READ THIS

Gentner News

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Upcoming Events

Web Courses

The following trainings are available via Webconferencing:

Echo Cancellation Short Course
AP Product Overview
Teleconferencing Sales
PSR1212 Technical Overview

Contact Dale Florence at (800) 945-7730 ext. 592 to schedule your training. Seven days advance notice is required.

Gentner Technical Institute Training

Join us for our One-Stop Room Solutions training class. In this class, you'll develop a working knowledge of Gentner Audio Perfect products, including our newest addition, the PSR1212 matrix mixer with signal processing.

January	18–19,	2001
February	8-9,	2001
March	1-2,	2001
March	22-23,	2001

Classes will be held at Gentner's headquarters: 1825 Research Way, Salt Lake City, UT. Register at our Web site www.gentner.com.

Trade Shows

CES	January 6-9, 2001	Las Vegas, NV
NSCA	March 8-10, 2001	Orlando, FL
NAB	April 23-26, 2001	Las Vegas, NV
Infocomm	June 13-15, 2001	Las Vegas, NV

Gentner Ships PSR1212

You've probably heard about Gentner's new PSR1212—a highly-advanced twelve-by-twelve digital matrix mixer with audio processing. It uses an internal macro language and 32 user-definable presets to quickly adapt to a variety of sound reinforcement and room-combining applications in auditoriums, stadiums, theatres, gymnasiums, hotel/convention centers, conference rooms, training rooms, and boardrooms. The PSR1212 system uses Gentner's new G-Ware software for setup and operation, which enables you to make quick, easy changes on-the-fly to accommodate changing venue needs.

The PSR1212 also features eight audio processing buses. Each bus has 15 filters which can be configured as parametric, high pass, low pass, CD horn, high shelving, low shelving, all pass, or crossover. Each bus also includes delay and compressor functions. This allows you to tailor the PSR1212's audio response to optimize the audio quality and fidelity characteristics of a wide variety of sound reinforcement systems.

The PSR1212 is now available. List price is $3995.

Product Highlight
Gentner's ClearOne® Conference Phone

The talk in audioconferencing circles lately has been about the Gentner ClearOne® Conference Phone. With built-in echo cancellation to remove echo and eliminate clipped speech, and full-duplex audio to allow talking and listening at the same time, the ClearOne delivers premium sound quality at an affordable price. It is also the only conference phone with a built-in conference calling feature: Gentner Express Conference.

The Express Conference™ button combines the convenience and reliability of Gentner Conference Call™ services with the award-winning ClearOne Conference Phone. With a simple push of a button, you'll be instantly linked to Gentner's Express Conference. A conference call

coordinator will dial out to your participants and connect everyone.

There's never been a better time to sell the only conference phone with built-in conferencing. Don't miss out on your chance for residual revenue.

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Tech Notes: Tail Time and Echo Cancellation

There are many factors that influence purchasing decisions: features of the product, reliability, price, reputation of the manufacturer, etc. This column focuses on the importance of echo cancellation and the role of tail time.
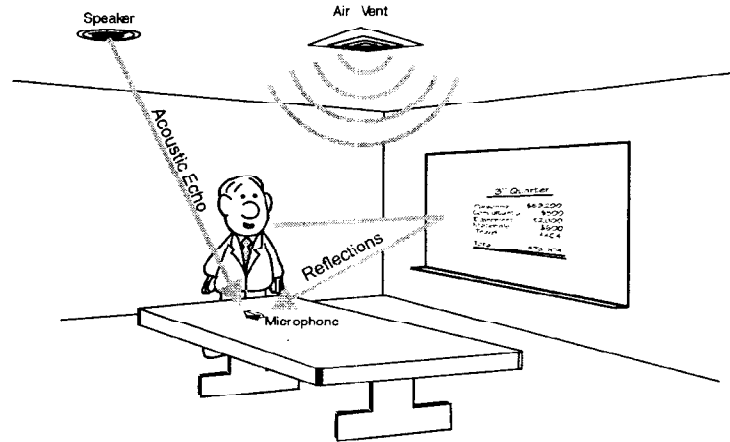
What is tail time?

Tail time can be defined as a specification relating to acoustic echo cancellation in teleconferencing and videoconferencing equipment. But the tail time specification isn't the whole story. The ultimate goal of an acoustic echo canceller is to prevent the retransmission of audio signals to their original source. Complete cancellation of acoustic echo is not required to achieve this goal. By applying additional techniques that work in conjunction with the echo canceller, audio sent to the far end of a conference may be free and clear of echo.

So how does tail time relate to echo cancellation and what other factors are involved? In order to reduce the transmission of echo to the far end of a teleconference or videoconference, the echo canceller must first sample the audio signals that have the potential to cause acoustic echo. The sample is taken at a point in the signal flow right before the signal is sent to an amplifier and reproduced by loudspeakers in the room. The sample is taken over a period of time commonly referred to as "tail time," and is normally measured in milliseconds. Tail time length should be long enough to effectively cancel all relevant acoustic echo.

Sampling Signals

Let's consider the signal that will be amplified and heard in the room via the loudspeakers. This signal consists of audio coming in from telephone lines or videoconference sys-

tems, along with any local program audio we wish to include in the conference. This audio is continually sampled and converted to a mathematical digital value. The digital signal is held in storage for the duration of the tail time. The stored digital signal will be used to cancel acoustic echo that occurs in the room.

Now, let's think about the audio signal that entered the room by way of the loudspeakers. A person in the room will hear the conference and program audio. The same signal may travel directly to any microphone in the room, enter the system and be sent right back to the far end as echo. Program audio routed directly to the far end may also be sent to the loudspeakers, picked up by microphones and sent again as a delayed signal, also known as echo.

To remove echo, any signal from the microphones in the room is converted to digital format. Now the echo cancellation circuit takes the stored sampled audio and runs it through a filter model of the room. This is done in order to give the sampled audio the same characteristics as audio that actually passed through the room. The modeled audio is then

inverted and applied to the sounds picked up by microphones in the room. Any portion of the microphone audio signal that matches the stored sample will be cancelled out, as they are combined $180°$ out of phase. Any new sounds picked up by microphones in the room will be transmitted to the far end without echo.

Environmental Considerations

Now let's throw another variable into the mix. Sound from the loudspeakers may travel directly to a microphone. Sound that strikes other surfaces in the room may be absorbed or reflected depending on the frequency of the sound wave, the material the surface is made of and the angle of incidence as the sound wave strikes the surface. Since reflected sound travels a longer distance to the microphones than direct sound does, it will arrive later in time and may be heard as echo. Multiple paths may mean multiple echoes.

The same sample we used to cancel the first incidence of echo can be applied to later arriving echoes that occur within the tail time. Will we miss some of the late arriving echo? Will it make any difference to the success of the echo canceller? Is a

Phase Cancellation
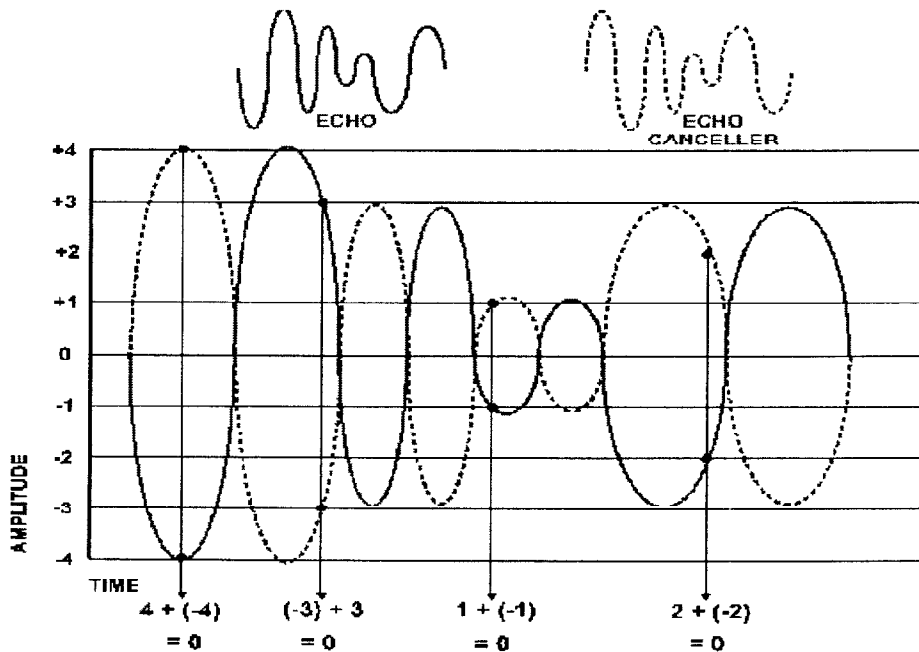
late arriving echo relevant? Well, the total amount of echo cancellation is the combined total of echo return loss within the room and the echo return loss provided by the active electronics of the echo canceller. Echo return loss created by a room includes any attenuation involving the inverse square law. Basically, the inverse square law shows that if we double the distance traveled by a sound wave, the signal is decreased 6db. Every time a sound wave is reflected some of the energy is absorbed and converted into heat. Sound waves with multiple reflection paths travel farther still. This means that the signal may lose a significant amount of energy before it reaches a microphone.

OK, we've been talking about echo return loss provided by the room. This can also be expressed as room gain with a negative value. Reducing gain in the room provides better echo cancellation. The less gain, the better the echo cancellation. Using error correction algorithms and non-linear processing to eliminate resid-

ual echo, Gentner echo cancellation products can provide clear audio to the far end with no perceptible echo, and still maintain full duplex operation. Gentner echo cancellers can even provide effective echo cancellation with room gain of up to +12dB.
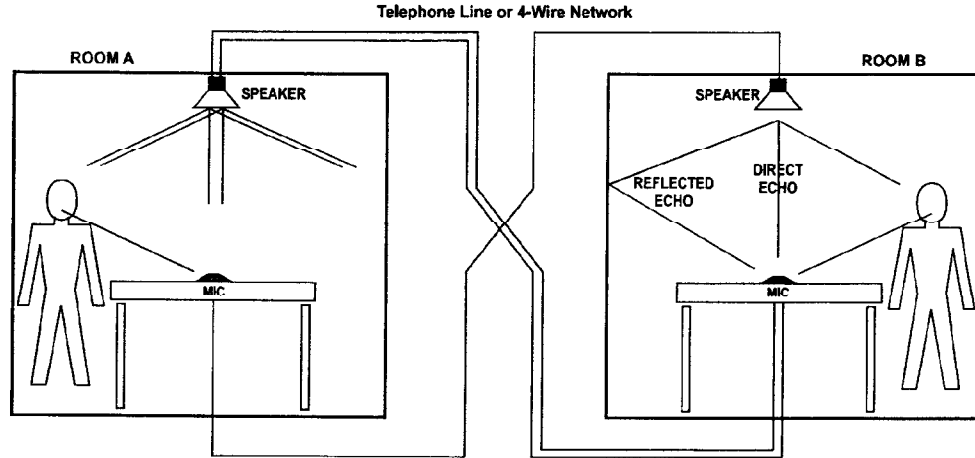
Why 128 milliseconds?

Gentner Audio Perfect products use a tail time of 128 milliseconds. This allows for successful echo cancellation in nearly any sized room. Let's consider the effectiveness of tail time in a relatively large room. For example, a sound wave can travel 145 feet in 128 milliseconds at room temperature. Let's imagine a room with a front to back wall distance of 80 feet. A loudspeaker horn is mounted at the front of the room with a microphone placed at a distance of 40 feet from the horn and 40 feet from the back wall. Let's also say that the direct sound from the horn reaches the microphone at 60dB SPL. The direct sound impulse from the horn would reach the microphone in about 35 milliseconds. This signal is the first incidence of

acoustic echo in the room. Since the signal arrives at the microphone within the duration of the tail time, echo cancellation may be successfully applied. This will effectively remove the echo before audio is sent to the far end of the conference.

Echoes that occur after the first incidence are caused by reflections in the room. Using the same room dimensions as the last example, a reflection from the back wall to the microphone will travel a minimum distance of 120 feet. The reflected sound will arrive at the microphone in about 106 milliseconds at less than 51.5dB SPL. This assumes no loss due to absorption by the reflective surface. In reality, absorption may provide a significant amount of loss, so the signal at the microphone will actually be less than 51.5dB. In these examples we are only considering loss as defined by the inverse square law. So, the reflected signal has lost at least 9.5dB because of the increased distance traveled from the horn to the microphone. This echo also arrives during the tail time. The echo canceller will use the same originally sampled audio to eliminate this echo.

Now lets consider a reflection with a much longer delay time. If direct sound from the horn strikes the back wall of the room, bounces straight back to front wall, bounces yet again to the back wall, and finally bounces from the back wall to the microphone, the signal has traveled a total of 280 feet! This echo arrives at the microphone after 248 milliseconds, which is longer than the tail time.

Telephone Line or 4-Wire Network

ROOM A — SPEAKER — MIC

ROOM B — SPEAKER — REFLECTED ECHO — DIRECT ECHO — MIC

This echo will not be cancelled, but this may not be a problem. Since the echo reaches the microphone at a less than 43dB SPL, it has lost at least 17dB. There are many other factors that can affect echo cancellation performance. This example shows that added loss by absorption, combined with suppression provided by the non-linear processor, that is incorporated on each mic input channel of Gentner echo cancellers, means that this particular echo may not be relevant to the success of effective teleconferencing.

Why Gentner?

Gentner AP800 and AP400 echo cancellers are equipped with serious processing power. Our A/D converters provide a 32 kHz sampling rate with 18 bits of resolution. Our AP800 uses 9 dedicated DSP processors to allow fast convergence and echo cancellation even in rooms with constantly changing acoustic parameters. We've combined shorter tail time with fast processing speed to provide superior performance. A shorter tail time means less data to process. This allows rapid application of powerful algorithms, resulting in faster processing and superior echo cancellation. Each channel of echo cancellation also uses automatic error correction and user adjustable NLP (non-linear processing) to remove residual echo artifacts.

The AP800 and AP400 eliminate the need for an external microphone mixer. The AP products automatic microphone mixer works in the digital realm, right along with the echo cancellation. This allows for faster echo convergence, improved mixer performance, and less equipment to rack and wire. Gentner products reduce system complexity and save hours of installation and set-up time. Consider the advantages of using Gentner in your systems.

Gentner expands solutions with Panja P3 Partnership

Do you have clients who want hands free telephone calls for use in their home or home office? Gentner provides many solutions to fit your clients' needs and budget.

As a P3 partner, Gentner employs Panja's ICSP as common ground for integration into both residential and commercial applications. When a Gentner product is coupled with Panja's ICSP-driven control system, it will automatically identify itself and join the network of electronic components in the application. Once networked, the system server will

GT1524

adapt to the product's specific control properties and personality— essentially transforming Gentner's high-end, integrated systems into plug-and-play products.

ClearOne

Gentner's GT1524 seamlessly integrates into your house sound system. Use low profile microphones

and speakers in your home office or any room you want hands-free telephone capabilities. Touch panels and pre-programmed GT1524 control software are available through Panja. Call (800) 222-0193 for more information.

For portable desktop or installed conferencing in your home office, also consider these Gentner products:

- ClearOne
- AP800
- AP10