ClearOne® Converge™ Pro Benefits Analysis

Question: Why are ClearOne products better? Answer: Our technology is better.

Benefits	Features	ClearOne Technology (HD Conferencing)	ClearOne Value	Competitive Comparison	Conclusions
Advanced Conferencing Technologies	Adaptive Modeling	A signal processing method of predicting changes in the room acoustical environment through the continual monitoring of key parameters of an audio signal. By monitoring key parameters within the audio signal, potential disruptive audio effects within the conferencing system can be avoided by applying adaptive signal processing techniques. Disruptive audio effects may include microphone-to-speaker coupling, feedback, and residual echo from reflections or acoustical events generated by participants (pen tapping, coughing, door shutting, etc.)	ClearOne's conferencing technology will consistently perform in acoustically challenged rooms, and it recovers from instantaneous acoustical anomalies. ClearOne's audio remains near-transparent with dynamic changes to the acoustical environment.	Other products on the market with AEC may work well in rooms with low NC ratings or when participants are following proper conferencing etiquette. They typically rely heavily on suppression techniques to eliminate residual echo. Once placed in reflective rooms, duplex performance is significantly degraded. Also, systems can be highly susceptible to degraded performance when acoustical events occur within the room. This may be a participant coughing, a HVAC system turning on, a door shutting, etc. The result is far-end audio cutting out for seconds because of excessive suppression, or constant low level echo.	With over 80,000 conference room products installed since 1990, ClearOne technology is field-proven. The Converge Pro is the 4th generation (TI, AP, XAP, Converge Pro) conferencing mixer line from ClearOne. The Converge Pro provides reliable, consistent audio quality across all applications and installations. The Converge Pro will work in non-pristine acoustical environments and with participants that do not follow proper conferencing etiquette.
	Acoustical Echo Cancellation	The primary signal processing technique required for audio conferencing is Acoustical Echo Cancellation. Acoustical echo in a conference system results from far-end audio distributed through the loudspeaker in the local room being picked up on the microphone and re-transmitted to the far-end. The resultant effect is a delayed replication of the transmitted audio signal of the far end. ClearOne's AEC uses a sub-band method for computation of the echo signal. An audio sample is segmented into frequency bands from 20Hz to 20kHz. Each band has unique spectral content that can be characterized as the echo signal. ClearOne's AEC algorithm utilizes this unique spectral content to make processing decisions to eliminate the unwanted signals and pass the wanted signals. The sub-band method provides more precision in the AEC processing and minimizes artifacts that can result from excessive aliasing with other computation techniques. The AEC algorithm also uses a set of 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 will change within an audio conference. Common occurrences, such as a participant increasing the volume in the room or placing a piece of paper over the microphone can severely impact the performance of the echo cancellation algorithm. These events cause a mismatch in the acoustical model of the room resulting in echo. ClearOne's correlation criteria allows the AEC to compensate for the dynamic change prior to presenting the audio to the far-end.			
	Adaptive Suppression	Suppression algorithms are used in conjunction with the AEC processing to eliminate any residual echo created from mismatches between the calculated room model and the room's actual acoustical environment. ClearOne's suppression processing routines have been 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. Secondly, the suppression algorithm shares information with the AEC algorithm to reduce the error coefficient associated with the calculated room's acoustical model.			
	Line Echo Cancellation	Line echo cancellation utilizes an adaptive echo cancellation with integrated noise cancellation.			

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Superior Automatic Microphone Mixer	Look-Ahead Gating	Look-ahead gating is a technique used to minimize adverse audio effects created with multiple active microphones in an audio conferencing system. Having multiple active mics can create distortion from the combination of indirect and direct audio signals arriving at different microphones at different instances of time with different amplitudes. The distortion is typically described a “hollow” or “tunnel” sound by the participants. This effect is minimized by an intelligent method of activating only one microphone at a time. ClearOne products utilize a voice detection scheme to determine the best microphone to activate based on the participant’s proximity. All other microphones are attenuated to a point that the audio contribution in the summed signal is insignificant. An adverse result from instantly adding gain to the active microphone is pumping effect of the noise floor. To overcome this, ClearOne has developed a technique to eliminate this artifact called “look-ahead” gating. The concept of look-ahead gating is to slightly delay 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.	ClearOne’s automatic microphone mixer produces a natural audio experience independent of number of participants and room characteristics. The gating control functions facilitate application flexibility for optimization of audio performance.	Competing auto-mixers can produce artifacts that effect audio quality. Artifacts can include audible gate transition, false gating, and limited noise control. These artifacts are accentuated in reverberant rooms, speech lift applications, and applications with high microphone counts.	ClearOne’s automatic microphone mixer is the best on the market, and produces natural-sounding audio performance in all application and room configurations.
	Adaptive Ambient	This algorithm adjusts processing threshold based on ambient noise floors within the room. The ambient level within a conference room dynamically changes as the number of participants increases, air handlers activate, and similar acoustical events occur. The adaptive ambient algorithm monitors these changes using the microphone element as the pick-up source. The algorithm automatically changes gate thresholds to compensate for the increased noise floor. This ensures audio quality of the conference system is maintained regardless of room acoustical changes.			
	Gating Controls	ClearOne has integrated various gating controls which include Gating Groups, Chairman Override, Max Number of Mics, and Last Mic On. These controls allow an installer to optimize the microphone mixer for a specific application and room type. Gating groups allow individual microphones to be assigned to function as an individual auto-mixer. Chairman Override is a mixer control allowing an individual microphone to take precedence over other microphones within the group. This function is useful in applications requiring a presenter to override other participants’ microphones. Maximum number of microphones is a control to set the number of microphones that can gate on in a gating group. This function is useful in conferencing applications in which participants use free-flowing conversations in which multiple parties may speak simultaneously. Last Mic On is an automatic technology that leaves the at least one microphone gated on (the most recent one that gated on based on proximity to the talker), even when the room goes silent. This picks up ambient noise in the room, and prevents “pumping” artifacts as audio levels change.			

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Noise Control	Noise Cancellation	Noise Cancellation is a processing technique to eliminate broadband noise sources from voice picked up by the microphones. Noise sources in a conference room can include HVAC systems, laptops, projectors, and fluorescent lights. The majority of products on the market claiming to have noise cancellation use a noise gate technique in which the overall signal (voice + ambient noise) is attenuated to the device's noise floor as the amplitude approaches a pre-defined threshold. The threshold is based on ratio of audio signal compared to the device's noise floor. As the signal to noise ratio approaches 1:1, far-end participants listening to the call have to strain to discriminate the voice from the noise. This causes 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 a "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. ClearOne's noise cancellation analyzes the spectral content of the overall signal and discriminates the voice component from the ambient noise sources. Attenuation is applied only to ambient noise sources with significant spectral energy. This negates the artifact caused by rapid gain changes.	Noise will severely impede intelligibility of a conference and potentially cause user fatigue with an audio conference. ClearOne's signal processing algorithms minimize noise contributions while maintaining audio performance as microphone counts increase and/or sound reinforcement is applied.	Some of the competitors have challenges with noise and audio artifacts as microphone counts increase. As mentioned in the noise cancellation description, the noise gate technique used by most competitors causes "pumping" artifacts and produces inferior results when the signal-to-noise ratio approaches 1:1.	Noise and room acoustical anomalies impede a user's audio experience. ClearOne's technology possesses the best noise control measure that maintains performance through increased microphone counts.
	PA Adaptive Mode	Power Amplifier Adaptive mode is a processing technique that uses the loudspeaker audio level on a specified output as the new ambient level for the microphone gating decision. This prevents loudspeaker audio from unnecessarily gating microphones on, while allowing participants' voices to gate microphones as they speak.			
	Downward Expander	ClearOne's telephone hybrid utilizes a downward expander function on the receive audio. Typical noise floors on central office or PBX telephone lines are significantly higher (up to 20 dB) than local room audio systems. The downward expander is a signal processing technique to attenuate the telco receive audio to the mixer's natural noise floor.			
Scalability	Expansion Bus	The ClearOne Converge Pro product line employs a proprietary digital audio bus that facilitates linking multiple units to create scalable audio systems up to 64 microphones. The proprietary bus is comprised of 12 mix-minus sub buses that function at 24 MHZ. This computes to a unit-to-unit delay of less than 4 msec. Competing products that produce excessive bus delay in conjunction with Acoustical Echo Cancellation can experience reduced performance.	The Converge Pro was designed to scale by connecting multiple mixers via a proprietary digital bus called Expansion Bus. The Expansion Bus was designed specifically for minimal delay to prevent degraded echo canceling performance created by a non-correlated microphone audio sample and AEC reference signal.	Some competitors utilize digital audio protocols typically used for audio distribution. These protocols produce 10-20 msec delays, which do not impact the user experience within a room for a pure audio distribution application. However, in audio conferencing applications, particularly when paired with video conferencing, these delays can create user-perceived anomalies, including degraded AEC performance and lip synchronization issues.	ClearOne products were designed to maintain the same conferencing performance as the room scales with increased microphone count and the addition of sound distribution. The signal processing from microphone to loudspeaker and mixer to mixer has been designed for consistent performance in any conferencing application.
	Mix /Minus	The Converge Pro deploys a mix-minus bus structure on its proprietary expansion bus. A total of 12 mix-minus buses are available to create the necessary audio mixes between units, which maximizes application flexibility.			
	Virtual & Ebus References	The Converge Pro also contains sub-bus mixes entirely dedicated to creation of echo cancellation references. This can be used when a microphone AEC requires an echo reference consisting of multiple audio sources playing through the loudspeaker. The expansion bus also contains 4 buses dedicated for sharing AEC references between units. The Virtual References also contain a feature designating output level tracking, which allows the AEC algorithm to automatically adjust to acoustical gain changes on an output without diverging the AEC.			

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Configuration	Macro Language	ClearOne has developed a full macro language for programming control of the audio conferencing products. The Converge Pro has 256 Macros that are user definable. The Console application also contains a Macro Recorder feature that automatically loads all configuration changes into a defined macro.	The Converge Pro configuration features can be used to reduce 3rd-party controller programming time. In addition, the Converge Pro inherits all the serial commands of the XAP product line, which allows existing control programs to be used with the Converge Pro with a simple change to the DID address.	Some competitive products utilizes a non-descriptive language, which can complicate 3rd-party programming and require more time.	ClearOne designs products with the installer in mind. Reduced configuration and programming time results in a more competitive business partner.
	Preset Functionality	The Converge Pro offers 32 user-programmable presets to facilitate configuration changes to include room combining, conferencing applications, and audio configurations. Presets contain a masking feature allowing specific audio routing/configuration changes to be made without affecting other audio within the matrix.			
	Verbose Serial Commands	ClearOne's serial command protocol was developed with the programmer in mind. Command structures are self-descriptive with automatic responses to all commands. ClearOne also employs a broadcast protocol allowing connection to any units within the site for serial command control.			
Management	SNMP	The Converge Pro products include a Simple Network Management Protocol (SNMP) agent, which allows for remote management of the product through standard management consoles such as HP Open View. There is a MIB for each product within the family.	The Converge Pro has included multiple features and functions for remote configuration and management once installed in the room. In addition, the Converge Pro has included industry-standard protocols typically associated with IT systems, which facilitates integration into common management consoles.	Other products on the market have limited management capabilities, and typically utilize custom protocols.	ClearOne products have the most comprehensive management capabilities on the professional audio market, allowing for easy integration into Network Operating Centers (NOC) and Help Desks. All features improve service level of operational conferencing rooms.
	SMTP	The Converge Pro products include Simple Mail Transfer Protocol (SMTP) for automated notification of errors and events that may require attention. E-mail notifications are configured through standard registration with email servers.			
	HTTP Server	The Converge Pro mixers have an integrated HTTP server, which allows direct connection via any Internet browser. This includes customized screens for dialing, troubleshooting, and configuration modifications.			
	Timed Events	The Converge Pro includes timed events capabilities, allowing automated execution of presets and macros at given pre-programmed times. Time values are obtained from either a time server or the product's internal real-time clock.			
	System Checks	System Checks is an automatic maintenance function that checks microphone, loudspeaker, and telephone functionality and reports any problems.			
Reduced TCO	Product Cost	The Converge Pro is competitively priced against competing systems, and is priced at parity with ClearOne's existing XAP product line. In addition, on-board Ethernet is now included in all Converge Pro models, which eliminates the need for the extra expense of XAP Net that would be required on the XAP line. The Converge Pro line also introduces the Converge Pro 8i mixer, an input-only system priced below the full allowing a cost effect method to add microphones to a large system.	ClearOne products focus on reducing total cost of ownership through the lifecycle of the product. IT buying decisions are based on Return On Investment (ROI) analysis, and ClearOne product are positioned as the most cost-effective solution on the market when all elements are considered.	Many competitors focus on selling a box to their partners, and then relinquish responsibility after the sale is complete.	ClearOne is entering its 25th year of providing professional audio conferencing product to the market. Our focus has always been on the customer and providing the best audio technology to meet business requirements for conferencing. We don't push boxes, we provide conferencing technologies that deliver exceptional audio experiences.
	Design Cost	ClearOne has invested heavily in the Converge Pro to reduce design cost for its partners. This includes addition of features in the product like drag & drop programming, remote management suite, and advanced serial command protocol. ClearOne has also invested in its partner support team with 8 Field Application Engineers, training programs, and world-class technical support.			
	Installation Cost	The Converge Pro technology reduces installation costs associated with audio conferencing. Our conferencing technologies provide consistent audio performance independent of room acoustics and end-user tweaking. Call-backs to fix a room reduce profits and lead to end-user dissatisfaction. Converge Pro products minimize call-backs.			
	Maintenance Cost	The Converge Pro product was design to seamlessly integrate to the enterprise with advanced network-based management. These features allow deployment of NOC or Help Desk with minimal manpower. In addition, ClearOne provides a 2-year warranty with advanced replacement to minimize room downtimes.			
	Replacement Costs	ClearOne has a vested interest to maintain long-term customer loyalty. We will be introducing a XAP to Converge Pro trade-in program to facilitate existing users' investment protection.			