Engineering News

ALTEC

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TIME DELAY CALCULATIONS

With the increasing ability to control time delay through the use of digital devices, many more sound system designers will expect the sound contractor to be familiar with time delay basics.

Converting Distance to Time

One time delay basic is the ability to convert a distance on a drawing or in an actual space into time so that sound, traveling different distances before arriving at the listener, may be compared for their difference. To find the time in milliseconds (1/1000 of a second), the formula is:

$$D \left(\frac{1}{1.13} \right) = T \text{ in milliseconds.}$$

For example: If the direct sound D_D = 125' and the first reflection D_R = 160', then the time difference between their arrival times

is: $$D_R \left(\frac{1}{1.13} \right) - D_D \left(\frac{1}{1.13} \right) = T.D.$$

or: $$160 \left(\frac{1}{1.13} \right) - 125 \left(\frac{1}{1.13} \right) = 30.97 \text{ msec.}$$

Converting Time to Distance

In the use of tone burst signals of short duration (10 msec typically), it is possible, through using an oscilloscope and camera, to record the time interval between a direct sound and a reflection. Once you have measured the time delay, the detection of the surface from which the reflection came, is a matter of using a compass on a drawing of the space with its center at the microphone location. The radius of the drawn circle is equal in distance to the time delay, and wherever the arc touches a surface, you have a candidate for the reflecting surface you may wish to examine. The formula used to convert time into distance is:

$$T (1.13) = \text{distance}$$

For example, the direct sound arrives from the source 78 msec after the sweep starts and the first reflection comes in 36 msec later. This means the reflection traveled

$$36 (1.13) = 40.68 \text{ ft}$$

further than the direct sound. Your task is now to look for a sound path that has a total length of

$$(78 + 36)\ (1.13) \quad = \quad 128.82 \text{ ft}$$

This satisfies the geometrical laws of reflection from the source to the microphone.

These formulae lend themselves to rapid solution using the H.P. 35 calculator.

DISTANCE CONVERTED TO MILLISECONDS

STEP	KEY	ENTER	READ	STORAGE			
		x	x	y	z	t	s
1	1		1				
2	ENTER		1	1			
3	1		1	1			
4	•		1	1			
5	1		1.1	1			
6	3		1.13	1			
7	÷		$\frac{1}{1.13}$				
8		Dist.	Dist.	$\frac{1}{1.13}$			
9	X	T_{ms}					

TIME IN MILLISECONDS CONVERTED TO DISTANCE IN FEET

STEP	KEY	ENTER	READ				
		x	x	y	z	t	s
1	1		1				
2	•		1				
3	1		1.1				
4	3		1.13				
5	ENTER		1.13	1.13			
6		T_{ms}	T_{ms}	1.13			
7	X		Dist.				