ClearOne®

Improving Teleconferencing with the Right Technology

RAV 600 & 900

Business Conferencing System

Technology Solution: ClearOne RAV Conferencing System

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Contents

Technology Solution Overview

High-quality audio is essential to productive conferencing, as it enables conversations in which people can address important issues and make decisions efficiently. It's at the heart of every top conferencing system and successful meeting space.

You have large groups that need to meet with remote groups and individuals, so your meeting rooms and boardrooms have to support your most critical communications needs. That means equipment selection is crucial. And system ease of use is key. Every participant has to be able to interact naturally and be heard clearly—especially in medium to larger rooms, where echo and sound distribution become big issues. But the average conferencing phone or speakerphone simply can't provide coverage and clarity in boardrooms and other large-group meeting areas, and just doesn't have enough individual microphones to let people fully participate. In addition, the vast majority of conferencing phones and speakerphones can't interface with video or webconferencing systems to enhance the sound quality in meetings using those types of rich media devices.

Until now, a professionally installed system, which typically costs more than $10,000, was your only option for achieving premium sound quality in your audio, video and webconferences.

This document discusses a new conferencing solution that delivers top quality sound, is easy to install and use, and comes at a price significantly below that of professionally installed systems.

Contact Information

Sales Contact

ClearOne Communications Inc.
sales@clearone.com
800.707.6994

Additional Information

www.clearone.com

What is RAV?

Conference calling with professional-quality audio

Everyone is familiar with conference calls. There's probably a conference-call telephone sitting on a large table in a room just down the hall from your office. Unfortunately, they usually sound awful. Voices drop out or fade away. People sound like they're speaking from inside a cave. Conversations are muddled. And when several people in a room need to speak, well, you know how miserable it can be.

At ClearOne Communications, we've developed RAV (we pronounce it "rave") to solve the quality problems associated with conferencing phones:

> **ClearOne's RAV is a business conferencing system that combines the sound quality of a professionally installed audio system with the operational simplicity of a familiar tabletop conferencing telephone – all for a starting price of $2,599.**

RAV is a complete high-fidelity audio conferencing system. It even includes a pair of top-quality Bose speakers for wall or ceiling mounting. RAV can be used for audio conferencing, to enhance the audio portion of a video conference, or as a group audio interface for Web conferencing.

Top Features

What makes RAV different? This section highlights the key features we believe your audience will find most interesting.

Superior Audio Experience

- **Audio Clarity.** Advanced microphone gating and dynamic acoustical noise cancellation suppresses unwanted ambient noise.

- **Sound Distribution.** RAV includes a pair of high-quality Bose loudspeakers. And ClearOne's speech-enhancement technology creates richer sound.

- **Duplex Performance.** Distributed acoustical echo cancellation maintains conversations without the audio cutting out when both parties speak.

Simple Installation

- **Fast Installation.** RAV can be installed in less than one hour.

- **Plug & Play.** The RAV-Ware configuration software is pre-configured for optimal audio conferencing.

- **Minimal Training.** RAV's operation mimics a telephone. Once installed, its wireless tabletop controller requires no training to initiate a call.

Flexible and Scalable

- **Network Management.** RAV's built-in HTTP server supports remote management via the enterprise network.

- **Multiple Applications.** With its flexible hardware and software design, RAV works with the newest multimedia technologies, including videoconferencing and Web conferencing systems, without any modifications or upgrades.

- **Investment Protection.** ClearOne maintains a continuing improvement program with technology advancements to guard against obsolescence.

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Overview of RAV 600 & 900

A look at the product and target market

RAV targets conferencing users who are dissatisfied with their current tabletop solution. To create a satisfying, high-quality experience, ClearOne's engineers have combined telephony, audio, wireless, and networking technologies in a way that's never been done before. We believe you'll find the results unique and affordable.

RAV Fills a Marketplace Void

The teleconferencing market has always consisted of two product types: tabletop phone units common in conference rooms, and high-end professionally-installed systems with ceiling- or table-mounted microphones and loudspeakers for corporate executive suites and boardrooms. Only rarely has a product targeted the vast territory in between.

- Tabletop conferencing phones, though affordable, are problematic. With an all-in-one unit, speaker and microphones are just an inch or two from each other. Consequently, echo and audio cut-outs are common. Satellite microphones can sometimes be added to catch the voices of those more than a few feet away, but these products do not typically offer satellite speakers. The result can be a dozen or more people huddled around the tabletop unit's speaker to hear the other end of the conversation. The overall experience is often one of dissatisfaction.

RAV FILLS THE GAP BETWEEN TABLETOP CONFERENCING PHONES AND HIGH-END CUSTOM INSTALLED SYSTEMS

- Custom-installed systems are better, but far more expensive, often costing more than $10,000. Microphones can be permanently mounted in the ceiling or flush-mounted in holes drilled into a conference table. Multiple video and audio sources can be mixed in. These custom-designed systems are not likely to be approved for rank-and-file employee conference rooms.

- RAV fits in between. RAV delivers the quality, flexibility, and feature set of a custom-installed conferencing system in an easily installed, simple to use, affordable solution. The high-quality Bose speakers are easily mounted on a wall, away from the microphones, to avoid the possibility of echo. Audio and video sources can be mixed in. Outputs jacks allow conversations to be recorded. Call initiation and management is through a wireless desktop

control module. And the mixer can be managed though an Ethernet connection to the corporate network (or via a direct USB or serial connection.)

- RAV delivers immediate benefits. Improved intelligibility means sentences no longer need to be spoken again and again, leading to shorter calls, reduced user fatigue, and improved productivity. Without the need for call participants to gather around a single tabletop loudspeaker, frustration levels are slashed. That means employees won't be conjuring up reasons to skip a call or leave early.

System Components

RAV is a system that consists of several hardware and software components designed to work with each other. Here's an overview of the key components.

Audio Mixer

The heart of the RAV system, all components connect to or communicate with the mixer. It contains ports for connecting the telephone line, microphones, an RF antenna (for communicating with the controller), Ethernet network, and speakers. Connections are also provided for record/playback devices such as a VCR, an external audio amplifier or video codec, and for using voice tracking to control the movement of a motorized video camera in videoconferencing applications. Internal twin 15-watt, Class D audio amplifiers drive the included Bose speakers. The mixer's sides are easily removed and flipped to allow for easy rack mounting.

Wireless RF Controller

The elegant RF controller sits on the desktop or conference table. Emulating a standard telephone, right down to its familiar user interface, RAV is completely intuitive to use, even for non-technical and first-time users, and allows the call leader to manage calls, program user preferences and adjust various settings. Most phone-specific functions, such as dialing a call or adding a phonebook entry, are managed from the RF controller. Alternatively, phonebook and dialer actions can be performed through the RAV-Ware software. The controller has a 50-foot range to the mixer unit and runs on four AAA batteries that typically last for six months.

THE WIRELESS CONTROLLER HAS A 50-FOOT RANGE TO THE RAV MIXER

Microphone Pods

These are the microphones that are placed on the conference table. Two "pods" are included with the RAV 600, three with the RAV 900. Each pod contains three professional-grade microphone elements with automatic level control capability. Each pod's three elements work together to provide full 360° coverage. Multiple pods are daisy-chained from the mixer using standard Cat5 cables with RJ-45 connectors (included). Each pod features a mute button and a pair of LEDs that glow green when the microphone is live and red when it is muted. Pressing the mute button mutes all microphone pods.

Speakers

One pair of Bose model 161 Articulated Array® speakers and two 50-foot rolls of speaker wire are included. These are high-quality speakers that are often used for a home stereo or home theater installation and are driven by the 15-watt, Class D audiophile-quality amplifiers built into the mixer. Don't confuse these speakers with the a.c.-powered speakers used with most computers. (Wall speakers shown, ceiling-mount speakers are also available.)

Visit Bose at for additional information:
www.bose.com/controller?event=VIEW_PRODUCT_PAGE_EVENT&product=161_bookshelf_index.

RAV-Ware Software

ClearOne's RAV-Ware software (see screen shots starting on page 13) provides an easy interface for configuring system settings and customizing the audio in the RAV 600 and 900 conferencing system. The RAV system is designed to work right from the box for audio conferencing, but RAV-Ware provides advanced functionality, including the ability to adjust audio speaker levels and equalizer settings, and to mix and adjust levels of various audio sources. Once installed, RAV-Ware allows configuration locally through a USB or RS-232 serial connection, or remotely through a LAN connection.

ClearOne Product Line Overview

ClearOne manufactures and markets three different conferencing solutions: XAP, RAV, and MAX. Think of RAV as the mid-level product offering. The following three paragraphs provide a brief summary of each.

XAP Product

ClearOne's XAP® installed audio conferencing products are sophisticated, feature-rich systems for boardrooms, convention centers, distance learning facilities, courtrooms, and other multiuse conference rooms. XAP systems are highly flexible: multiple units can be linked, providing support for up to 64 microphones. They can be used with virtually any microphone and sound system, and they include the ability to connect to a wide variety of multimedia devices.

For XAP information, visit:
www.clearone.com/product_service/product_detail.php?prodid=13

RAV Product

The solution covered in this reviewer's guide, RAV is a complete out-of-the-box conferencing system that includes a mixer, wireless controller, dedicated microphones, Bose loudspeakers, and management software. RAV offers selected features of the XAP line in a simplified form with basic configuration options. RAV is easy to install, and provides more functionality and far better audio quality than a typical tabletop conference phone. For installations that do not require the power and flexibility of XAP, RAV is an excellent solution. RAV 600 includes two microphone pods; the RAV 900 includes three microphone pods.

For RAV information, visit:
www.clearone.com/product_service/product_detail.php?prodid=196

MAX Conferencing Phones

ClearOne's MAX® conferencing phones are engineered with the same audio technology used in the company's XAP and RAV systems, providing improved audio performance over other traditional tabletop conferencing phones. With innovative features, including expandability and wireless operation, MAX conferencing phones are a good fit for conducting teleconferences anywhere.

For MAX information, visit:
www.clearone.com/product_service/product_detail.php?prodid=129

For MAX Wireless information, visit:
www.clearone.com/product_service/product_detail.php?prodid=127

Product Info Box

The following is a brief summary of the RAV Audio Conferencing System.

ClearOne RAV Summary	
In Brief	ClearOne's RAV audio conferencing system has the sound quality and flexibility of a professionally installed system but the simplicity of a tabletop conference phone. Installed in less than an hour, its multi-input mixer can be managed through an Ethernet connection and features distributed acoustical echo canceling. Call management is via a wireless tabletop control unit. Stylish microphone pods provide 360-degree pickup of all local participants. Two Bose loudspeakers complete the system.
Operating systems supported	RAV-Ware utility software runs on Windows 98 SE, 2000, and XP
In the box	RAV audio mixer with removable rack-mount brackets, wireless RF control console, microphone pods (2 with RAV 600, 3 with RAV 900), pair of Bose model 161 Articulated Array® speakers(choice of wall mount or ceiling mount), power cords and adapter, CD with RAV-Ware software, Quick Start Guide, User Manual, hard-copy Quick Start Guide, 4 AAA batteries. Cable assortment: 12' phone, 7' and 25' RJ-45, 6' USB, 2 50' rolls of speaker wire, 2 6' RCA audio cables, 12' RJ-45 microphone cables. It also is available without Bose speakers.
Price	RAV 600, $2,599; RAV 900, $3,099
Vendor	ClearOne Communications Inc. Salt Lake City, Utah
Web site	www.clearone.com

Part

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Technology Achievements

Advanced features in an affordable solution for any location

RAV is not simply a collection of parts. It's a technology *tour de force* that brings features, previously available only in professionally installed systems costing $10,000 or more, to any conference room, for prices starting as low as $2,599.

ClearOne RAV provides a "natural" audio experience with intelligibility and sonic clarity nearly equivalent to conferencing participants being in the same room.

This section highlights key technology achievements you may wish to share with your audience.

ADAPTIVE MODELING ASSURES HIGH-QUALITY AUDIO EVEN AS A ROOM'S ACOUSTIC CONDITIONS CHANGE

Adaptive Modeling

Description: Adaptive modeling is a signal-processing method of predicting changes in a room's acoustical environment through the continuous monitoring of an audio signal's key parameters. Disruptive audio effects, such as microphone-to-speaker coupling, feedback, and residual echo from reflections within the conferencing system, can be avoided by applying adaptive signal processing techniques.

User Benefit: ClearOne's adaptive modeling technology assures high audio quality regardless of varying room dynamics, number of participants, seating arrangements, and other environmental factors.

How it Works: An algorithm adjusts the processing threshold based on ambient noise levels within the room. This ambient noise level changes as the number of participants increases, as the air-conditioning system cycles on and off, and

as other acoustical events occur. The adaptive ambient algorithm monitors these changes using the microphone pod elements as the pick-up source.

Acoustical Echo Cancellation

Description: The key signal-processing technique required for audio conferencing, acoustical echo cancellation (AEC) prevents the incoming audio being played through the local loudspeaker from being picked up on the microphone and re-transmitted to the remote call participant.

ECHO CANCELLATION PREVENTS A MICROPHONE FROM RE-TRANSMITTING AUDIO FROM A LOUDSPEAKER BACK TO ITS SOURCE

User Benefit: Echo-free calls eliminate the need for participants to repeat themselves, resulting in briefer calls, reduced telephony use, enhanced productivity, and an overall improved user experience. ClearOne's fourth-generation AEC algorithm is optimized for the group conferencing environment and automatically adapts to changing acoustical conditions.

How it Works: ClearOne's Distributed AEC architecture, introduced in 1998, uses separate acoustical echo cancellers for each microphone element (each RAV pod contains three elements). Even though the three microphone elements in each pod are only inches apart, each hears things differently. These differences allow RAV to build a precise model of the room's acoustics, allowing creation of a transparent audio experience.

For the technically minded, AEC is the result of three component technologies, sub-band computation, TX and RX correlation, and suppression algorithms.

- Sub-Band Method: ClearOne's AEC uses the sub-band method for echo signal computation. An audio sample is segmented into frequency bands from 20Hz to 20 KHZ. Each band's unique spectral content can be characterized. ClearOne's AEC algorithm uses this unique spectral content to make processing decisions to eliminate unwanted signals and pass desirable signals. This method minimizes artifacts that result from excessive aliasing with other computation techniques.

- TX and RX Correlation: ClearOne has developed comprehensive processing decision criteria based upon the correlation of transmit-to-receive audio. Within an audio conference, the transmit (room acoustics) and receive (line acoustics) conditions change continuously. Common occurrences, such as a participant increasing the volume or accidentally placing a sheet of paper on the microphone pod severely impact performance of the echo-cancellation algorithm. The result may be a mismatch in the room's acoustical model resulting in echo. ClearOne's correlation criteria allow the AEC to compensate for this dynamic change prior to presenting the audio to the far-end.

- Suppression Techniques: Suppression algorithms are used in conjunction with AEC processing to eliminate residual echo resulting from mismatches between the calculated room model and the actual room's acoustical envi-

ronment. ClearOne's suppression-processing routines are optimized for audio transparency based on its adaptive modeling. In essence, suppression is applied to the unwanted echo with minimal impact to the intended audio signal. Also, the suppression algorithm shares information with the AEC algorithm to reduce the error coefficient associated with the calculated room's acoustical model.

Noise Cancellation

Description: Noise cancellation eliminates broadband noise sources from sounds picked up by the microphones. Noise sources include HVAC systems, laptops, video projectors, and fluorescent lights.

CLEARONE ELIMINATES SPURIOUS NOISE WITH SPECTRAL ANALYSIS INSTEAD OF A NOISE GATE

User Benefit: ClearOne's noise-cancellation technology eliminates unwanted audio signals generated from environmental factors. The company's noise-cancellation algorithm attenuates these noise sources while allowing the voice signal to pass to the far-end with pristine quality.

How it Works: Most products claiming to offer noise cancellation use a "noise gate" technique in which the overall signal (the sum of voice and ambient noise) is attenuated to the device's "noise floor" as the amplitude approaches a pre-defined threshold. The threshold is based on the ratio of audio signal compared to the device's noise floor. As the signal-to-noise ratio approaches 1:1, far-end participants strain to discriminate voice from noise. This leads to fatigue and misinterpretation. The noise gate masks the ambient noise in the room by pushing it below the device's noise floor, allowing voice to pass. However, a side effect of the noise gate technique is the common "pumping" artifact created by the rapid gain changes in the signal as the gate is applied. ClearOne's noise cancellation algorithm eliminates these artifacts by using a different technique. It analyzes the spectral content of the overall signal discriminating voice component from the ambient noise source. Attenuation is applied only to ambient noise sources with significant spectral energy. Doing so negates the artifacts caused by rapid gain changes.

Look-Ahead Gating

Description: Look-ahead gating minimizes adverse audio effects created when multiple microphones are active simultaneously – as they almost always are in an audio conferencing system. Adverse effects include distortion resulting from the combination of direct and indirect audio signals arriving at different microphones at different instances of time with different amplitudes. This distortion is typically described as a "hollow" or "tunnel" sound.

User Benefit: Typically, group conferencing environments have multiple participants speaking sequentially during the meeting. As the conversation proceeds back and forth, different microphones are activated based on the proximity to the person speaking. The rapid way microphones are automatically turned on and off can create unwanted artifacts and can impede intelligibility to the far-end. The far-end hears clicks, swishing, or completely misses the talker's first word as the conversation transitions back and forth. ClearOne's look-ahead gating technology eliminates these artifacts to create natural audio sound to the far-end, regardless of who is speaking.

How it Works: This effect is minimized by an intelligent method of activating only one microphone at a time. ClearOne uses a voice-detection process to determine the best microphone to activate based on the participant's proximity. All other microphones are attenuated, rendering their audio contribution insignificant. An adverse result from instantly adding gain to the active microphone is a pumping effect of the noise floor. To overcome this, ClearOne developed look-ahead gating. It delays slightly the audio sent to the far-end. This delay is not perceived by the user but allows the gating algorithm to compensate for rapid gain change artifacts.

ClearEffect

Description: RAV features ClearOne's ClearEffect technology. ClearEffect provides a natural audio experience, creating intelligibility and clear audio, virtually the same as if conference call participants were in the same room. In most conference calls, narrowband telephony signals connect the conference parties. Their poor sonic quality leads to excessive fatigue after an extended period. This is due to strained listening due to the narrow band of the audio transport path (telephone). Other experiences are a sense of "unnatural sounding" participants. We're all familiar with it: The far-end party does not sound the same on the telephone as in person. All these effects lead to reduced intelligibility and a potentially ineffective conference.

User Benefit: ClearEffect overcomes many of these anomalies, ensuring the most productive audio conference with an enhanced user experience.

How it Works: ClearEffect is a signal processing method of emulating wideband audio on narrowband (200 to 3.3 KHz) telephone signals. ClearEffect leverages the psycho-acoustical phenomenon associated with human listening, and simulates out-of-band signals through emphasis and delay of the received telephone signal. The result is an audible impression of a full-band audio signal by the human brain.

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Hands-On With RAV

Installation takes just minutes

As you work with the RAV unit, you'll find that it's easy to install and configure. In this portion of the ClearOne RAV Reviewer's Guide, we'll discuss the hardware environment, system requirements, installation, and testing.

Don't hesitate to contact ClearOne with questions as you proceed. Editorial contacts are listed on page 'v.'

Hardware Environment

You can manage the RAV mixer from a PC through a LAN connection, or with a direct USB or serial connection.

As discussed in the System Components section that starts on page 4, RAV consists of a wireless desktop control unit, a mixer, two speakers, two or three microphone pods, and the RAV-Ware software application.

- To install the RAV unit, refer to the *RAV 600/900 Quick Start Guide* and the *RAV 600/900 User Manual.*

    ⚠️ Avoid plugging a LAN cable into the mixer's microphone port.

Network Information

To use RAV over a local area network (LAN), you need to know if the LAN uses Dynamic Host Configuration Protocol (DHCP) or if you need a static IP address. If the LAN uses DHCP, there is no need to make any network adjustments unless you want to assign a static IP address.

If the LAN does not use DHCP, the following information is needed:

- IP address to be assigned to the RAV
- Subnet mask
- IP address of the default gateway

Connecting To The RAV

When you connect the RAV to a network and install the RAV-Ware software on a Windows-based PC, that computer automatically finds the RAV unit installed on the same network segment (if DHCP is used).

Optionally, you can connect a PC directly to the RAV using either the USB port located on the front of the unit or the serial port located on the rear.

RAV-Ware Software

Though the wireless desktop controller is used to initiate calls and manage conferencing sessions, the RAV-Ware software utility is used to manage, maintain, and configure many different aspects of the mixer. The following screen shots provide illustrated examples of the features available.

The RAV-Ware utility is designed for easy navigation. Simply clicking on an icon displays the configuration dialog for that feature. At the top, the yellow arrow icon updates the RAV firmware; the wrench icon to its left invokes the system diagnostics.
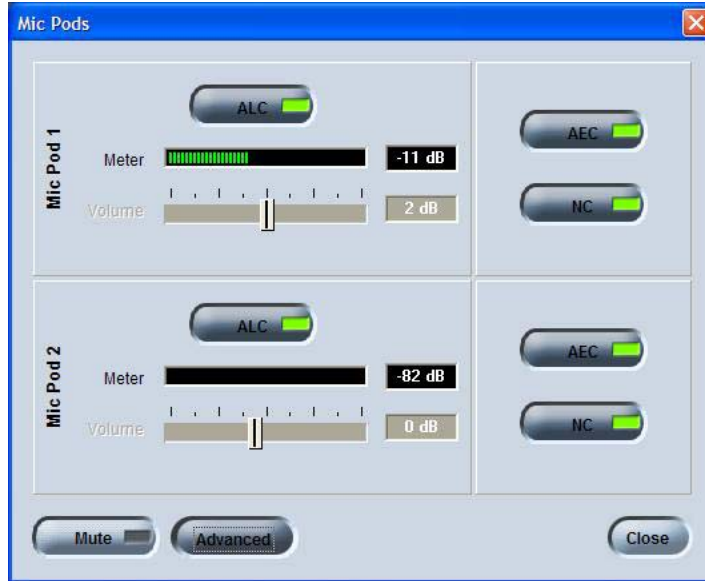
Microphone volumes can be automatic (note here that Automatic Level Control is enabled). Acoustical Echo Cancellation and Noise Cancellation are also enabled. This screen, from the RAV 600, shows two microphone pods; the RAV 900 supports three microphone pods.

The Bose loudspeakers are managed through this dialog. ClearEffect enhances the audio from the incoming telephone line to emulate wideband audio. It does this by adding high and low frequencies to the audio signal, creating a fuller sound. Speaker volume is set with the horizontal slider, ensuring that everyone in the room can hear the remote participant. There's no more need for everyone to huddle around a tabletop speaker.
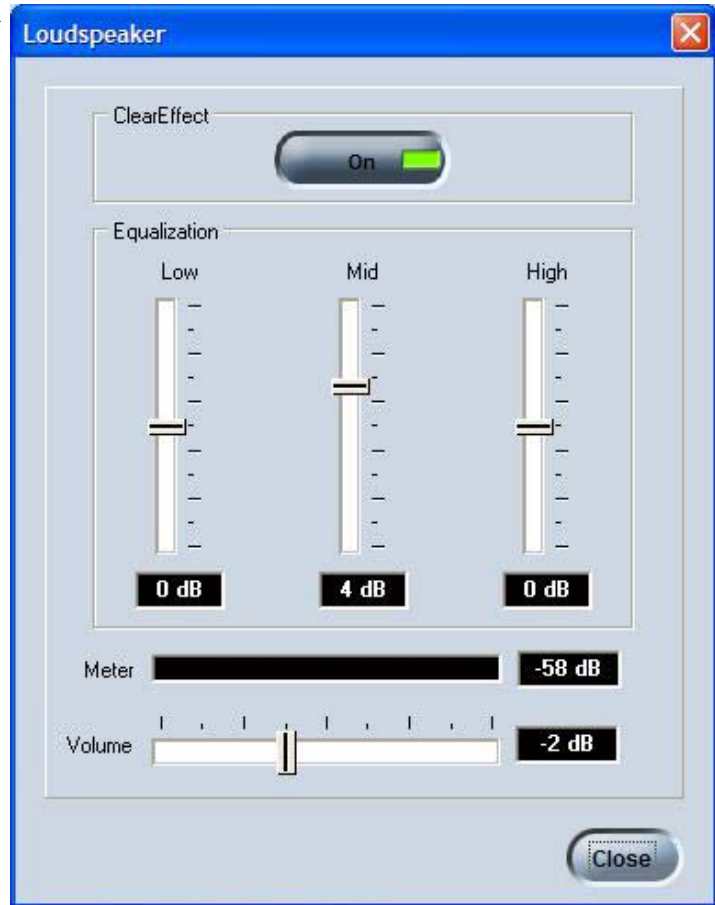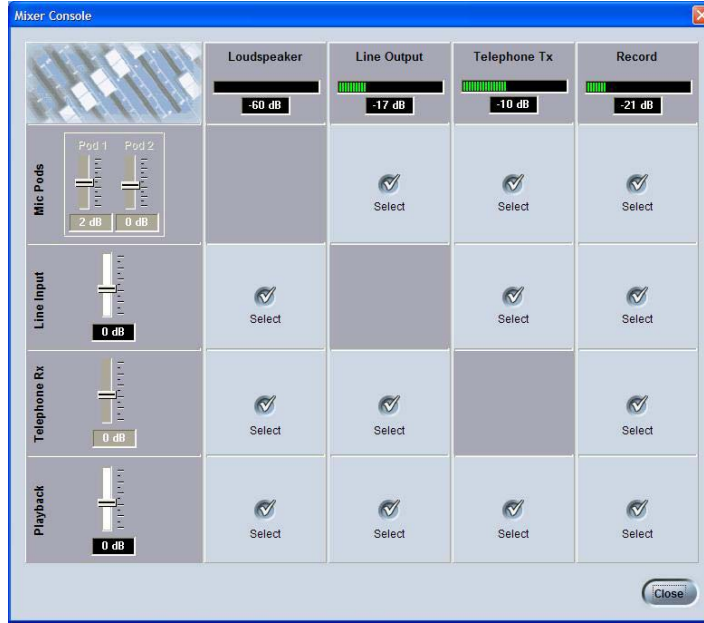
The Mixer Console allows the user to create audio mixes for the different outputs, adjust volume levels, and view output meters. Inputs are shown along the left side and outputs across the top. RAV-Ware prevents routing microphone audio to the loudspeakers, line in to line out, or telephone receive to telephone transmit. This prevents audio looping.

While most calls are made using the wireless desktop controller, they can also be managed from the RAV-Ware dialer screen. A user can dial a number, redial the last dialed call and disconnect calls. Line flash, microphone muting, and speaker volume adjustment is also supported.
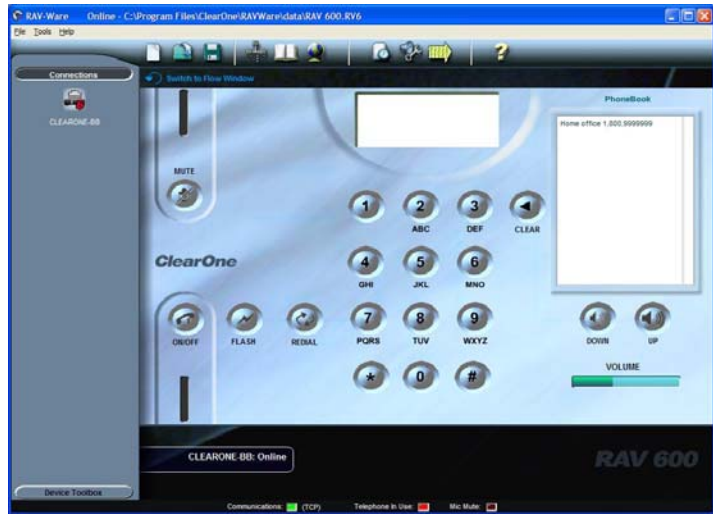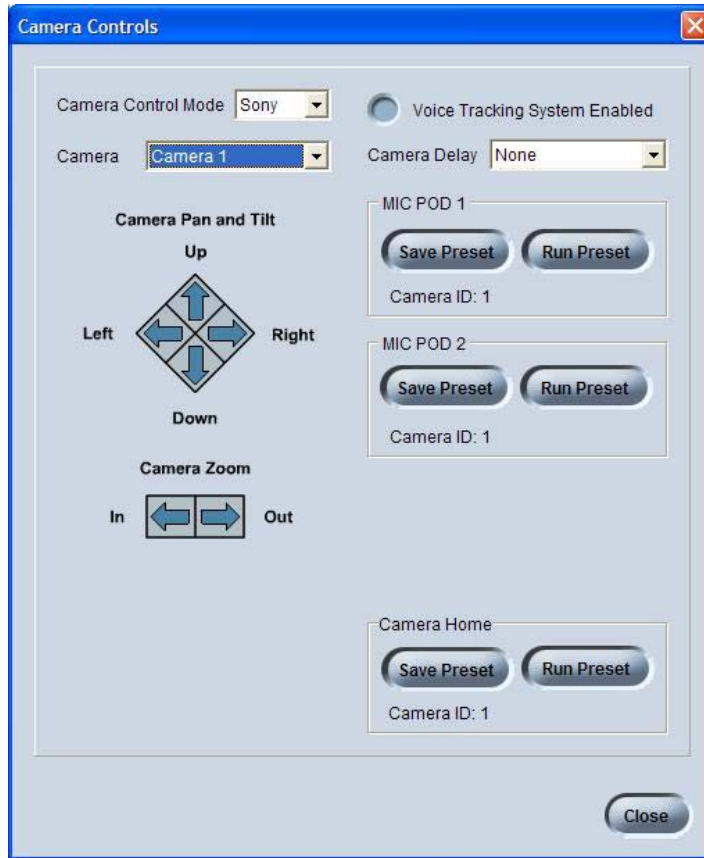
The RAV system provides voice-tracking capabilities for supported video cameras through a VISCA control-port connection to a PTZ camera. The camera presets are programmed in RAV-Ware and assigned to each microphone pod. When a specific microphone is activated, the PTZ camera moves to the associated preset position. RAV 900 supports three camera positions and a home position; RAV 600 supports two camera positions and a home position.

The diagnostics dialog provides immediate feedback. For illustration purposes, the second microphone pod was disconnected. The result is clearly shown with a red indicator and text message.

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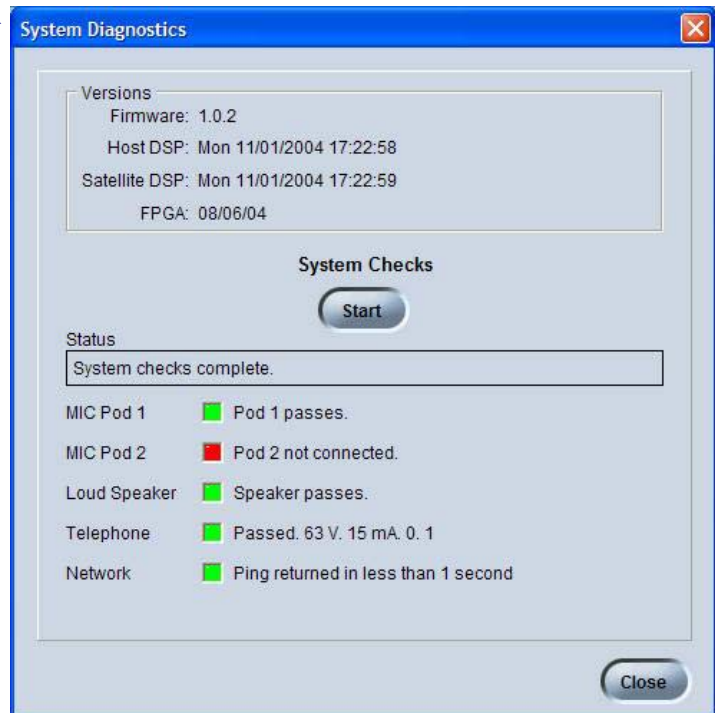
Additional Materials

This section contains a variety of background materials that you may find useful as you compile information for your review of the ClearOne RAV system.

Company Backgrounder

ClearOne develops and sells products for audio, video and Web conferencing. The reliability, flexibility and performance of ClearOne's solutions create a natural communications environment, saving time and money by enabling more effective communications. ClearOne was founded in 1981 as a developer of audio products for the radio and television broadcast industry. It introduced its first audio conferencing products in 1990 under the Gentner brand. Since then, more than 40,000 units have been installed in customers ranging from Fortune 1000 corporations to the federal government. The company's headquarters are in Salt Lake City, Utah and has offices in London, England; Ottawa, Canada; Hong Kong, China; and Singapore.

Customers

Who uses ClearOne Products? Here's a partial list.

Best Buy	Boeing	Merrill Lynch
Cisco Systems	Hewlett-Packard	VISA
IBM	Intel	Morgan Stanley
National Basketball Association	Nortel Networks	Goldman Sachs
The Federal Reserve Board	VISA	KPMG
Fidelity Investments	Pfizer	Microsoft
Mayo Clinic	Merck	NASA
ConocoPhillips	Credit Suisse	DaimlerChrysler

Product Specifications

Audio Performance
Conditions: Unless otherwise specified,
all measurements are performed with a
22 Hz to 15 kHz BW limit (no weighting)

Audio Mixer
AEC tail time: 128 ms
Adaptive noise cancellation: (6 – 18 dB)
Gating: Adaptive ambient, 1st mic priority,
look-ahead gating, NOM attenuation
Audio bandwidth: 16 kHz with videoconferencing
or other full-band networks

Microphone Pod
Coverage: 360 degrees
Connection: RJ-45 with Cat. 5, Link
In/Out Ports
Maximum Distance from Base Mixer:
50' (RAV 900), 75' (RAV 600)
Frequency Response:60 Hz – 14 kHz (+/-1 dB)
THD+N: <0.08% (–45 dBu input @ 1 kHz)
Sensitivity: -45 dBu
Input Level: -6 dBu for 1 kHz 94 dBSPL
microphone input
Dynamic Range: > 65 dB

Line Input
Connection: Unbalanced RCA
Gain: -10 dBu nominal, adjustable from
-14 dB to +18 dB
Nominal Level: -10 dBu
Maximum Level: +9 dBu
Impedance: > 10 kOhm

Line Output
Connection: Unbalanced RCA
Nominal Level: -10 dBu, adjustable from
-14 dB to +18 dB
Maximum Level: +9 dBu
Frequency Response:40 Hz – 15 kHz (+/-1 dB)
Dynamic Range: > 80 dB
THD+N:< 0.02% (+6 dBu input @ 1 kHz)

Playback/Record Input
Connection: Unbalanced RCA
Gain: -10 dBu nominal, adjustable from
-14 dB to +18 dB
Nominal Level: -10 dBu
Maximum Level: +9 dBu
Impedance: > 10 kOhm

Playback/Record Output
Connection: Unbalanced RCA
Nominal Level: -10 dBu, adjustable from
-14 dB to +18 dB
Maximum Level: +9 dBu
Frequency Response:40 Hz – 15 kHz (+/-1 dB)
Dynamic Range: > 80 dB
THD+N: < 0.02% (+6 dBu input @1 kHz)

Loudspeaker
Connection: Left and right push terminals
Power: 10 Watts into 8 Ohm load
Impedance: 8 Ohm
Frequency Response:60 Hz – 15 kHz (+/-1 dB)
Dynamic Range: > 80 dB
THD+N:< 0.5% (+5 dBu line input @ 1 kHz)
Output Level:90 dBSPL output @ 1 meter

Telephone Interface
Conditions: All measurements taken with
ALC disabled.
Connection: RJ-11 (Set and Line jacks)
Tail Time: 30 ms
Frequency Response:250 Hz to 3.3 kHz (+/-1 dB)
THD+N:< 0.2% (+7 dBu line input @1 kHz)
Dynamic Range: > 60 dB

RS-232 Control Port
DB9 female
9,600/19,200/38,400/57,600
(default)/115,200
Baud rate: 8 bits, 1 stop, no parity
Hardware flow control on (default)/off

Communication I/O
10/100 Ethernet Control Port:
RJ-45 with LED indicators for link,
duplex and activity status.

USB 1.1 Configuration Port
Slave port

VISCA Camera Port
DIN, 9600 baud, no Flow Control

Dimensions (W x D x H)
Mixer: 17" x 7.5" x 2"
(43.2 cm x 19.1 cm x 5.1 cm)
RF Controller: 10.5" x 4.5" x 2.75"
(26.7 cm x 11.4 cm x 6.9 cm)
Mic Pod Diameter: 7" (17.8 cm),
Height: 1.5" (3.8 cm)

Weight
Mixer: 4.5 lb (2 kg)
RF Controller: 2.0 lb (.9 kg)
Mic Pod: 1.1 lb (.5 kg)

Environmental
Operating Temp: 32-122º F (0-50º C)

Power Supply
Primary Voltage: 100 to 240 VAC
Auto-Sensing, 50-60 Hz

Optional Accessories
Remote Antenna, Credenza, A-D Converter,
Document Camera, Roll-About Cart