependent on the channel-to-system signal-to-noise ratio. This process provides maximum gain to any single microphone and prevents feedback in multimicrophone operation.

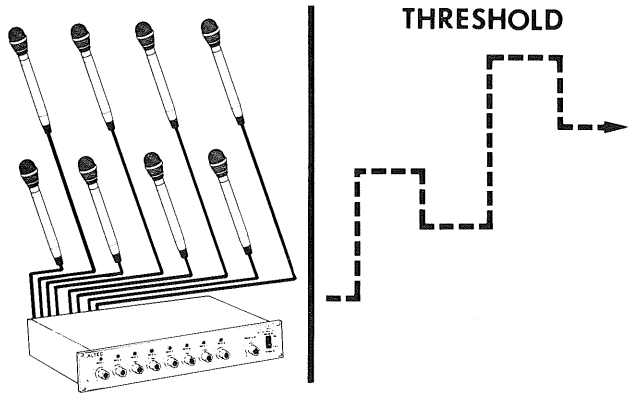
We should define just what is meant by the above statement "channel-to-system signal-to-noise ratio". Channel-to-system (in the case of a single 1628A in

which all eight inputs are equipped with microphones) means the channel which is activated by a talker speaking into a microphone vs. the other seven channels not activated by a talker. In this case, "signal-to-noise" takes on a different aspect. "Signal" means the channel activated by a talker. "Noise" means the ambient noise in the room or the sounds from the loudspeakers detected by all the microphones in the system, whichever is louder.

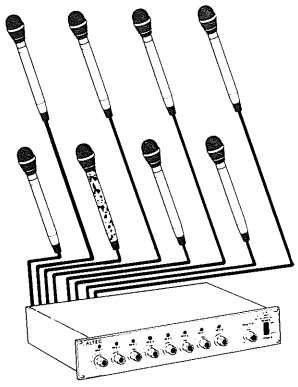
Now we can discuss "adaptive threshold audio gating" and more clearly describe its differences and benefits compared to VOX.

Whereas, with VOX, the threshold is manually set and thus fixed, the adaptive threshold of the Altec 1628A is automatically adjusted as a function of the ambient noise in the room. Remember, here we are using "noise" to denote not only ambient noise but also the sound from the loudspeakers. All noise, heard more or less uniformly by all mics in the system, varies the threshold in proportion to the sound pressure level of the noise. However, a sound, such as a talker close to the mic, will be above the threshold level, thus that mic will open and the talker will be amplified. Through the technique of "adaptive threshold audio gating" the 1628A does discriminate between "signal" and "noise".

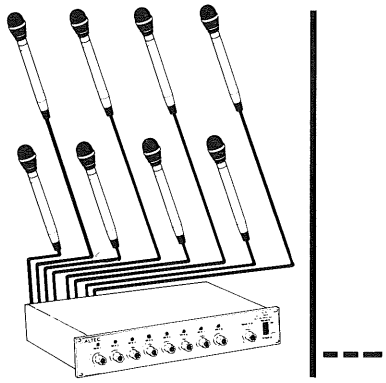
Let's review the operation of the 1628A as it is depicted in the audio-visual presentation.



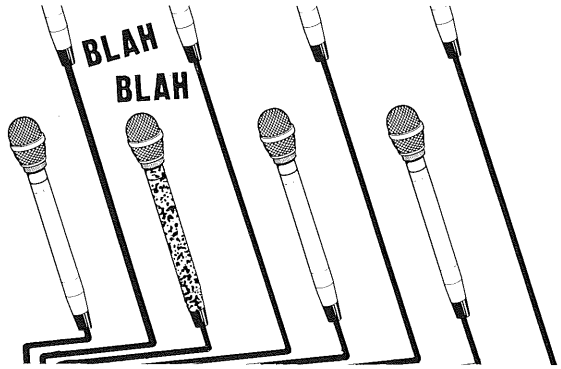
The 1628A takes the sum of the noise level at each mic in the system, and uses this to vary the threshold level.



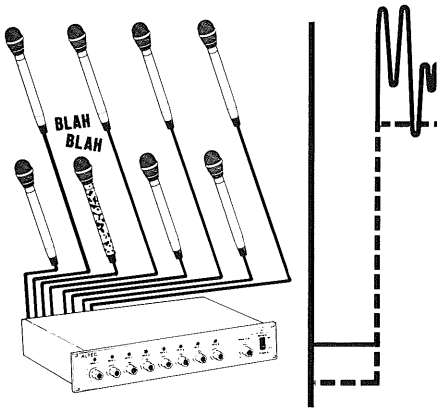
Let's follow what happens with a single channel — say, channel three.



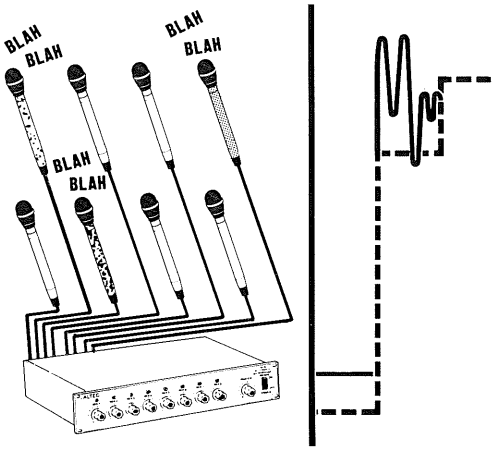
When no one is speaking and the room is quiet, the threshold level is low. The microphones are never entirely cut off; they are just turned down to a "safe" level.



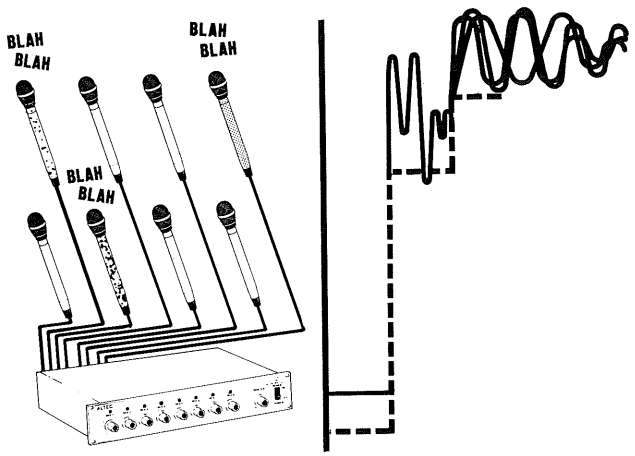
Now, if the man at microphone three starts talking . . .



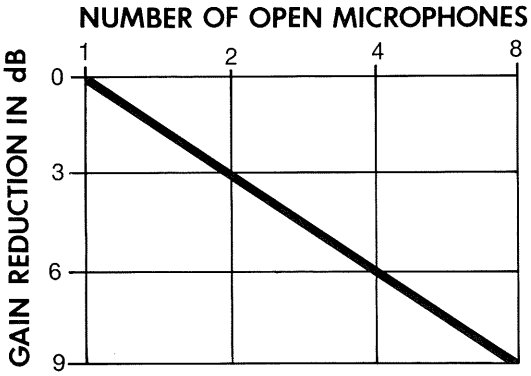
. . . his voice produces a signal greater than the threshold level. This causes his mike to gate open . . . and the threshold rises.



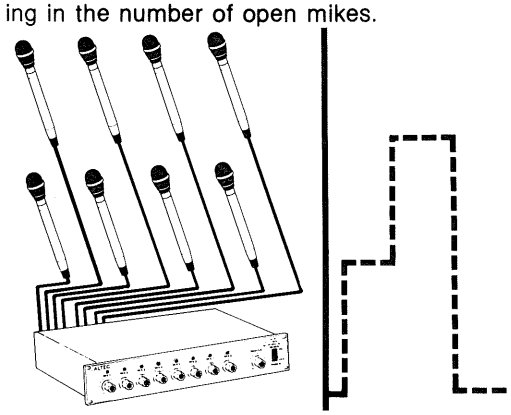
Suppose the men at mikes two and eight now chime in at the same time.



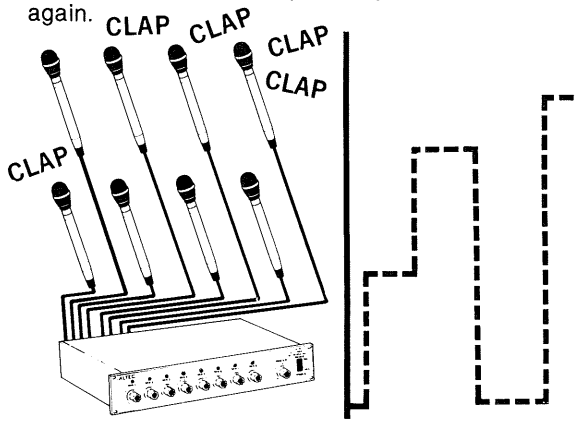
The threshold goes up . . . but each of the three mikes is receiving a sound above the new threshold level — so all three are gated open simultaneously.



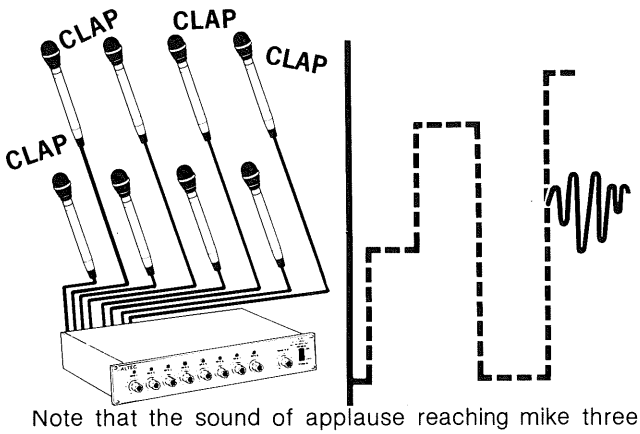
At the same time, overall system gain is reduced, to prevent howling. Gain is reduced by 3 dB for each doubling in the number of open mikes.



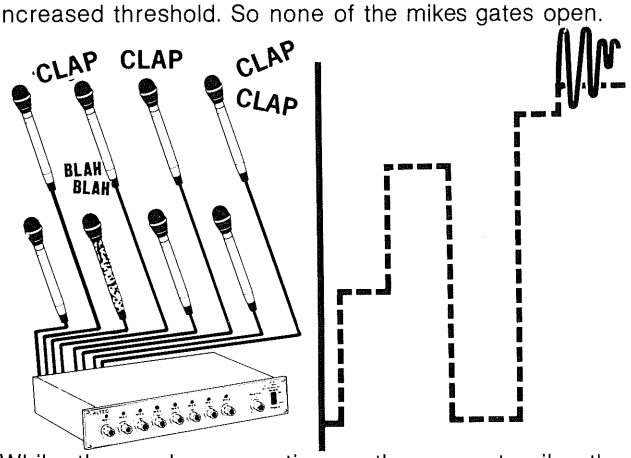
When all three men stop talking the threshold goes down again.



Now the audience applauds. The noise reaches all mikes, and the threshold goes way up. Remember — threshold is determined by the sum of the sound reaching all mikes.



Note that the sound of applause reaching mike three — like all the others — produces a signal that is below the increased threshold. So none of the mikes gates open.



While the applause continues, the man at mike three starts talking. The sound level in this channel is now above threshold, so the mic is instantaneously opened.

So that is the action of the adaptive threshold of the Altec 1628A. The threshold is constantly changing in response to the sum of the sound reaching each mic.

And the gating — achieved by a comparator in each channel — only opens a channel when the sound level at its mike is greater than the ambient level.

The Altec 1628A is a highly flexible system. It works with a wide variety of microphone types, or with a microphone preamplifier. Once installed, microphones can be added or subtracted at any time, with no overall system adjustments required.

A number of 1628A's can be strung together, to expand the system for additional microphones. And, though no operator is needed, the system can be run manually if desired.

Indicator lights located directly above each volume control show which channels are in use — so a manual operator isn't under pressure to remember which volume control goes to which mike.

Another unique feature of the 1628A is the input one priority. By remoting a switch to the input one priority jack in the rear of the 1628A, a person actuating the switch may take control by attenuating all system microphones but his own. This is an extremely useful function for say, the judge in a courtroom.

The applications are numerous — for either new construction or as an add-on to existing systems. And, not just Altec systems but almost any other brand or type of systems.

The Altec 1628A finds immediate uses for city council chambers, board rooms, churches, courtrooms . . . and many other places with four or more microphones, and a mixing problem.