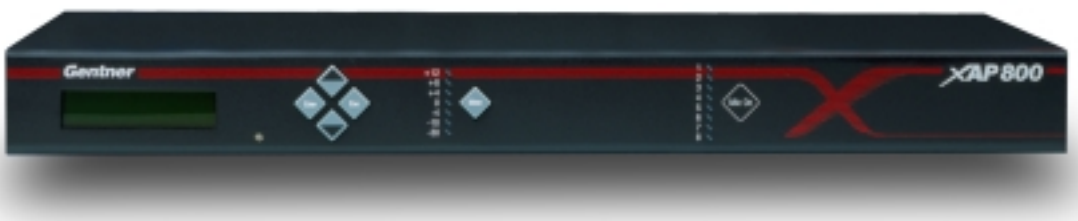
Gentner®

XAP 800™
White Paper



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XAP 800 White Paper
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1 Introduction

Overview

Audio is critical to human communication. Media such as voice mail, the Internet, conference calling, videoconferencing, and electronic presentations are driving the demand for better audio-communication technologies. The audioconferencing and videoconferencing arenas also demand higher-quality sound. The XAP 800 provides better sound quality as well as the ability to provide total sound system performance for telecommunications and any other multimedia audio event.

The XAP 800 Audioconferencing System meets the demands of a wide variety of conferencing and sound reinforcement requirements with 12 x 12 digital matrix mixing, Gentner's proprietary Distributed Echo Cancellation®, noise cancellation, parametric equalizers, filters, and 32 customizable presets. These features enable the XAP 800 to create a quality audio experience in many venues—from corporate briefing centers and courtrooms to training rooms and boardrooms.

A quality teleconferencing experience is one where the audio or audio source material is the message, not the audible inadequacies of a poorly designed or configured teleconferencing system. With a properly configured XAP 800, participants and observers do not become fatigued by reverberated audio, which reduces sound clarity.

For ease of use, the XAP 800 facilitates local and remote PC setup, control, and diagnostics; compatibility with custom control panels; integration with popular control systems; logic outputs, and gated microphone operation. Microphone inputs and mic mixing parameters can be individually customized, while automatic gain control keeps the overall sound level consistent. Input channels 1-8 can be configured as an automatic microphone mixer.

Any combination of inputs can be routed to any combination of outputs, allowing flexibility in accommodating different applications and customer requirements.

Adjustments in routing, level, and other functions can be made through presets activated through a closure on the rear panel or an RS-232 serial interface.

The key benefits the XAP 800 provides are:

- High reliability
- Proven technology
- Outstanding audio quality and clarity
- Seamless integration to external control devices
- Reduced number of separate audio devices required
- Adaptability to a variety of sound applications
- Expandability
- Ease of design and installation

For more information about installing and configuring the XAP 800, refer to the XAP 800 Installation and Operation Manual.

This document outlines the features, functions, applications and technical details of the XAP 800. Some of the diagrams included here depict other Gentner products, such as the XAP TH1 Telephone Interface, APV200-IP Video Codec, and PA870 Power Amplifier. You can find out the latest information on all Gentner products by calling us at 801.975.7200 or 800.945.7730; or visiting our Web site at www.gentner.com.

2 Product Description

Introduction

The XAP 800 is a highly-advanced audioconferencing system with a twelve-by-twelve digital matrix mixer Distributed Echo Cancellation®, noise cancellation, and audio processing. It utilizes an internal macro language and 32 user-definable presets to quickly adapt to a variety of sound reinforcement and room-combining applications in courtrooms, multimedia centers, hotel/convention centers, conference rooms, training rooms, and boardrooms.

Features:

- Gentner's proprietary Distributed Echo Cancellation. DEC places an acoustic echo canceller on each mic input for greater echo cancellation flexibility and effectiveness.
- Noise cancellation on each mic input to reduce unwanted ambient noise.
- 8 Mic/Line Inputs:
  - Input gain control
  - Configurable processors with 5 filters (PEQ, high-pass, low-pass, all-pass, and notch)
  - Automatic gain control with speech leveler for consistent audio levels
- 4 line inputs
- Twelve line output channels. All output levels are adjustable and can be muted.
- 12 x 12 matrix mixer with level control at the cross points.
- Any combination of inputs can be routed to any combination of outputs.
- Adjustable automatic mic mixer:
  - 8-channel automatic mix mixer. Up to 4 mixers operate across bus.
  - 4 internal mixers
  - 4 global mixers linked across Expansion Bus
  - Adjustable parameters
  - Look-ahead gating to eliminate clipped audio
- Eight audio processing buses, each with 15 filters, can be placed anywhere within the matrix mixer audio path.
- Remote and local PC set-up and diagnostics.
- All interconnected devices can be accessed, controlled, and programmed via a single RS-232 connection.
- Macro Pro scripting language allows the unit to function without an external control system.
- 32 programmable presets for instant configuration changes.
- Network-based interconnectivity allows up to eight XAP 800s to be connected and controlled as a single unit, allowing 96 inputs and 96 outputs.
- Logic outputs.
- 100 percent digital signal processing.
- Gentner service and support.
- Worldwide certifications for safety and emissions: CE, FCC, CSA, C-TICK registered.
- One-year limited warranty.

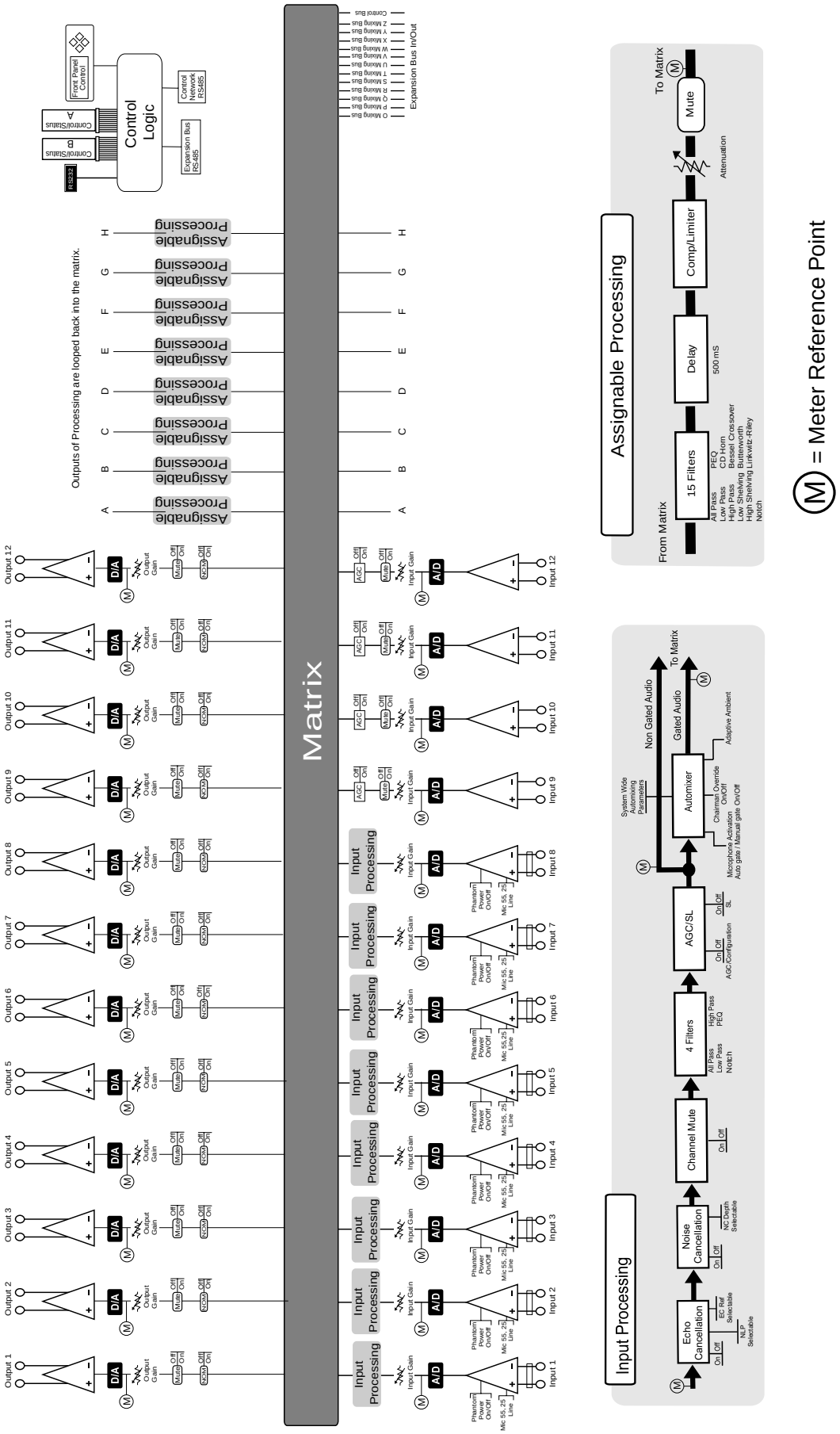


Figure 1. XAP 800 Block Diagram

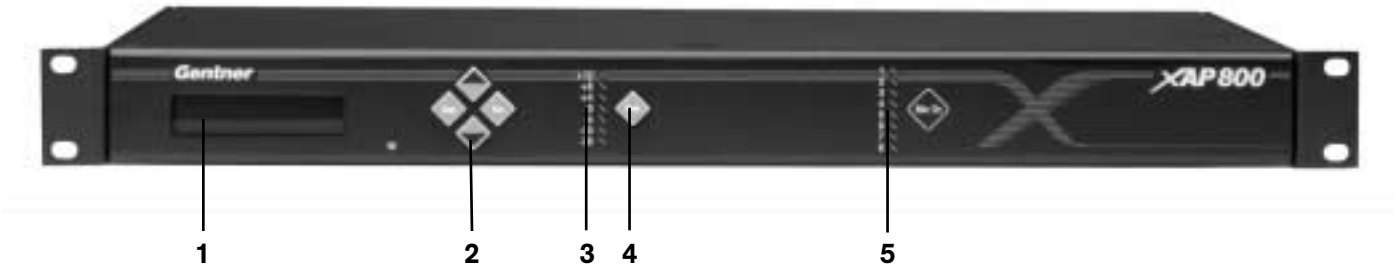


Figure 2. XAP 800 Front Panel

1. LCD - Used for numeric display of audio levels, gain readouts, and limited set-up and programming functions.

2. Enter/▲▼/ESC - Used to navigate the XAP 800's menu system.

3. LED Meter - This LED bar meter is used to display the audio level of an input, output, or processing channel of the XAP 800.

4. Meter - Takes you directly to the Meter branch of the XAP 800's LCD programming tree.

5. Mic On LED - These LEDs indicate microphone gate status.

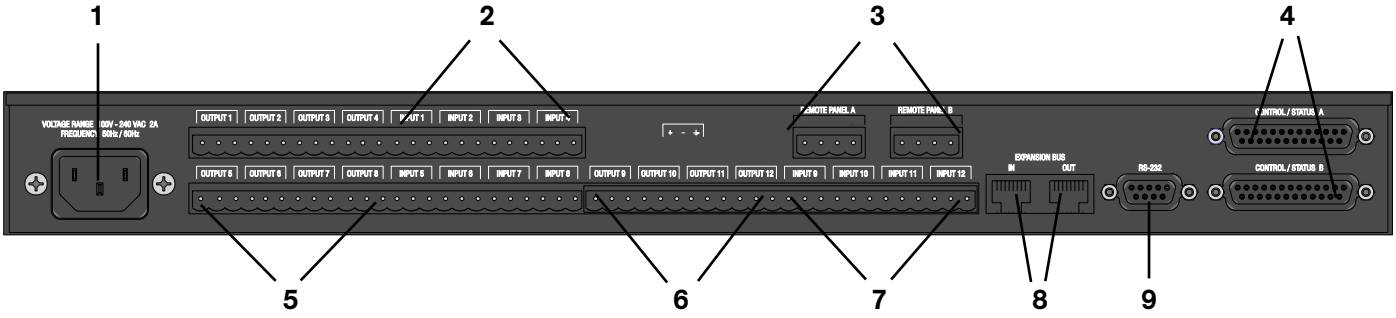


Figure 3. XAP 800 Rear Panel Connections

Rear Panel Connections

1. Power - The power module accommodates an AC voltage input of 100–240VAC, 50/60Hz, 30W. No switching is required.

2. Inputs 1-8 - For mic- and/or line-level inputs.

3. RS-485 Remote Control Ports - These four-pin Phoenix™ ports allow you to control the XAP 800 with a Gentner Control Panel.

4. Control/Status Ports A and B - These DB25 connectors are for connecting custom control devices. The control devices have access to the command set for the XAP 800 and can be used for functions such as volume, muting, preset change, room combining, etc. Devices can be connected to either port.

5. Outputs 1-8 - Line-level outputs that may be configured for any combination of gated and non-gated inputs, as well as a mix of mic- and line-level inputs.

6. Inputs 9-12 - For line-level inputs.

7. Outputs 9-12 - Same functions as Outputs 1-8.

8. Expansion Bus In/Out - Used for passing audio and control information between XAP 800 units.

9. RS-232 - This DB9 serial port is for interconnection between the XAP 800 and a PC, modem, or popular custom remote control system.

Expansion Bus Connections

The Expansion Bus network architecture allows up to eight XAP 800s and up to 96 inputs, 96 outputs, and 64 microphones to be controlled as if part of a single unit.

Expansion Bus This digital mix-minus bus allows audio routing to and from any destination on the Expansion Bus network. It contains 12 independent digital audio buses labeled O-Z and four PA adapt/acoustic echo cancellation reference buses. Each audio bus can route mic or line-level inputs across the Expansion Bus network. These buses are divided into two groups—O-R buses and S-Z buses— based on their capabilities and default settings.

O-R Buses These four audio buses are defaulted as the mic mix buses; they can communicate the NOM count (see page 25) across the network to other XAP 800s. Otherwise, these buses are identical to buses S-Z.

S-Z Buses These eight buses are defaulted as auxiliary mix buses. They are used to route auxiliary audio, such as from a CD player, video codec (such as the APV200-IP) or XAP TH1 Telephone Interface, to and from other units on the network. These buses are also used as mic mix buses when NOM count is not required.

PA Adapt/Acoustic Echo Cancellation Reference Buses These buses provide a system-wide bus for input channels to receive a reference input for PA Adaptive Mode. See page 23 for more information about PA Adaptive mode.

In addition, there are four global mixer groups (A-D). They support first-mic priority, maximum number of mics, etc., and work across all linked XAP 800s. Unlike the audio buses, they contain only mic status and gate parameters. All gated mics are default routed to the A mixer and to the O bus for routing.

Network Requirements

The Expansion Bus (RS-485 LAN) lets you link multiple XAP 800s. The maximum distance allowed between any two XAP 800 units on an Expansion Bus network is 80 feet. Gentner recommends category five twisted-pair (10BaseT LAN) cable be used.

Equipment Placement

The XAP 800 is designed for mounting in a 19" equipment rack. Do not block any of the ventilation holes. With a desktop kit, it can be modified for tabletop placement.

Environmental Requirements

The XAP 800 can safely operate in temperature environments between 32°—110°F.

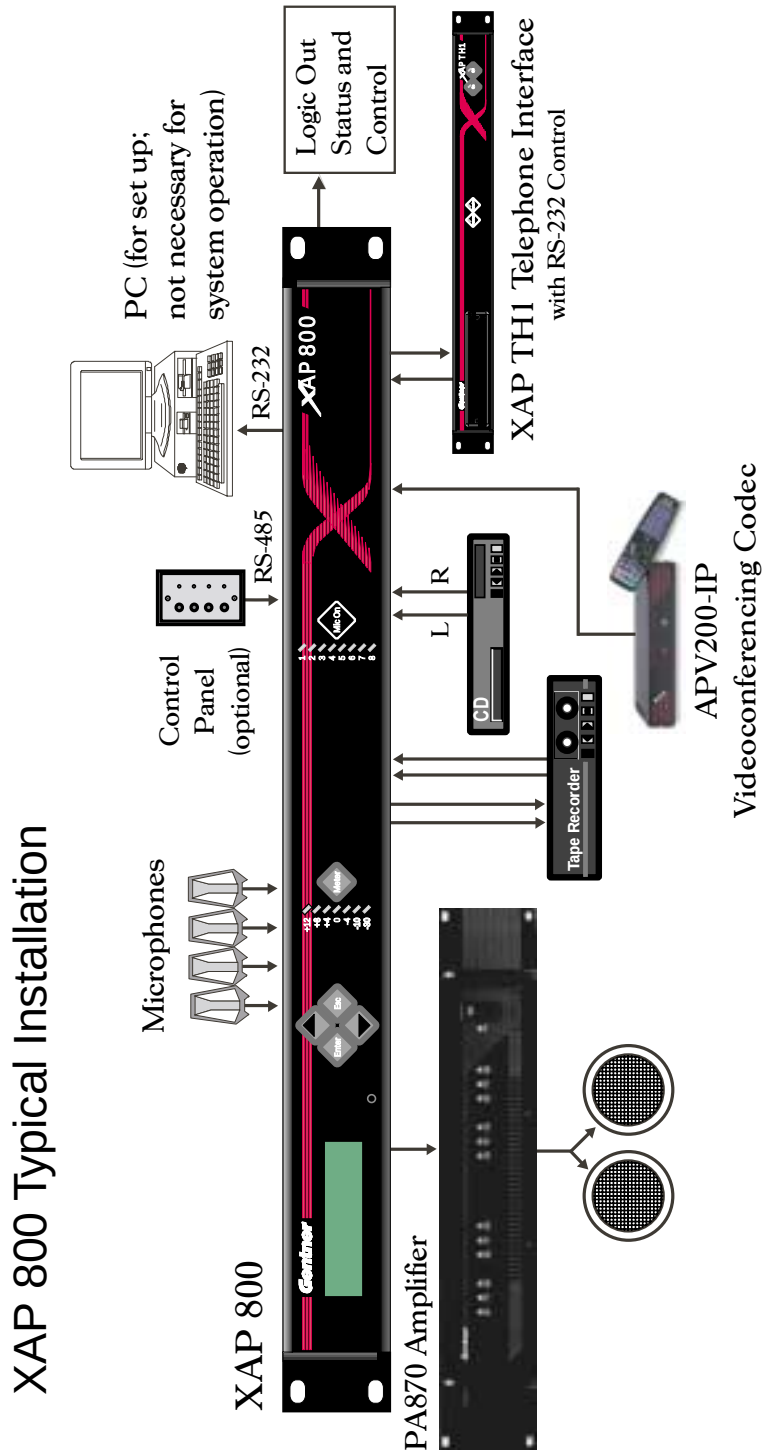


Figure 4. Typical XAP 800 Installation (simplified for illustrative purposes)

3 Echo and Noise Cancellation

Echo Cancellation

Acoustic echo is a significant challenge to overcome in virtually any teleconferencing environment. The effects of acoustic echo can destroy a teleconference because it impairs participants' abilities to understand and communicate.

Acoustic echo is created when microphones pick up audio from a loudspeaker and return it to the originating teleconference site. This echo will cause a conference participant to stop speaking while trying to listen to the echo.

One way to remove echo from your teleconference is to use an acoustic echo canceller. An acoustic echo canceller samples audio coming in from the remote site and prevents this audio from being sent back to the originating site. To be most effective, each site should utilize an echo canceller.

There are several factors that contribute to poor echo cancellation. These include:

- Poor room acoustics
- High reverberation
- High noise
- Rapidly changing acoustical environment
- Wireless or other moving microphones
- Poor microphone/speaker placement
- Automatic mic mixers not properly configured to work with an echo canceller
- Other audio devices such as audio processors and user gain controls that change the acoustic gain to which the echo canceller must adapt.

Figure 5 shows a how a single echo canceller attempts to cancel echo in a room. Audio from the distant room is sampled and used as a reference for the echo canceller. When far-end audio is picked up by the microphone (acoustic echo), the acoustic echo canceller senses the echo and builds an adaptive filter that eliminates the echo.

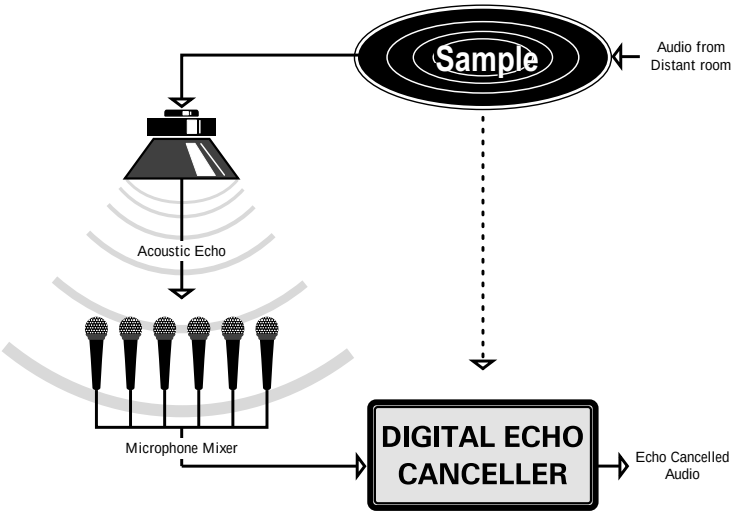


Figure 5. Single Echo Canceller

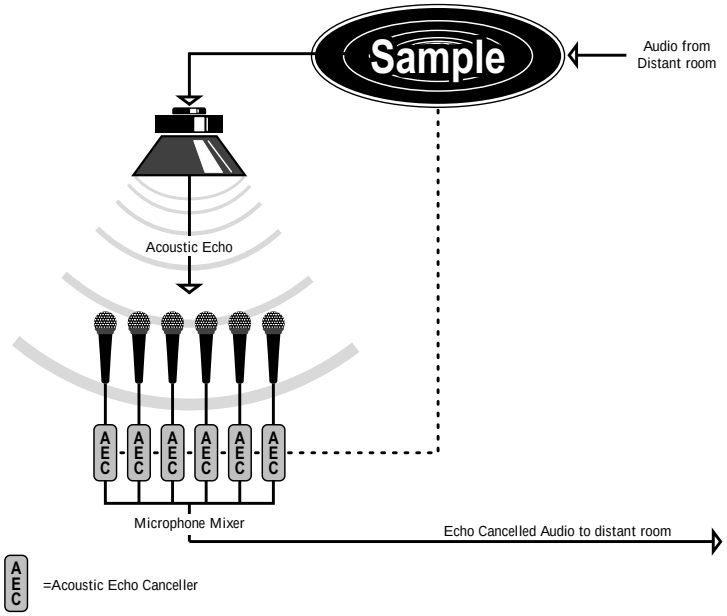


Figure 6. Gentner's Distributed Echo Cancellation

The XAP 800's Distributed Echo Cancellation places an echo canceller on each mic input for dramatically improved echo cancellation (see Figure 6).

In this example, audio from a distant room is sampled. This audio is a reference for each echo canceller on every mic. When sampled audio (acoustic echo) is detected by the echo canceller, the echo is eliminated.

The XAP 800 Advantage

The XAP 800 overcomes acoustic echo cancellation challenges through the use of Gentner's proprietary Distributed Echo Cancellation® technology. Unlike older systems, which use a single echo canceller across all audio sources in the system, Distributed Echo Cancellation dedicates an echo canceller to each mic input. The DEC system is far more effective in canceling echo, resulting in clearer, more accurate echo cancellation. The DEC system can also track changes in the room environment more effectively, keeping the audio quality at the highest level.

The advantages of Distributed Echo Cancellation® include:

- Significantly better echo cancellation in a wider variety of acoustical environments
- Plug and play echo cancellation
- Faster convergence time
- Better full duplex
- Reduced noise and suppression
- Increased gain
- Higher tolerance to room and network audio level changes

Instead of a single echo canceller covering the entire room, an echo canceller is put on every acoustic (mic) input. In a room of eight microphones, a DEC system would have eight echo cancellers. Each echo canceller must work only on one acoustic reference. Obviously, such an echo canceller has a far easier time canceling echo than a single echo canceller with eight acoustic references. In addition, when compensation techniques are required for times when echo cannot be fully canceled (suppression, center clipping, etc.), the compensation effects are heard only on the single microphone channel, rather than the entire mixed audio source. This greatly improves full duplex, noise, gritch, and compensating audio level reduction.

Noise Cancellation

Today's hi-tech microphones are becoming more sensitive, which means the chance that simple sounds will be detected and amplified is much higher. Some of these sounds include:

- Heating, ventilating and air conditioning (HVAC).
- Fluorescent light ballasts, generators, power cords, and other electrical items that generate low-level (60Hz) hum in amplification equipment.
- Portable devices such as laptops and overhead projectors have fans can transmit on frequencies that are occasionally detected and amplified.

Elimination of Noise

Since the term "noise" covers a variety of unwanted audio generated by many different sources, there is also a variety of ways to cancel the noise.

Most noise can be eliminated by:

- Acoustical treatments in and around noise sources.
- Conducting microphone placement tests.
- Reducing the amount of reflective surfacing.
- Identifying and reducing or eliminating hum.
- Using quality, shielded cable and connectors.
- Using a noise cancellation device, such as that found in the XAP 800.

Gentner's XAP 800 features a revolutionary new algorithm that actively eliminates background noise within the vocal range on each mic input. Unlike other noise canceling devices, the XAP 800 does not simply gate audio off when a mic input drops below a specified level. Gentner's noise cancellation actively separates and attenuates ambient noise from the speech signal, leaving speech audio virtually untouched. It effectively reduces noise between 20Hz and 20kHz.

Gentner's noise cancellation also ensures that your entire system functions more efficiently. Noise not only interferes with human communication, it unnecessarily hampers all sound system components (i.e., DSPs, amplifier power, loudspeaker bandwidth), thereby significantly decreasing a system's power and responsiveness. By reducing signals unassociated with human speech, the XAP 800 ensures the entire system sounds clearer and is much more efficient and responsive.

Noise Cancellation vs. Echo Cancellation

Since the job of any sound system is to amplify audio signals, all noise is picked up and amplified. Even barely audible signals may become very loud once picked up by a sound system. However, unlike echo cancellation, noise cancellation is much more challenging because it lacks a reference signal. Despite these challenges, Gentner's revolutionary noise canceller discerns and actively tracks ambient noise and eliminates it from the final mix.

The XAP 800's noise canceller is an excellent complement to the acoustic echo canceller. This is because it reduces ambient noise, which can cause the echo canceller to deviate from an optimal echo cancellation solution. By reducing much of the ambient noise, it ensures the echo canceller has the purest, most accurate room reference by which to cancel echo.

4 Filters

Processing Blocks

The XAP 800 features the power of eight processing blocks, which are dedicated signal processing resources that can be applied to any mic or line input routed to it. Within each processing block, compression, delay, gain adjustments, and up to 15 different filters may be applied to any mic and/or line input routed to the block. Each input also has up to four assignable filters for shaping the input's audio response.

For example, say you have a conferencing scenario in which mics connected to input 1 and 4 are having feedback problems. The problem frequencies could be attenuated in each mic input, or both mics could be assigned to processing block A, where problem frequencies are attenuated. In the future, other microphones can also be routed to the same processing block and will therefore receive the same feedback cancellation—without any additional adjustments. Microphones not routed to processing block A would be unaffected by these filters.

Feedback

Perhaps the most common (and most annoying) problem for professional sound engineers is feedback. Feedback is often a high, piercing tone caused when mics pick up a particularly resonant frequency and amplify it through the sound system, where it is picked up again by the microphones—this time louder—and the process is repeated.

In addition to being painful to hear, feedback can also cause amplifiers to clip, and can destroy drivers and loudspeaker components. While most feedback can be controlled by proper microphone placement, resonant frequencies can be attenuated using filters like parametric equalizers.

Low frequency feedback isn't necessarily audible, but it decreases the system's power and responsiveness. By attenuating the low-end frequencies (low cut/high pass) not needed for vocals, the XAP 800 system operates more efficiently because it doesn't need to allocate resources to produce low frequencies throughout the system.

XAP 800 Feedback Control System

The XAP 800 includes a number of highly customizable filters that are excellent tools for feedback control. These filters boost or attenuate certain audio ranges, compensate for poor acoustical environments, and generally fine-tune your sound system. Some filters, such as pass filters, allow you to select a range of audio frequencies above or below a given point and attenuate it, while others allow you to attenuate specific frequencies. Filters are also excellent for use in canceling out frequency ranges that cannot be transmitted through telephone lines, thereby freeing up the system's resources.

The XAP 800 features the following filters:

All Pass: A filter that provides only phase shift or phase delay without significantly changing the magnitude of the signal. Useful in custom crossovers designed to compensate for loudspeaker driver deficiencies.

CD Horn Equalizer: A constant directivity horn driver has an inherent 6dB/octave high frequency roll-off. This device products a 6dB/octave boost to compensate. The CD horn device is implemented using a high shelving filter. The level control is fixed at +12dB, and is hidden.

High Pass: Allows frequencies above a designated frequency to pass while attenuating those below it. Perfect for attenuating low, rumbling noises like those captured by a microphone when placed on a stage, table or in a microphone stand.

High Shelving: Boosts or attenuates frequencies above a designated frequency while leaving those below it unaffected. The transition between the spectrum above and below the designated frequency occurs at a fixed 6dB/octave rate. When boosted, it enhances the higher, more intelligible aspects of the vocal range. When cut, it is excellent for avoiding resonant frequencies (feedback) and ranges of extraneous sibilance (like a constant "sssssss" noise).

Low Pass: Allows frequencies below a designated frequency to pass while attenuating those above it. Useful for reducing overall sibilance and avoiding shrill resonant frequencies (feedback).

Low Shelving: Boosts or attenuates frequencies below a designated frequency, leaving those above it unaffected. The transition between the spectrum above and below the designated frequency occurs at a fixed 6dB/octave rate. Excellent for enhancing the low-end range of a signal.

Notch Filter: A band-stop filter that can remove a select range of frequencies. Commonly used for removing specific resonant frequencies from a system.

Filters for the XAP 800 are configured in G-Ware software. Refer to page 42 to see the filter configuration window in G-Ware.

Parametric Equalizer: A multi-band variable equalizer that allows the user to define the amplitude of the filter, shift the center frequency of the filter, and control how wide the range is to which the equalizer is applied. Excellent for general tone shaping or feedback removal.

The XAP 800 also features a crossover function. The crossover combines high-pass and low-pass filters that divide a full-range signal into separate frequency ranges. These ranges can then be sent to amplifiers and loudspeakers optimized for producing those respective frequency ranges. Band-pass filters can be designed by overlapping high-pass and low-pass filters.

For example, the bottom end of a frequency range might be defined as 400Hz and lower. This signal might then be heavily compressed and sent to bass bins and woofers powered by amplifiers. The midrange (say, 400Hz to 5kHz) can be sent to full-range loudspeakers. The high end (say, 5kHz and above) can be directed to smaller amplifiers and associated tweeters, piezos, horns, etc.

The XAP 800 includes three types of crossovers: Butterworth, Bessel and Linkwitz-Riley. Each of these is characterized by the steepness of their roll-off slopes (the rate of attenuation outside their passbands). Crossovers in the XAP 800 are created by assigning the appropriate type of high-pass filter in a processing block with the complementary low-pass filter in a separate processing block.

Bessel Crossover: Utilizes a low-pass filter design characterized by having a linear phase response (or maximally flat phase response), but also a monotonic decreasing passband amplitude response (which means it starts rolling off at DC and continues throughout the passband). Linear phase response (e.g., a linear plot of phase shift vs. frequency producing a straight line) results in constant time-delay (all frequencies within the passband are delayed the same amount). Consequently, the value of linear phase that reproduces a near-perfect step response (there is no overshoot or ringing resulting from a sudden transition between signal levels). The drawback is a sluggish roll-off rate. For example, for the same circuit complexity, the response for a Butterworth crossover rolls off nearly three times as rapidly.

Butterworth Crossover (1 pole): A type of crossover circuit low-pass filter design characterized by having a maximally flat magnitude response (i.e., no amplitude ripple in the passband).

Linkwitz-Riley (LR-4) Crossover (2 poles): The 4th-order (24 dB/octave slope) Linkwitz-Riley (LR-4) design represents a vast improvement over the previous 3rd-order (18 dB/octave) Butterworth standard. It consists of a cascaded 2nd-order Butterworth low-pass filter, and is considered the de facto standard for professional active audio crossovers.

The XAP 800 also has an intuitive filter display, which shows the aggregate filter response in a particular processing block. This display can also overlay the filter responses of other processing blocks, which is useful in designing active crossovers. The aggregate phase response of the processing block can also be shown superimposed on the filter response curve.

5 Inputs and Outputs

Input and Output Level Control

The XAP 800 has 12 inputs consisting of eight mic/line inputs and four line inputs. The unit has 12 line outputs.

All inputs and outputs are actively balanced. Inputs 1-8 have 4kOhms of terminating impedance while line-level inputs 9-12 provide >20kOhms of termination. Outputs provide a source impedance of 50 Ohms. All levels are referenced to a 0dBu level.

Input and output level control is executed in the digital domain. As a result, input levels should never exceed +20dBu. The unit will deliver a maximum output level of +20dBm. The XAP 800 utilizes 24-bit A/Ds and D/As while sampling at a 48kHz rate. This results in a system-wide dynamic range of 100dB, a pass band from 20Hz to 20kHz, and a SNR >100dB at maximum input level. All input and output levels can be monitored in real time on the front-panel LCD and through the RS-232 serial port. The LCD display and RS-232 port provide precise numeric readouts indicating level. This allows extremely precise level calibration. Additionally, while monitoring numeric dBu audio levels, input and output gains can be adjusted for optimum audio performance.

Inputs 1-8
Balanced audio is input at the rear panel Phoenix™ connector. Mic or line level is selected and phantom power is provided (if required). The XAP 800 then converts this audio from analog to digital for processing by the DSP engine. Once converted to digital, audio is level controlled. This function, along with all other input and output controls, can be adjusted via the RS-232 port and/or the control pins on the control/status connector. This provides for real-time audio volume control, muting, etc. Minimum and maximum levels can also be set to limit the range of gain to suit audio requirements.

The acoustic echo canceller/speech leveler is the first option in the audio signal flow. Here, you set the echo cancellation reference, non-linear processing (optional), and meters reflecting echo cancellation activity. You can also enable the noise canceller and depth of cancellation.

Next, four configurable filters can each be set individually as an all-pass filter, a low-pass filter, a high-pass filter, a parametric equalizer (PEQ), or notch filter. Each may be activated to equalize

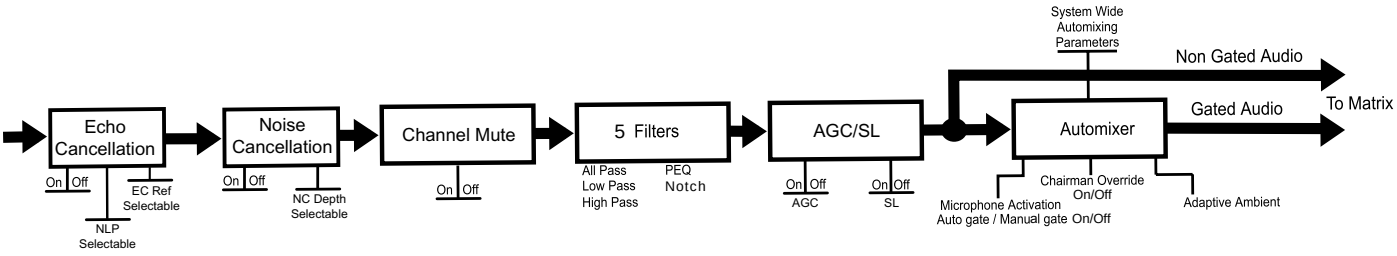


Figure 7. Inputs 1-8 Parameters

different microphones to sound similar, filter out unwanted hum, etc. You can increase or decrease each band up to 15dB, in increments of .5dB on each input.

The next option is the automatic gain control (AGC) and speech leveler. The purpose of the AGC is to automatically increase gain when the level is too low and decrease gain when it is too high. AGC is provided at all inputs and should be activated for microphones or line inputs that experience audio level fluctuation. The speech leveler targets speech audio and equalizes the audio levels of someone who is speaking close to a mic and someone who is speaking from farther away. For example, if audio coming from a video codec fluctuates (depending on the connection at the other end), the AGC will compensate for these differences.

After the channel mute stage, non-gated audio is applied to the routing matrix for outputs that need direct audio. The final stage (automixing) determines how the audio is directed into the post-gating input to the routing matrix. Each input can be set for a variety of automixing functions, including activation settings, chairman mic, and adaptive ambient mode. The functions determine when, how, and why an individual microphone will gate on or off:

■ Microphone Activation. There are two modes of mic activation that can be selected on a per-input basis: auto-gate and manual gate on/off. In auto-gate mode, the input channel is voice activated, based on the programmed automixing system parameters. In manual gate mode, the mic is activated by manually switching it on or off and allowing the input to contribute to automixing parameters.

■ Chairman Override (On or Off). Each gated input may be selected as a chairman override input. This feature adds this input to the chairman override group and, when gated on, gates off inputs that are not in the chairman override group.

■ Adaptive Ambient (On or Off). In the ON mode, the ambient level used to calculate gating is based on the room's actual noise floor, integrated over time, as measured by the input in the room. In the OFF mode, the manual ambient level is set by the integrator, and will be used to calculate gating.

Figure 8 shows inputs 9-12. These line-level inputs can be level controlled, muted, and gain controlled through the AGC. All of these functions operate identically to inputs 1-8.

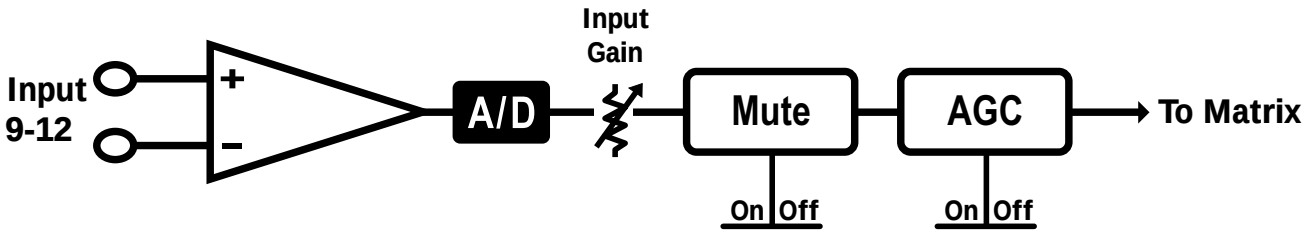


Figure 8. Inputs 9-12

Outputs

All 12 of the line outputs are identical, as shown in Figure 9. Three functions are associated with each output: gain control, mute, and NOM (number of open mics). Gain control allows you to set the output level. the min/max controls allow you to set minimum and maximum gain levels that the user will be limited to. The mute function essentially turns the volume off. All of these functions can be controlled via the RS-232 port or the control/status connector. An example would be if you want to control the volume of the speakers—you could use two control pins on the control/status connector for volume up and volume down. Another pin could be used for mute.

Activation of NOM places this output ONLY in a mode where, as more microphones routed to this output are gated on (either by auto gate or manual gate), the total overall output gain will remain constant. This reduces the possibility of feedback occurring.

A feature of the XAP 800 is its ability to provide NOM at every output. Most automixers have a single master NOM output. NOM is used to maintain a constant acoustic gain in the room, permitting the system to optimize its gain before feedback status. This is most useful in sound reinforcement applications.

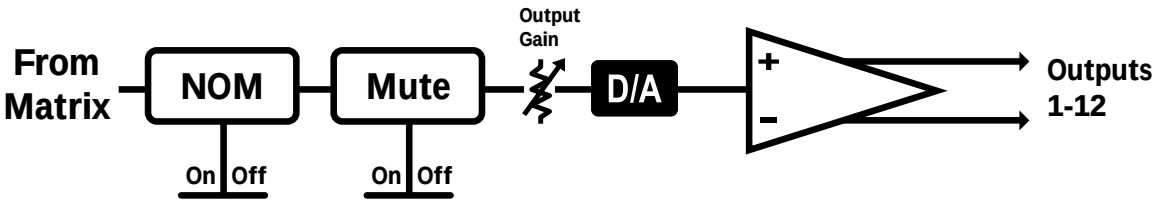


Figure 9. 12 Outputs from Matrix

6 Automatic Mic Mixing

Intelligible, Reliable Audio

Conferencing systems are in constant use in conference rooms, boardrooms, training rooms, and many other applications. Systems that produce intelligible and reliable audio are key to facilitating effective communication. Quality conferencing systems meet the following objectives:

- The audio must be transparent. Users should not have to think about the audio.
- The audio must not fatigue the users. Distorted, noisy audio will cause users to break off discussions before a natural conclusion occurs. It will also fatigue the users, producing a less-than-effective outcome.
- Since 10% of our population is hearing impaired, the audio system must be capable of producing effective results for all users.
- The audio system must be reliable.

Automatic microphone mixing is a key part of producing highly intelligible and reliable conferencing audio. An automatic microphone mixer, in conjunction with directional microphones, will reduce reverberation and noise — the two major culprits in making voice communications difficult to understand.

In Figure 10, direct audio from a person's voice is picked up by several microphones connected to a microphone mixer that has all microphones on at all times. Direct and reflected audio (reverberation) is picked up by all the microphones. In addition, the reverberated audio will have a variety of delays, depending on how far it has traveled in the room and how many surfaces reflected it. When this happens in an actual audio setting, we have a difficult time understanding the audio.

We have all experienced trying to speak in a room that has a lot of reverberation – it's difficult. When people hear reverberated audio, their initial response is to turn up the volume. This does not help make the audio more understandable; in fact, in audio room systems, turning up the volume will almost always degrade the performance of the entire system. In addition, with more microphones on, more noise is picked up by the system. Clearly, increased noise and reverberation hurts audio intelligibility and increases listener fatigue.

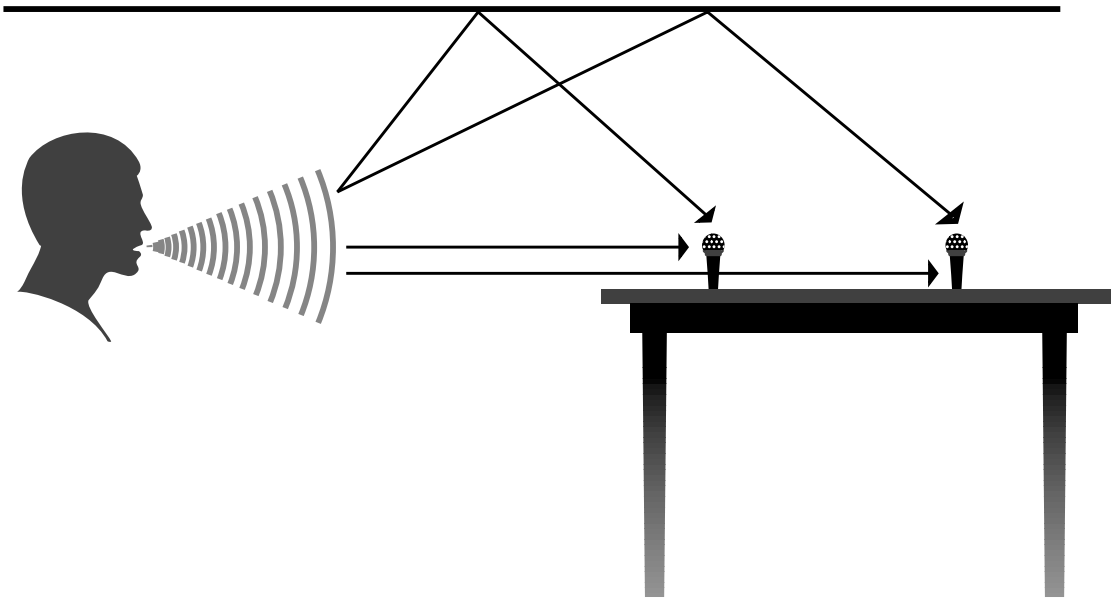


Figure 10. Microphones Pick Up Direct and Reflected Audio

There are several strategies that can be used to reduce reverberation and noise:

- Keep microphones close to the participants.
- Only activate those microphones where voice audio is present.
- Use directional microphones.
- Acoustically treat the room to reduce reverberation and noise.
- Eliminate or reduce the source of noise.

The XAP 800 was designed to implement automatic microphone mixing that increases audio intelligibility by reducing overall multiple microphone pickup of reverberation and noise. Unlike most automixers, the XAP 800 implements its mixing function completely in the digital domain. This greatly increases precision in making automixing decisions.

All audio is routed through the XAP 800 (both microphone and speaker audio), which means the XAP 800 can more accurately make microphone activation decisions.

For example, audio from another source (such as conference audio from another room) is amplified through the speakers in the room. Typically, an automixer would activate at least one microphone, as if that audio were a voice in the room. This false activation will not occur with the XAP 800 (see Figure 11) because the unit can determine that this audio is coming from the loudspeaker.

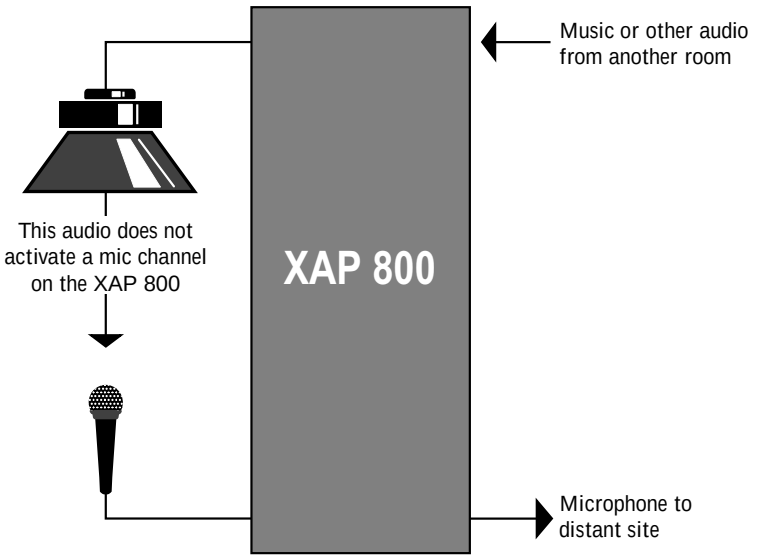


Figure 11. Microphone Activation

The XAP 800 has a variety of automixing functions that are implemented on both a per-channel basis and across the entire automatic mixer. These functions are described on the following page. Each XAP 800 can have up to four separate automatic mixers working independently within a single unit, and up to four independent global mixers across multiple units. In addition, more microphone channels can be added by linking XAP 800 units via the Expansion Bus, the digital network bus. Unlike other "expandable" automatic microphone mixers, the XAP 800 works as a single unit for up to eight units networked together, for a total of 64 microphones. Expanded analog automixers can offer only limited functionality such as NOM (number of open microphones). Multiple XAP 800 units can operate as a single unit because all functions are implemented digitally and all units are connected together using the high-speed digital network bus (Expansion Bus), which passes both audio and control information. See Figure 12.

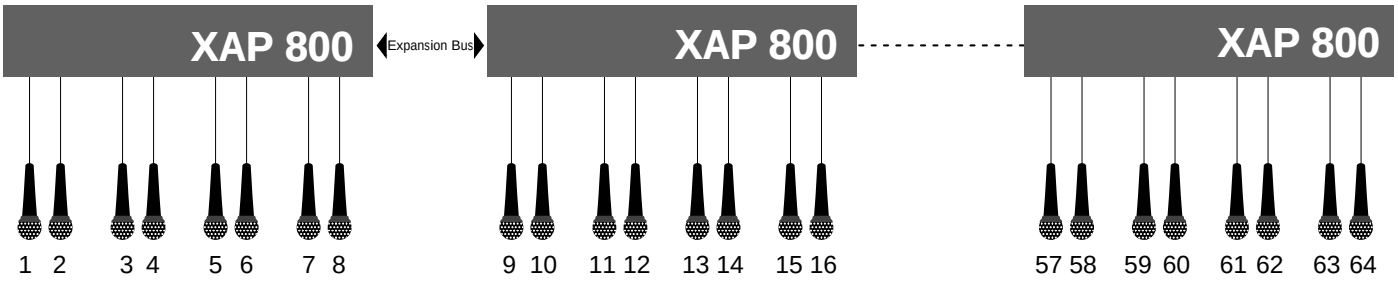


Figure 12. Expansion Bus Control of 64 Mics

The following parameters and modes are used on the XAP 800 to provide high precision and reliability in microphone mixing:

■ Mixer Mode. The XAP 800 can be set in two different mixer modes to accommodate a variety of installation needs: master or slave. When placed in the master mode, the unit acts as a stand-alone eight channel automatic microphone mixer. The master mode is also used for the master unit in a multiple-unit configuration. Slave mode is used for slave units in a multiple-unit configuration.

■ Chairman Override: This provides gating priority for all microphones selected for the chairman override group. When a mic in this group gates on, all microphones not included in this group gate off.

■ PA Adaptive (On or Off). The problem: Speaker audio gates on microphones when it shouldn't. The solution: PA adaptive knows when speaker channels are activated and prevents the speakers from gating the mics on. The reason the XAP 800 can accurately determine when loudspeaker audio is present is because audio goes through the XAP 800 a few milliseconds before it reaches the microphone.

■ Maximum Number of Microphones On (1-8 or Off). This mode allows you to program how many microphones (maximum) can be activated simultaneously. Generally, there isn't a need for more than two or three people to speak at the same time.

■ First Mic Priority Mode (On or Off). This feature increases the audio level required to gate on additional microphones after the first mic gates on. This helps ensure that only one mic gates on when a person speaks.

■ Last Mic On/Mic1-8/Off. Last Mic On leaves the last activated mic on until a new one is activated. Mic 1-8 mode reverts back to the mic you've selected for Mic 1-8 On when all other mics gate off. These features are useful to ensure the audio never goes completely away. Without it, you might even think that you have lost connection to the other room. You can set this parameter to Off, which disables this function.

The following are depicted in Figure 13:

■ Gate Ratio Adjust (0 to 50dB). This specifies how much louder the audio level must be above the ambient level to gate on. If, for example, the gate threshold is set at 35dB, it will take more than 35dB of audio above the ambient level in the room to activate the microphone. The ambient audio level can be specified or the adaptive ambient mode can be turned on. In this case, the ambient room level changes or adapts as the noise floor changes.

■ Off Attenuation (0 to 50dB). This sets how much a gated input is attenuated when it is not on.

■ Hold Time (.1 to 8.0 seconds). This programs how long the mic stays gated on after audio is no longer present.

■ Decay Rate (slow, medium, fast). This programs how quickly the audio level attenuates to the Off Attenuation level after the hold time has expired.

■ Manual Ambient Level (0 to -80dB). This setting is relevant only if the adaptive ambient mode is disabled on the individual gated inputs. This ambient level is then used in conjunction with the gate threshold to determine whether or not the mic should turn on.

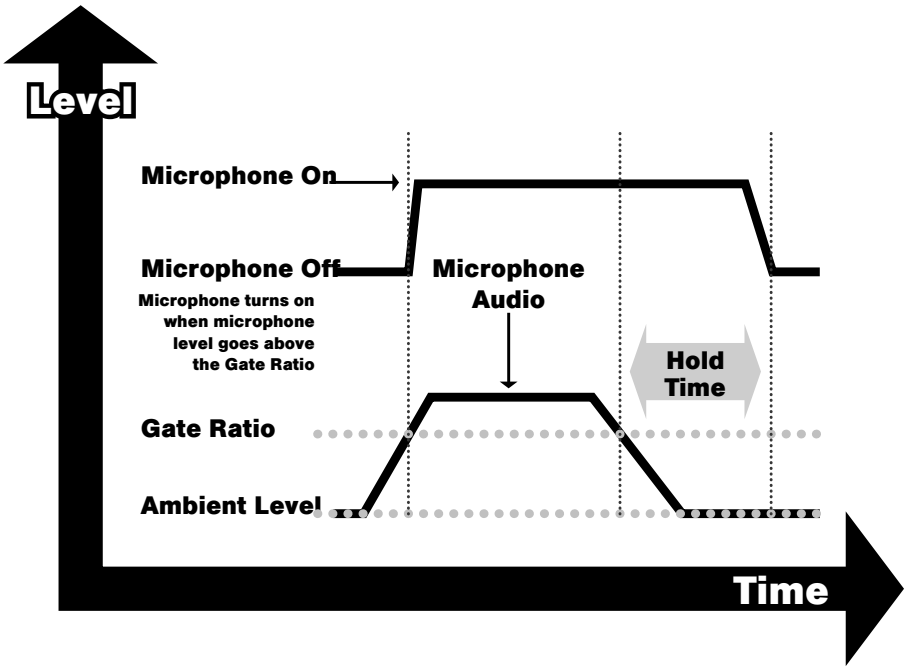


Figure 13. XAP 800 Automixing Gate Functions

Automatic microphone mixing is a key part of the XAP 800 solution set. Because all decisions regarding automixing are made by the same digital engine, better decisions in automixing can be made.

Mixing Parameter	System, Mixer, or Channel	Range	Description
Mixer Mode	System-wide	Master, Slave	Selects mixer mode of operation.
Microphone Activation	Input channel 1-8	Auto Gate, Manual Gate On/Off	Sets the method of microphone gating.
Chairman Override	Input channel 1-8	On, Off	When a chairman override channel is gated on, all non-chairman channels are gated off.
Adaptive Ambient Mode	Input channel 1-8	On, Off	Automatically sets the ambient audio level of the room averaged over time.
PA Adaptive Mode	Input channel 1-8	On, Off	This prevents mic channels from gating on to loudspeaker audio.
Maximum number of Microphones On	Mixer-wide	1-8 or Off	Sets the maximum number of micro phones allowed to be gated on at a time.
First Mic Priority Mode	Mixer-wide	On, Off	Increases the audio level required to gate on additional microphones after the first mic is gated on.
Last Mic Mode	System-wide	Last, Mic 1-8, Off	Keeps the last gated microphone or one Mic 1-8 on when no mics are pro viding a gating input.
Gate Ratio Adjust	Input channel 1-8	0 to 50dB	Specifies how much louder above the ambient level the audio level must be to gate on.
Off Attenuation Adjust	Input channel 1-8	0 to 50dB	Sets how much the microphone will be attenuated when it is not gated.
Hold Time	Input channel 1-8	.1 to 8.0 Seconds	Programs the amount of time it takes until the microphone starts the off attenuation process.
Decay Rate	Input channel 1-8	Slow, Medium, Fast	Programs how quickly the audio level is attenuated once a channel hold time has expired.
Manual Ambient Level	Input channel 1-8	0 to -80dB	Sets the ambient audio level when the adaptive ambient mode is off.
NOM/Constant Gain Mode	Output Sensitive	On, Off	Maintains constant gain of a selected output. As more mics gate on, each mic is appropriately attenuated.

Figure 14. Mixing Parameters

7 Audio Routing

Matrix Mixing

One of the more important functions of the XAP 800 is matrix routing of audio signals. Like all device functions, all routing is executed in the digital domain. In addition, changes in routing can be executed via the RS-232 port and/or via presets on the control/status connectors.

The XAP 800 audio matrix has 32 possible input sources and 32 output destinations, with level control at each cross point. The routing chart (Figure 16) describes the default XAP 800 routing. Inputs and outputs are labeled for this default routing diagram, but any input and output scheme could be used. To ensure understanding, inputs and outputs to the matrix are described below.

Inputs

Gated and Non-gated Inputs 1-8 - Inputs 1-8 (selectable for mic or line level) appear on the rear terminal block. Both gated and non-gated inputs are provided on the matrix for delivery to desired destinations. This is provided because, in some applications (such as a courtroom), direct, non-gated outputs are required. Default routing for gated microphone inputs are to the O-Bus. Non-gated outputs are routed by default to their corresponding output number (i.e., input 1 is routed to output 1).

Inputs 9-12 - These are line-level inputs that appear on the rear panel terminal blocks. This is typically audio that comes from a CD player, video codec, XAP TH1 telephone interface, and other auxiliary audio sources. In typical applications, this audio must be heard in the local PA system (as well as networked XAP 800 units). In the default routing, audio is routed to every other device except itself.

Outputs

Outputs 1-8 - These are exactly the same as outputs 9-12. Their default routing is for each non-gated input 1-8 to go directly to these outputs.

Outputs 9-12 - These are line-level outputs on the rear panel terminal blocks. This is typically audio that goes to an APV200-IP video codec, XAP TH1 telephone interface, tape recorder, power amp, and other audio devices. Normally, this audio contains auxiliary audio and audio from other networked XAP 800 units. In the default routing, inputs 9-12 (minus your channel input) and master auxiliary mix (all auxiliary audio from other XAP 800 units) are contained in this audio.

Expansion Bus

Expansion Bus This is a digital bus that appears at every XAP 800 networked on the system. This is a mix-minus bus. Any audio placed on the bus for a particular unit is not fed back to that unit when audio is taken off that bus. Audio on any networked XAP 800 can be placed on a bus or audio can be taken off a bus and routed to any destination within the unit. The XAP 800 system has 12 digital mix-minus buses with the following default programming:

O-R Buses These four audio buses are defaulted as the mic mix buses; they can communicate the NOM count (see page 25) across the network to other XAP 800s. Otherwise, these buses are identical to buses S-Z.

S-Z Buses These eight buses are defaulted as auxiliary mix buses. They are used to route auxiliary audio, such as from an APV200-IP video codec, XAP TH1 telephone interface, between units on the network. These buses are used as mic mix buses when NOM count is not required.

PA Adapt Expansion Bus Reference Buses The Expansion Bus reference buses provide a system-wide bus for mic channels to receive a reference input for PA Adaptive Mode and acoustic echo cancellation. For example, say you have four XAP 800 units Expansion Bused together. Audio on output 12 of unit 1 is audio routed to the PA system in the room. This audio is needed as a reference for mics on units 2, 3 and 4 so that speaker audio does not gate on the mics and the echo canceller cancels the appropriate audio. This is accomplished by selecting output 12 on unit 1 as Expansion Bus reference and then selecting microphones of units 2, 3, and 4 to use Expansion Bus reference.

See Chapter 4, for more information about the XAP 800's filters.

Assignable Processing

There are eight assignable processing buses in the XAP 800. Unlike with other matrix mixers, these buses can route any input or group of inputs to any output or group of outputs. Also, these combined sources can be filtered, delayed, compressed, and attenuated to provide specific enhancements to the audio (see Figure 15). These buses would typically be used to reduce feedback in the venue and provide crossovers for different speaker systems.

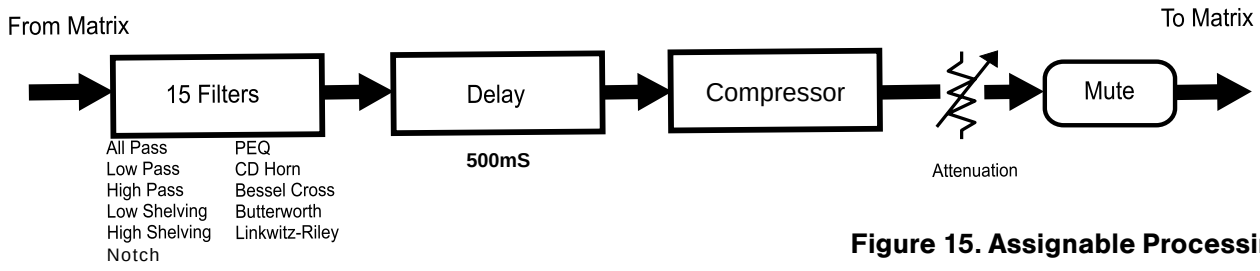
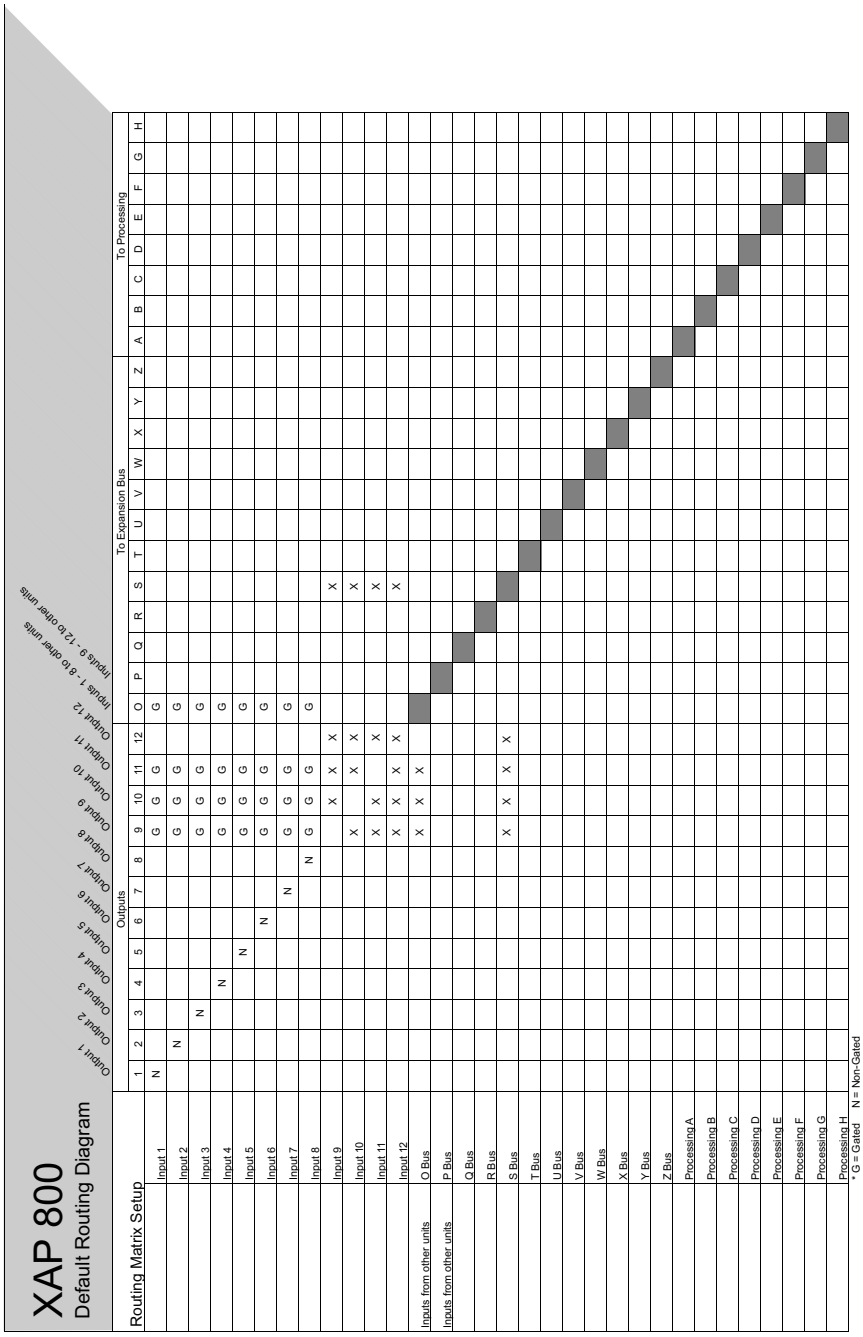


Figure 15. Assignable Processing



(Software shows actual cross point values.)

Figure 16. Default Routing Diagram

Default Routing Diagram

The Default Routing Diagram (see Figure 16) shows how all inputs, outputs, and buses can be routed. There is level control at each crosspoint.

Room Preset/Configuration Worksheet

The Room Preset/Configuration Worksheet (see page 64) is used for recording preset information such as description, command list, port usage, and other parameters.

The XAP 800 has 32 configurable presets.

Input/Output Parameters Worksheet

The Input/Output Parameters Worksheet (Figure 17) details each configurable input, output, and processing channel parameter and provides space to record settings for each. Default settings appear in bold.

XAP 800 Input/Output Parameters Worksheet

Input Channel		1	2	3	4	5	6	7	8	9	10	11	12
Program Parameter	**Selection Range**												
Input Type	**Mic 55dB**, Mic 25dB, Line												
Phantom Power	**On**, Off												
Input Gain Adjust	-60dB to +20 dB (**0**)												
AGC	On, **Off**												
Mute	On, **Off**												
Input Filters 1-4	*See Processing Filters Worksheets*												
Input Activation	**Auto**, Manual												
Chairman Mic	On, **Off**												
Gate Ratio	0 - 50 dB (**15**)												
Off Attenuation	0 - 50 dB (**12**)												
Hold Time	.1 - 8.0 seconds (**.3**)												
Decay Rate	Slow, **Medium**, Fast												
Manual Ambient	0dB to -70dB (**-30**)												
Adaptive Ambient	**On**, Off												
PA Adaptive Mode	On, **Off**												
PA Adapt Reference	Output 1-12, AEC/Expansion Bus Ref E1-E4									See System Parameters to define E1-E4.			
Mixer Group Select	Internal 1-4 or Global A-D (A)									See System Parameters to define Mixers.			
Acoustic Echo Cancellation	**On**, Off, adapt reference, non-linear process.												
AEC Reference	Output 1-12, AEC/Expansion Bus Ref E1-E4												
Noise Cancellation	On, **Off**, 6-15dB cancellation depth												
Speech Leveler	**Off**,On												
Output Channel		1	2	3	4	5	6	7	8	9	10	11	12
Program Parameter	**Selection Range**												
Output Gain Adjust	-60dB to 20 dB (**0**)												
Mute	On, **Off**												
NOM	**On** or Off												

Processing Channel		A	B	C	D	E	F	G	H
Program Parameter	**Selection Range**								
Processing Filters 1-15	*See Processing Filters Worksheets*								
Delay	0-500ms (**0ms**) .02ms steps								
Compressor	On, **Off**								
Threshold	-30dB to +20dB **(0dB)**								
Ratio	**1:1** - 1:20								
Attack Time	0.5ms to 100ms in 0.5ms steps **(1ms)**								
Release Time	5ms to 2sec/Increment of 5ms **(1s)**								
Processing Attenuation	0dB to -60dB **(0dB)**								

Gentner XAP 800

Figure 17. Input/Output Parameters Worksheet

8 Applications

Introduction

The sophistication and adaptability of the XAP 800 allow it to control and enhance many conferencing applications. Following are four applications where the XAP 800 forms the centerpiece of a high-quality conferencing system.

Distance Learning Installation

In a typical distance learning application, the primary source of audio comes from the instructor's wireless microphone. For phone-add capabilities, a telephone interface (such as the Gentner XAP TH1) would be used to transmit sound to distant sites. Secondary audio for presentation segments can be sourced from a VCR or CD player. In larger classroom settings, participants have desktop mics that enable everyone to hear questions and comments.

Microphone mixing and gating parameters can be set to favor the instructor's microphone to facilitate effective dialogue in the room. When a particular microphone gates on, nearby speakers can be attenuated or muted to reduce feedback. Also, participant microphones can be set to gate off when secondary audio sources are in use. The left and right speakers at the front of the room can be configured to provide stereo sound from a (stereo) secondary audio source, enhancing the training experience. All speakers can be optimized to produce full-fidelity audio by programming the XAP 800 's parametric equalizers and filters accordingly.

Typical distance learning applications also require that video be transmitted. A video codec, such as Gentner's APV200-IP, provide high-quality video to facilitate a complete distance learning experience.

Figure 18 shows a scenario including a wireless lapel microphone for the instructor; desktop microphones for participants; ceiling speakers to carry voice (primary) audio and some secondary audio; and left and right speakers at the front of the room, which carry primary and secondary audio.

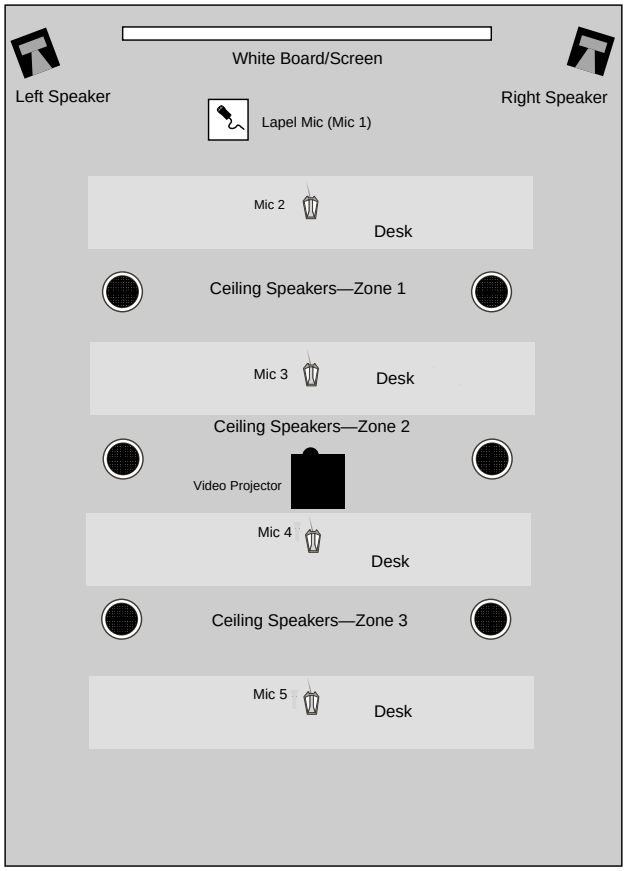


Figure 18.
Distance Learning Room

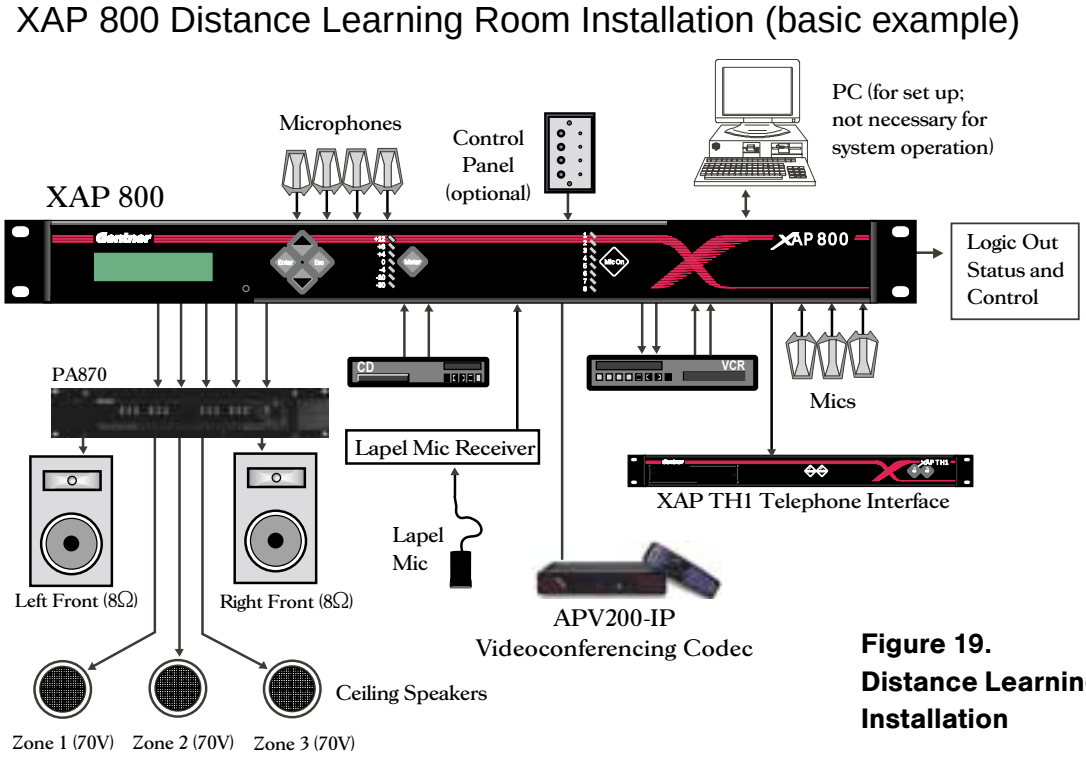
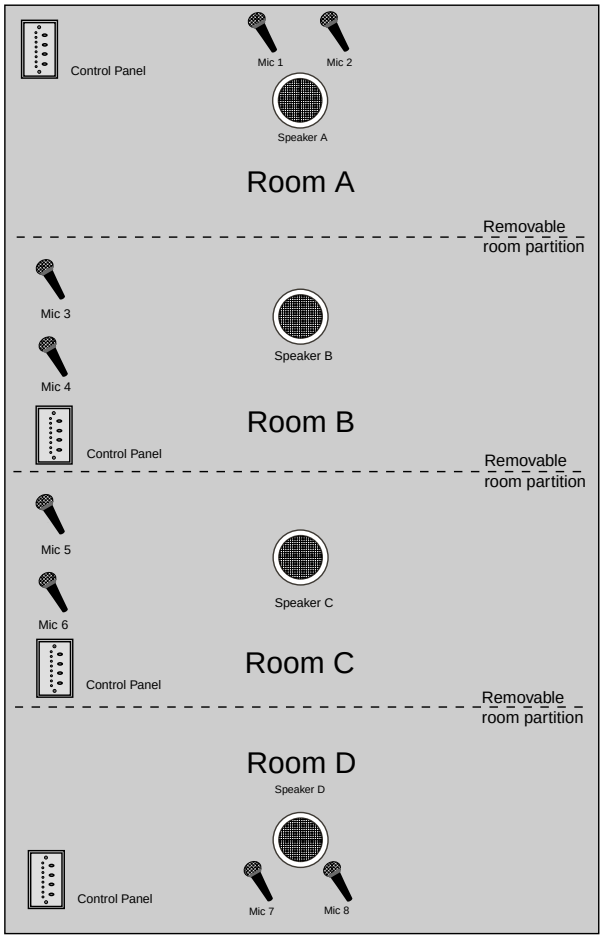


Figure 19.
Distance Learning Installation

Hotel/Convention Center Installation

A hotel or convention center sound system must adapt quickly to a variety of meeting scenarios to accommodate the changing needs of the group(s) throughout a meeting session or series of sessions. By configuring the presets on the XAP 800, the system can be quickly reconfigured in a way that accommodates the changing of room configurations in some meeting areas without disturbing meetings in other rooms where no room configuration changes are necessary.

Figure 20 shows four rooms with removable partitions. The XAP 800 can be pre-set to route microphone audio to one room or any combination of rooms. For example, say all four rooms are closed off for separate meetings; you can configure a preset to route the microphone audio only to the speaker in that room, with microphone gating properties applied as desired. Then, say the divider between Rooms A and B is removed for a combined meeting. You can use a preset that gates off microphones 3 and 4, while the audio from microphones 1 and 2 are routed to all speakers in Rooms A and B – while retaining the settings for the ongoing meetings in Rooms C and D. Later, when all partitions are removed for a final group meeting, you can use a preset that gates on only microphones 1 and 2, but routes audio to all speakers.



Conferencing capabilities via the XAP TH1 Telephone Interface or APV200-IP Video Codec can easily be routed to any room configuration. The XAP 800's Distributed Echo Cancellation quickly and accurately adjusts to any room. Multiple XAP TH1s and APV200-IPs can be used to accommodate simultaneous conference meetings in various rooms using just one XAP 800.

The use of other audio sources can be configured using the XAP 800's parametric equalizers and filters to enhance audio quality.

Figure 20. Hotel/Convention Center

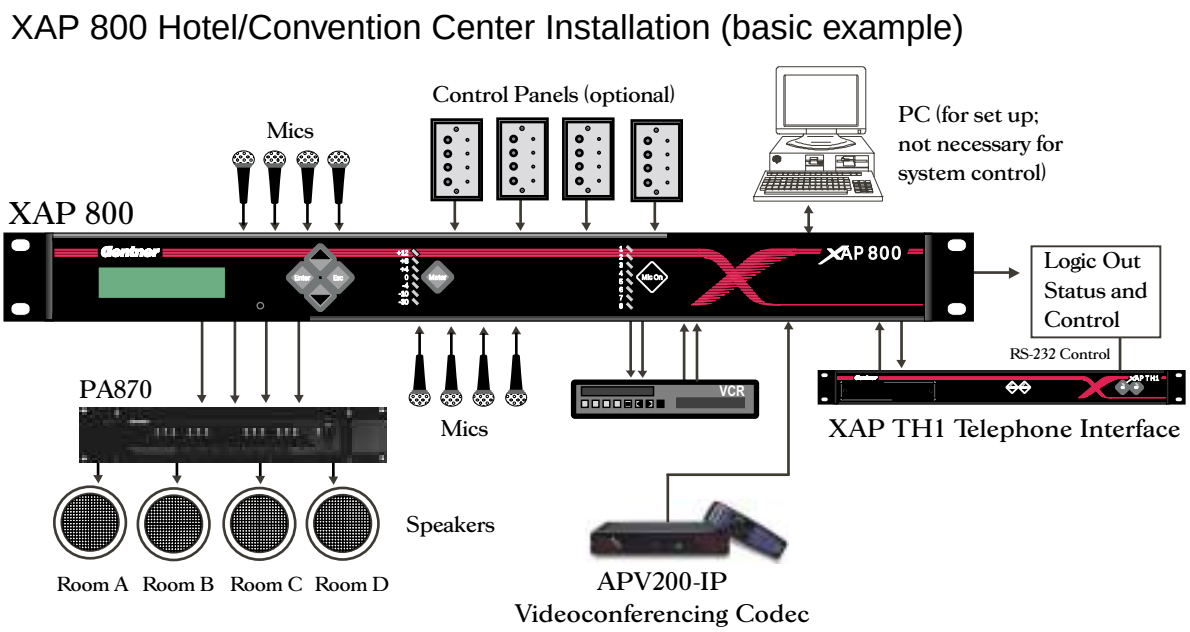


Figure 21. Hotel/Convention Center Installation

Courtroom Application

A courtroom application requires that the sound system be precisely calibrated so that all voice audio—including that from the judge, legal counsel, witnesses, and the jury—is easy to understand. The XAP 800 includes many features which enhance the performance of any courtroom audio system.

A typical courtroom setting requires at least six microphone inputs and eight line outputs. The XAP 800 features eight microphone inputs, each with individual gain, parametric equalizer, automatic gain control, high/low-pass filters and more. This allows you to provide everyone in the courtroom a natural and clear listening experience.

Gentner's XAP TH1 is easily integrated into the courtroom system, allowing participants from a phone line to be heard clearly throughout the courtroom.This is an ideal addition to the system because it allows people to appear in the court telephonically—reducing travel expenses and wasted time.

The APV200-IP Video Codec integrates perfectly into the XAP 800 conferencing system. This allows you to videoconference between courtrooms and jails to reduce transport costs and maintain security.

During courtroom sessions, judges might want to hold sidebar conversations with counsel. To prevent jurors from hearing these conversations, white noise masking can be sent out of the jurors' speakers.

Everything that transpires in the courtroom must be recorded. You can configure the XAP 800 to accommodate this requirement by routing all outputs to the court recorder–without gating.

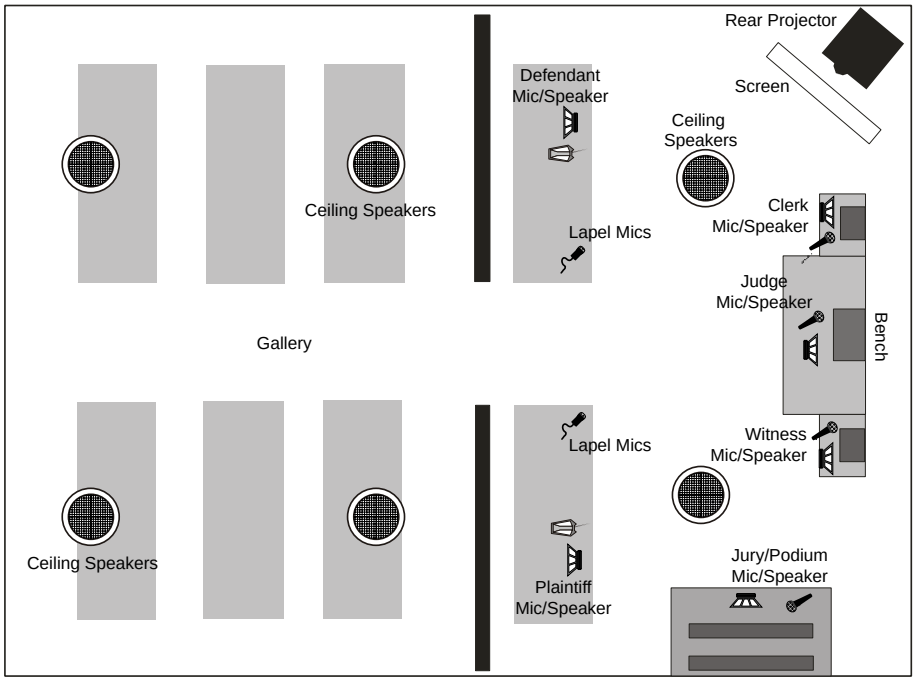


Figure 22. Courtroom

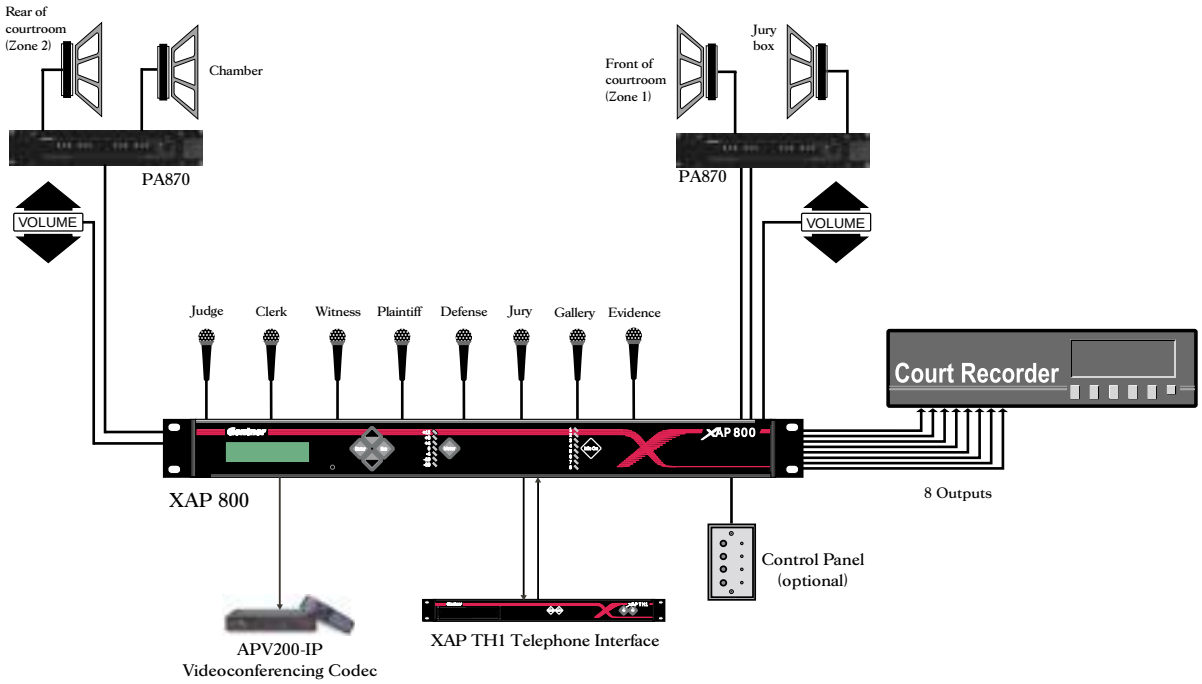


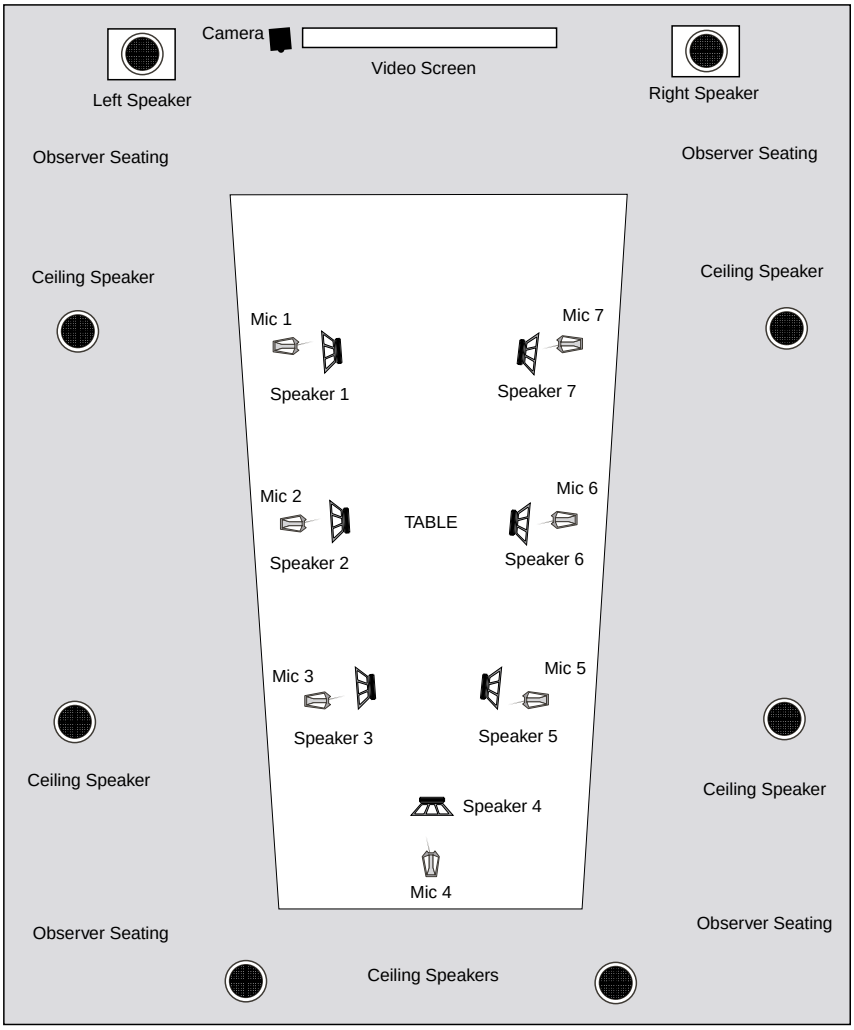
Figure 23. Courtroom Installation

Boardroom Installation

A boardroom application is a good example of a situation where microphone mixing and gating become critical to providing seamless dialogue between several people seated around a large table and at distant sites. Figure 24 shows a boardroom scenario with seven participants, each with their own microphone and speaker. Also, there are observer seating areas on the periphery of the room with speakers for monitoring the discussion at the table.

Boardrooms typically use audio- and videoconferencing capabilities. In this scenario, a XAP TH1 is used for bringing in phone line audio, and an APV200-IP is used for videoconferencing. The XAP 800 allows you to integrate both simultaneously.

Figure 24 shows how audio from the videoconference will come from the front left and right speakers, which directs participants' attention to the person speaking on the video screen. Program audio and other mic audio is routed to the ceiling speakers for a natural-sounding conference.



Whenever a given mic in the room gates on, audio to that participant's speaker would gate off to prevent feedback, and the volume level of the microphone to adjacent speakers might be reduced below normal output levels, providing a more comfortable audio level. Various parametric equalizers and filters might be configured for particular microphones to enhance the voice qualities of regular participants who sit in assigned seats. All audio would be routed to the observation areas at normal levels.

Figure 24. Boardroom

XAP 800 Boardroom Installation (basic example)

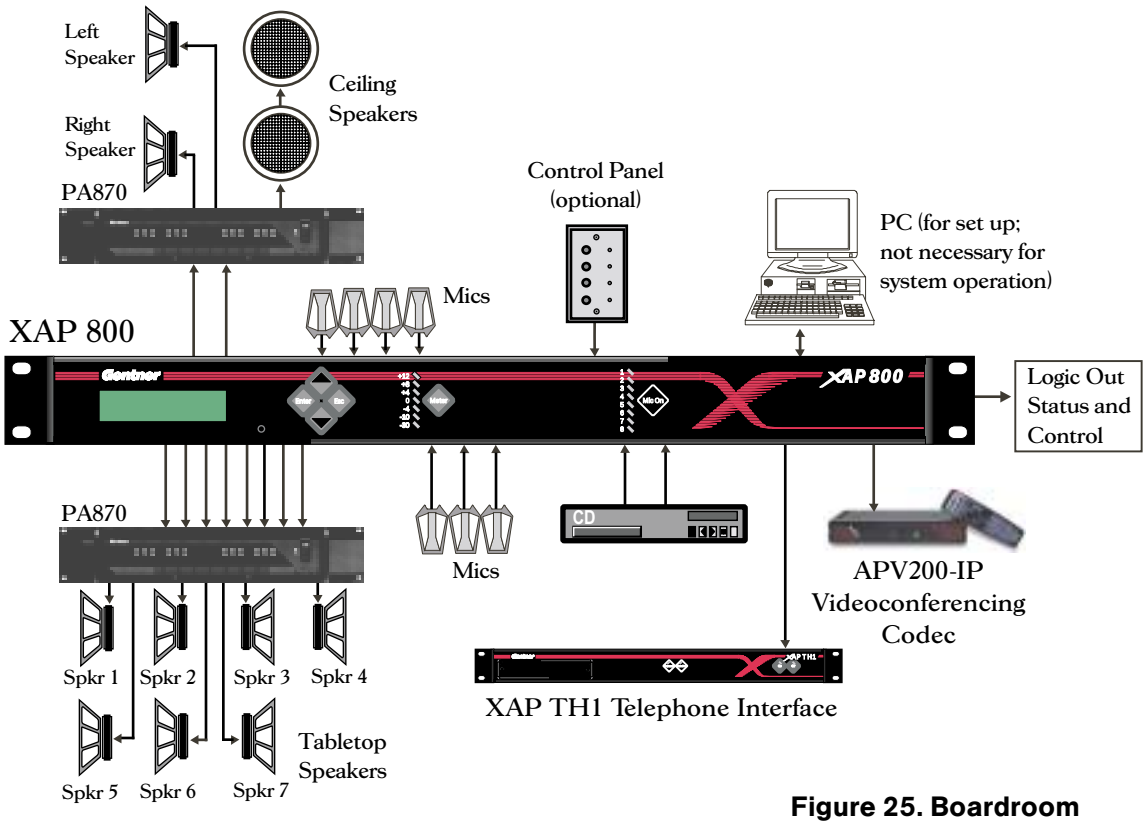


Figure 25. Boardroom Installation

Boardroom Application Example

This section describes how you would configure the XAP 800's inputs, outputs, and processors for a boardroom installation requiring mix-minus sound reinforcement.

Virtually all of the XAP 800's functions are configured with G-Ware software. The software windows depicted here show how you might configure some of G-Ware's functions for this application. Complete instructions for using G-Ware are provided in the XAP 800 Installation and Operation Manual.

Begin by selecting the Configuration matrix in G-Ware. The Configuration matrix in the figure below illustrates how the crosspoints in the matrix would be set for this application. Notice the cross point level control. Also, notice the equipment assigned to the inputs and outputs; these correspond to the installation diagram shown on the previous page. You can assign customized names to each of these inputs by clicking on the label.

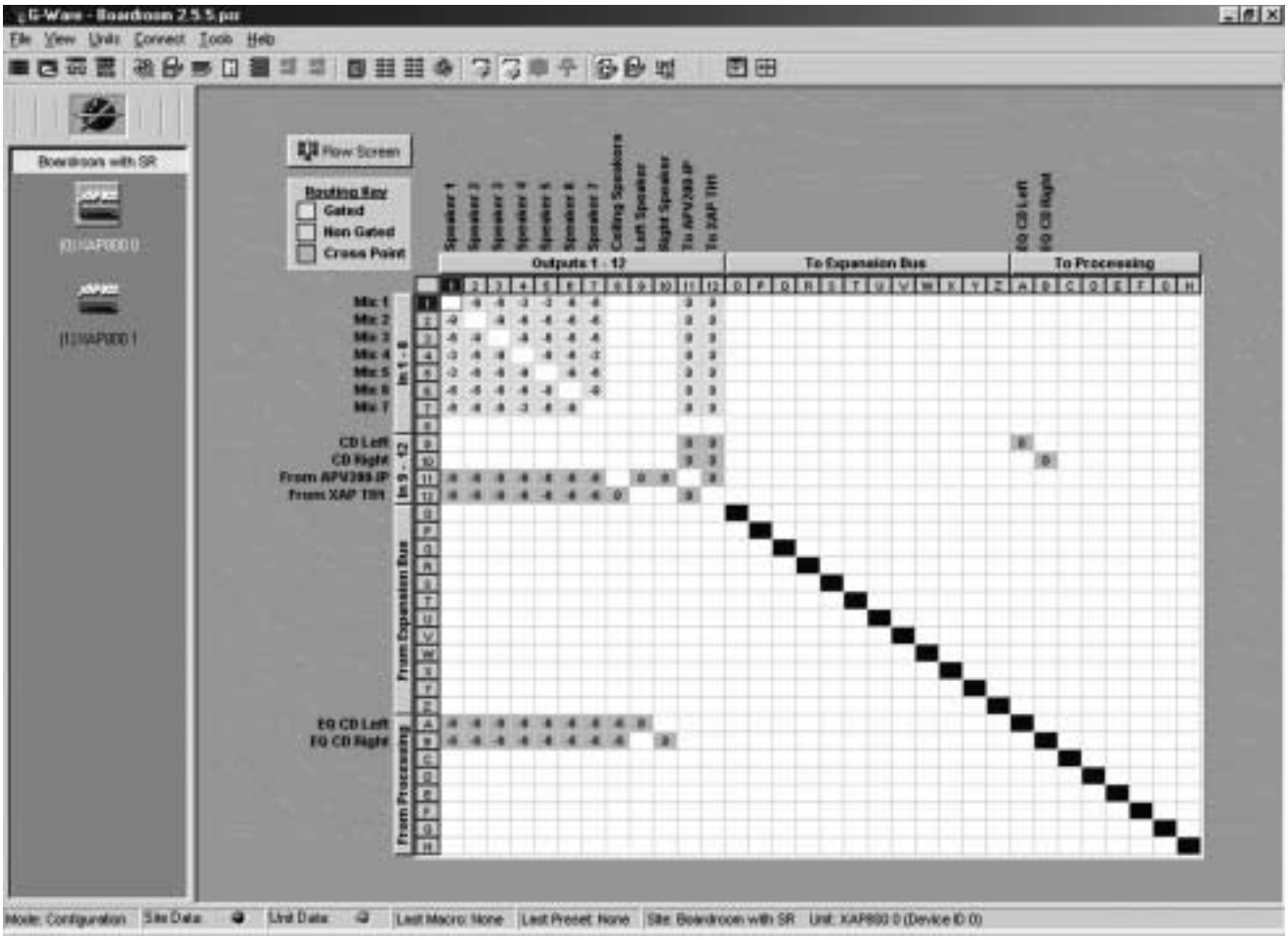


Figure 26. Boardroom Application Configuration Matrix

Next, click the **In 1-8** button near the upper-left corner of the matrix. This opens the Inputs 1-8 window (see Figure 27 below).

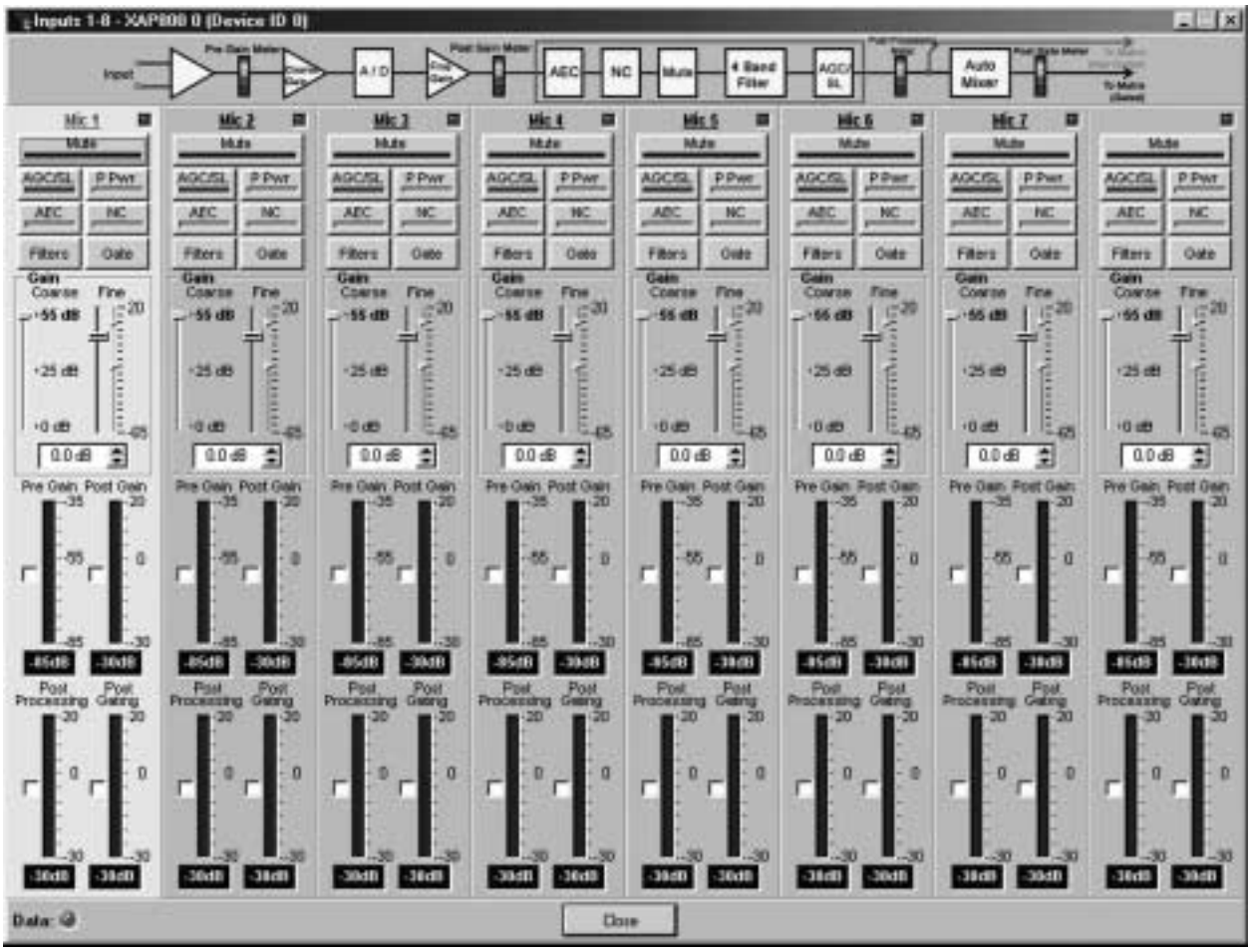


Figure 27. Inputs 1-8 Window

In this example, notice that the minimum and maximum gain limiters (yellow and green arrows) on the Fine gain adjustment are set to 10dB and -20dB. This keeps the audio within a specified gain range to eliminate problems associated with gain level extremes.

Click the **AEC** button on the Mic 1 input. This opens the Acoustic Echo Canceller window (see Figure 28).

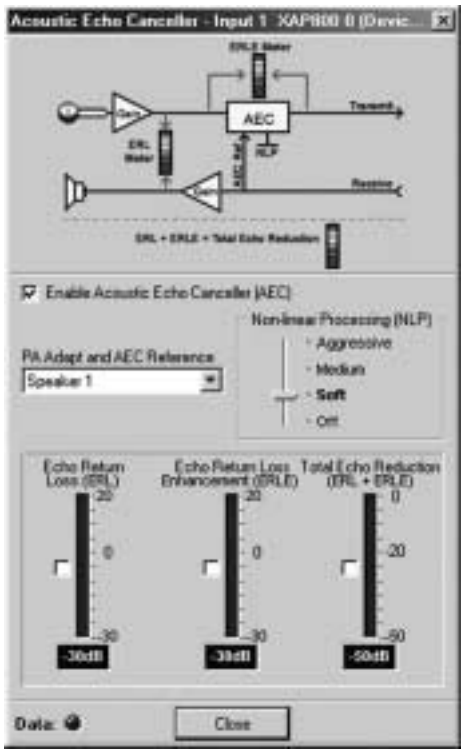


Figure 28. Acoustic Echo Canceller Window

Notice that Enable Acoustic Echo Canceller (AEC) is checkmarked.

Also, notice that Speaker 1 is selected as the PA Adapt and AEC Reference. In Figure 24 (the Boardroom, page 36), notice that Speaker 1 and Mic 1 are in immediate proximity to each other, and are used exclusively by the same participant. This is why Speaker 1 is selected as the acoustic echo canceller reference point for Mic 1. The AEC reference point for Mic 2 would be Speaker 2. This reference pattern continues as you configure the remaining mic inputs.

Click **Close** to return to the Inputs 1-8 window.

Figure 29. Noise Canceller Window

The **NC** button opens the Noise Canceller window (see Figure 29). Depending on the environment, you might wish to enable the noise canceller. Click **Close** to exit.

Next, click the **Gate** button to open the Gate window (see Figure 30). This is where you set up the gating characteristics of individual mics.

Note that PA Adaptive mode is on and that Speaker 1 is selected as the PA Adapt and AEC Reference. This will help prevent Mic 1 from falsely gating on to audio from Speaker 1.

All mics are selected to the same mixer group—A, in this case—to ensure that all mics share this gate information with each other. This ensures proper gating interaction between all mics in the room.

Click **Close** to return to the Configuration matrix.

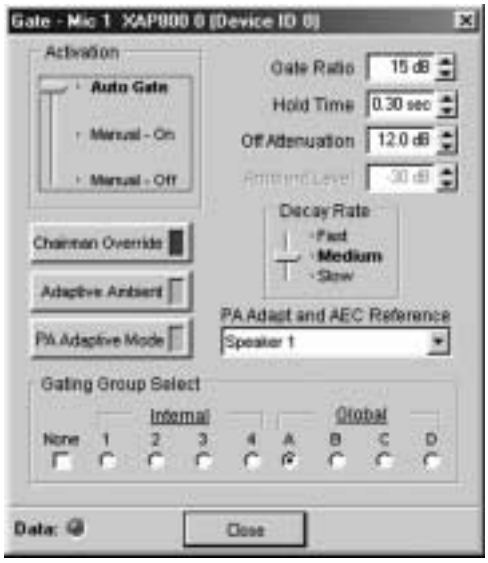


Figure 30. Gate Window

Note that in the Configuration matrix (Figure 26, page 38), the CD player inputs are routed through the processing channels. This allows for additional processing and control of the CD player audio.

Click the **From Processing** button near the bottom-left corner of the matrix. The Processing window opens (see Figure 31).

Click the **Cmprs** button on the EQ CD Left channel to open the Compressor Setup window (see Figure 32).

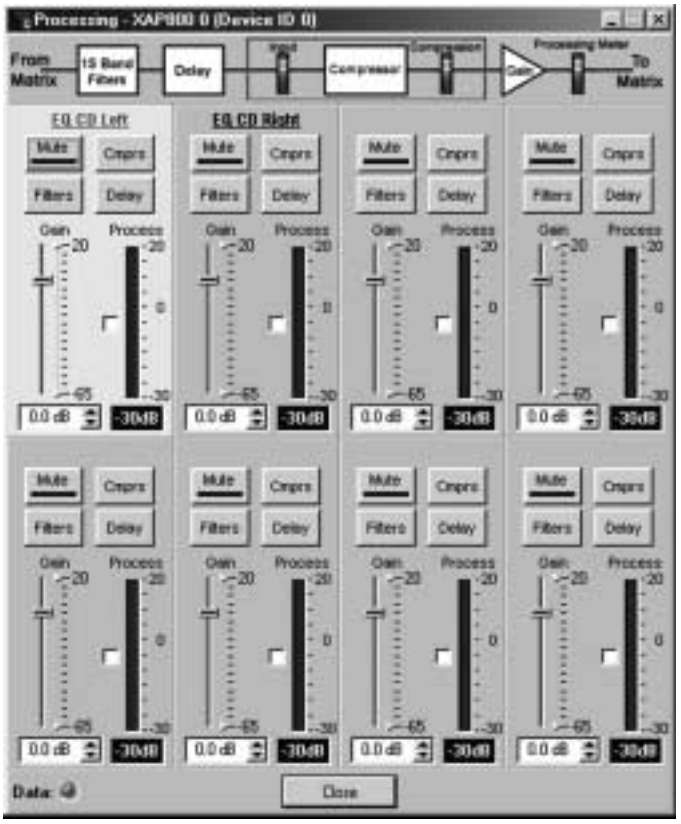


Figure 31. Processing Window

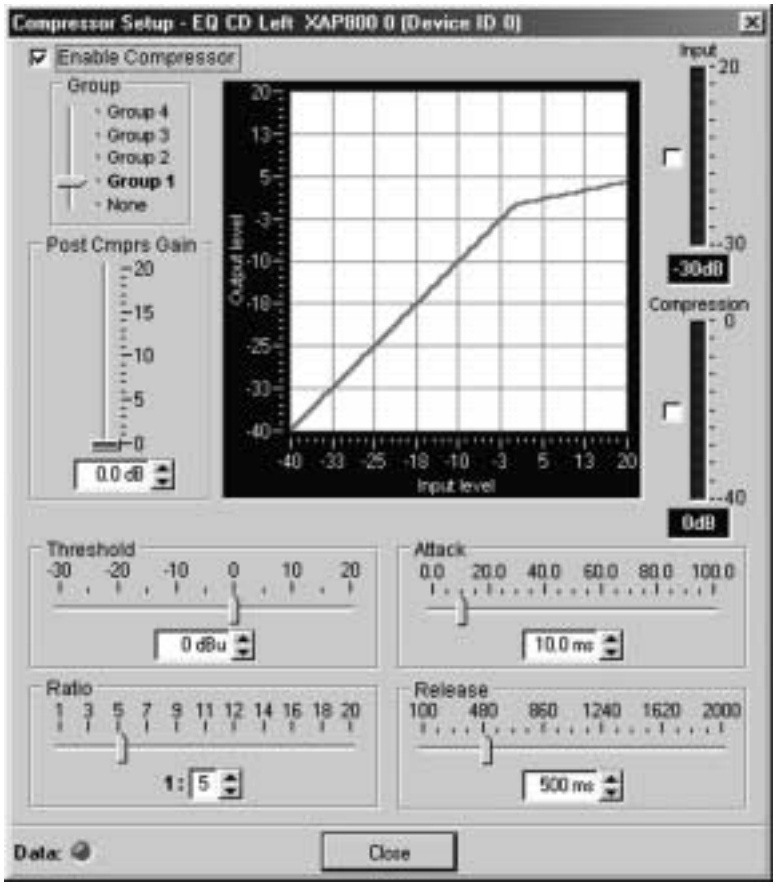


Figure 32. Compressor Setup Window

Note that the compressor is enabled.

Also, note that the Threshold is set to 10 dBu and the ratio is set to 1:5. These settings will help ensure a consistent maximum output level when there are sudden changes in input level.

The Group selector is set to Group 1 (the compressor for EQ CD Right is also set to Group 1). All compressors set to a particular group will operate simultaneously. In this case, you want the compressors for both the left and right CD channels to operate in unison.

Close this window, then click **Filters** in EQ CD Left to open the Processing Filters window (see Figure 33).

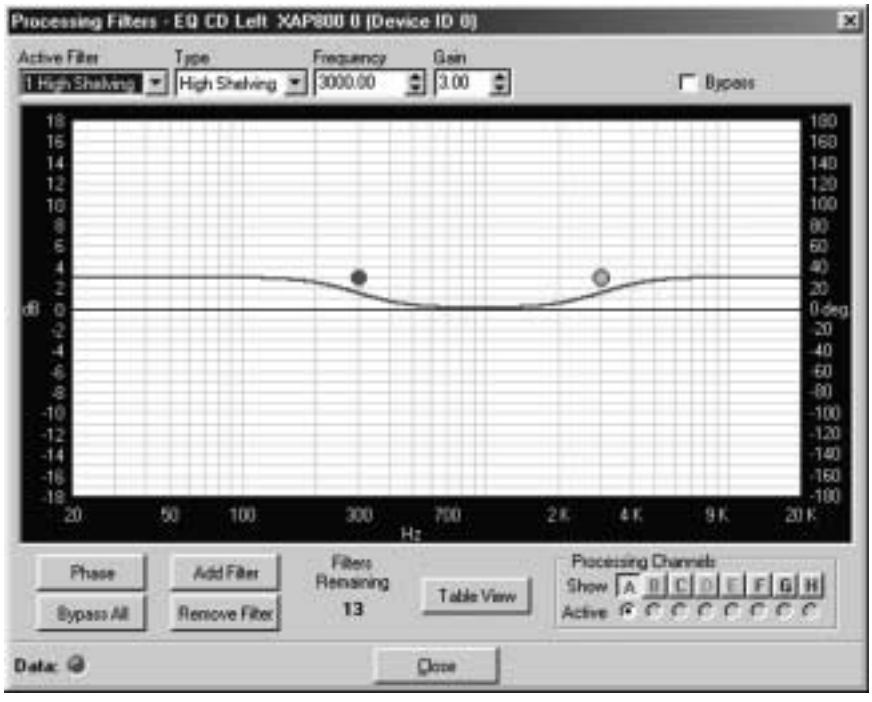


Figure 33. Processing Filters Window

In this scenario, high-shelving and low-shelving filters are established for the left CD channel to enhance audio response. The same filters would be established for the right CD channel.

The high-shelving filter has a frequency of 3kHz and gain of 3dB. The low-shelving filter has a frequency of 300Hz and gain of 3dB.

The outputs are assigned as indicated in the matrix; no further output configuration is necessary for this example.

For more information about configuring G-Ware functions, see the XAP 800 Installation and Operation Manual.

9 Remote Control and Status

Control and Status Configuration

To allow many different control configurations, the XAP 800 can be controlled serially via the RS-232 port; directly through the two control/status A or B labeled connectors on the rear panel; or through a combination of the above. Also, a few functions can be controlled from the front panel. This section discusses direct remote control.

There are two functions available: control and status (see Figure 34). To activate a control function, pins on the control/status connectors (labeled A and B) must go low either in a momentary or sustained action, depending on the setup of the unit. A status pin shows the status of a particular parameter. Status outputs sink at a maximum of 40mA of current through an open collector @20VDC.

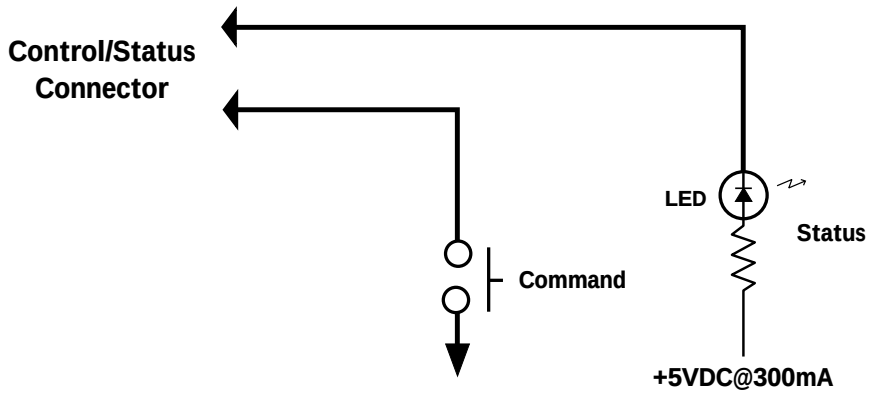


Figure 34. Direct Control/Status Operation

Any valid function of all XAP 800s connected to the Expansion Bus is capable of being controlled from the control/status pins of any connected XAP 800. These functions include volume up, volume down, mute, etc. In addition, pins can be programmed to call up to 32 preprogrammed presets (each preset representing a programmed configuration). Thus, routing, level control, AGC, equalization, etc. can instantly be changed or "reconfigured" by presets.

An example of a useful preset would be in room combining where the room configuration needs to change on the fly. Wall buttons can be used to activate presets. Refer to the Hotel/Convention Center Application Example on page 32.

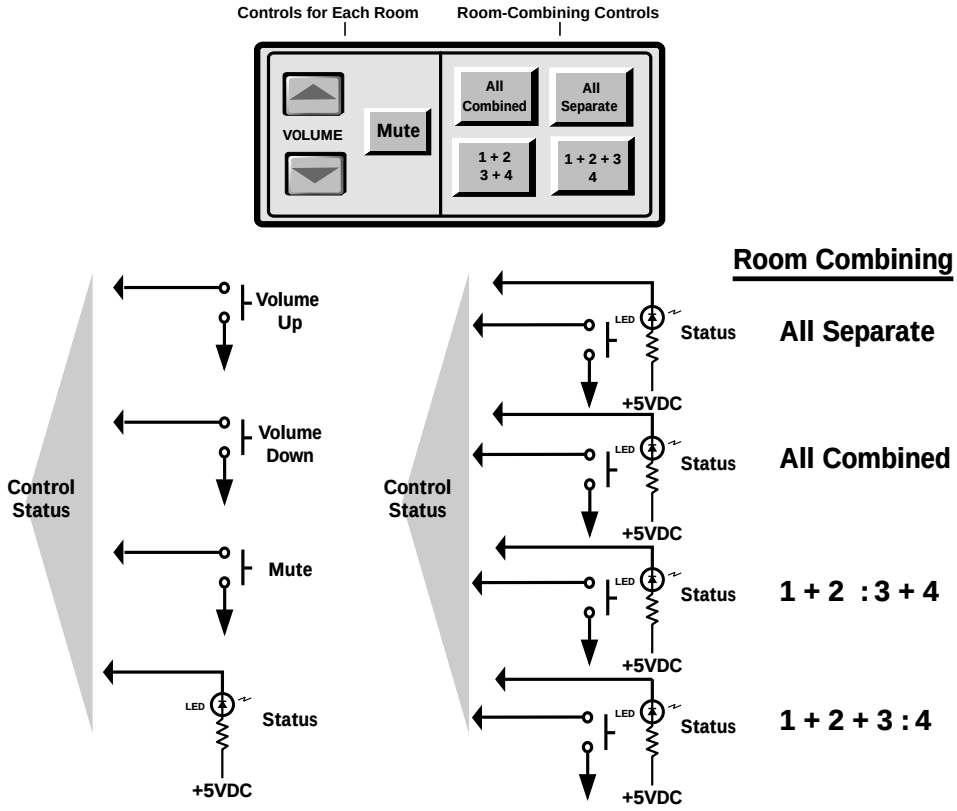


Figure 35. Room Combining Using Control/Status Pins

User Definable Control and Status Pins

Most of the pins on the control/status connectors can be programmed to perform any function—they are user definable. However, these pins come preprogrammed with defaults. There are some pins that are not user definable. The table on the following page outlines the pin configurations.

Control Status Connector A

PIN#	USER DEFINABLE YES OR NO	STATUS (S) OR COMMAND (C)	MOMENTARY (M) OR LATCHING (L)	DEFAULT DESCRIPTION
1	Yes	C	M	Lock front panel toggle
2	Yes	S		Status of front panel lock
3	Yes	C	M	Mute all mics toggle
4	Yes	S		Status of mute all mics
5	Yes	C	M	Mute 9 output toggle
6	Yes	S		Status of 9 output mute
7	Yes	C	M	Mute 10 output toggle
8	Yes	S		Status of 10 output mute
9	Yes	C	M	Mute 11 output toggle
10	Yes	S		Status of 11 output mute
11	Yes	C	M	Mute 12 output toggle
12	Yes	S		Status of 12 output mute
13	Yes	C	M	Not programmed
14	Yes	S		Volume up D output 1 (1dB)
15	Yes	C	M	Not programmed
16	Yes	S		Volume down D output 1 (1dB)
17	No	S		Mic #1 Gate Status
18	No	S		Mic #2 Gate Status
19	No	S		Mic #3 Gate Status
20	No	S		Mic #4 Gate Status
21	No	S		Mic #5 Gate Status
22	No	S		Mic #6 Gate Status
23	No	S		Mic #7 Gate Status
24	No	S		Mic #8 Gate Status
25	No	Ground		Ground

Control Status Connector B

PIN#	USER DEFINABLE YES OR NO	STATUS (S) OR COMMAND (C)	MOMENTARY (M) OR LATCHING (L)	DEFAULT DESCRIPTION
1	No	C	L	Preset select bit 0
2	No	S		Status bit 0
3	No	C	L	Preset select bit 1
4	No	S		Status bit 1
5	No	C	L	Preset select bit 2
6	No	S		Status bit 2
7	No	C	L	Preset select bit 3
8	No	S		Status bit 3
9	No	C	L	Preset select bit 4
10	No	S		Status bit 4
11	No	C	L	Preset select bit 5
12	No	S		Status bit 5
13	No	C	L	Preset select bit 6
14	No	S		Status bit 6
15	No	C	L	Preset select bit 7
16	No	S		Status bit 7
17	No	C		Preset select bit 8
18	No	S		Status bit 8
19	No	C		Preset select bit 9
20	No	S		Status bit 9
21	No connection			
22	No connection			
23	No	-		+5VDC 100mA
24	No	-		+5VDC 100mA
25	No	-		Ground

Often, a combination of serial and direct control might be used in an installation. For example, in the hotel/convention center application example, a custom remote controller touch screen might help with controlling the bulk of the equipment in the room. However, functions such as volume, mute, and room combining configuration may be controlled directly from the unit.

Below is an example of how to use the control and status pins (example can be workbench tested):
1. Design the entire audio chain and document.

2. Determine which pins on the control/status connector will be used for control and status (refer to Control Status Connector tables).

3. If using a custom remote controller, program these units to communicate via RS-232 ports with the XAP 800. Connect to the XAP 800 and verify proper operation.

4. With G-Ware software, configure the desired number of presets. Routing, AGC, equalization, levels, etc. are programmed and saved as a preset. Enable presets from the custom remote controller, front panel, control/status connector, or combination of the above.

5. Define the pin number on the control/status connector as the preset using the software. Also, program any status outputs.

6. Connect the user panel(s) and verify that direct control/status is operational.

7. Now install the audio system and complete the audio calibration procedure through the PC software. Test tones, test noise, and all gains and actual levels in dBu are provided.

Macro Pro Scripting Language
Macro Pro scripting language, included with the XAP 800, allows you to customize macro commands for a unit or networked system.

A macro is a command consisting of a list of other commands. When a macro is sent to the XAP 800, it executes the macro, or list of commands. Upon completion of each macro, the XAP 800 issues a macro-completed response which is used to keep all connected system devices synchronized with the state of the system.

A macro can contain another macro as another command. This allows you to create small macros to perform specific tasks, then combine them to perform larger tasks.

G-Ware software is used for programming a macro. A macro is built by adding commands from the list of available commands to the macro execution list. When the macro is assembled, it is downloaded to the unit and is available for execution.

A macro can also contain a network address in the command. This allows you to issue commands to Expansion Bused XAP 800 units. This can be done to issue single commands, change a preset, or execute a macro in the other box.

10 Serial Remote Control

RS-232 Port

Operation of linked XAP 800 units can be done with one RS-232 serial connection. Functions which can be controlled via this connection include audio level control, muting, audio signal routing, telephone dialing, remote diagnostics, and many other functions.

While any external device with an RS-232 serial connection can communicate with the XAP 800, the system was designed primarily to be programmed and set up using a personal computer, and operated using a custom remote controller. All commands are listed in the XAP 800 Installation and Operation Manual.

The XAP 800 provides real-time control and status via the RS-232 port of all system functions, including:

- Input and output audio levels in dBu
- Input and output gain in dB
- Channel input and output muting control and status
- Mic/line input select and phantom power on/off control and status
- Microphone gate activation status
- Control and status of AGC and equalization
- Routing
- Automixing functions and modes
- Control/Status connector configurations
- Preset/macro configurations
- Password protection
- Expansion Bus setup
- System setup

The RS-232 serial port was generally intended to be used as follows:
1. Set up and programming - During installation, a PC is connected to the XAP 800, and the unit is programmed for the application gain structure, routing, equalization, etc.

2. Calibration - Using the connected PC, precise input and output levels can be directly read from the PC. Additionally, the XAP 800 will tell you precisely how much gain is programmed into the system. Example: You place a -6dBu input tone into a mic/line channel in the line mode. The input reading will be -6dBu. If you apply 10dB of gain, the input will read +4dBu at 10 as a gain reading.

3. Operation - A custom remote controller is then used to operate the functions of the XAP 800.

11 Programming

PC Programming

One of the most important features of the XAP 800 is its expandability. Analog audio products such as automatic microphone mixers offer limited expandability. Using analog methodologies, such mixers provide only a few functions that operate across all expanded units. The most common mode that is expanded is NOM (number of open microphones). Unlike these devices, G-Ware software makes all functions available to expanded units, making a linked XAP 800 system capable of automixing 64 microphones and 32 line inputs.

G-Ware takes advantage of a DSP infrastructure to accomplish this task. It uses the Expansion Bus, a high-speed network protocol, to allow up to eight XAP 800 units to be networked together. The Expansion Bus provides two primary system functions: 1) communications among units, and 2) audio linking.

Front Panel

Using G-Ware software on a connected PC is the only method for programming all the features of the XAP 800, but a few parameters can also be adjusted through the front panel buttons and displays. The front panel consists of an LCD display, five parameter adjustment buttons, an LED VU meter, and eight mic LEDs.

To protect from unauthorized changes, the XAP 800 is pass-coded. Navigation of the menus is allowed without a password; however, changes to programming require a valid password.

The five parameter adjustment keys consist of ▲, ▼, Enter, Esc (Escape), and Meter buttons. The first four keys (▲, ▼, Enter, and Esc) are used for menu navigation and parameter selection. The Meter button determines what audio is selected on the front panel LED VU meter. In addition, numeric audio levels are displayed on the LCD panel.

Menu Structure

System - This menu is used to access presets 1-32 and set security parameters and the master/slave configuration. Also, the System menu is used for viewing the device ID number, unit ID number, and software version information.

RS-232 - This menu is used to configure baud rate and flow control through the RS-232 port. It is also used to enable the modem and clear passwords.

Meter - The Meter menu lets you select which audio source is displayed on the LED meter, including any input or output. You can set the meter to display speaker-to-mic room loss for any input 1-8. Also, you can set it to display a default input, output, or room loss level.

The eight Mic On LEDs indicate the gate status of a mic channel. If an LED is on, it indicates that the respective mic is gated on.

Gentner recommends that you use G-Ware PC software (described on the previous page) to program these parameters of the XAP 800.

12 XAP 800 Connections

System Connections

Audio Connections

The XAP 800 utilizes removable Phoenix™ block connectors that are supplied with the unit. To connect, standard audio cables should be stripped and inserted into the terminal block. The terminal screw in the block is then tightened, providing a secure and reliable audio connection. The terminal block can then be inserted into the rear panel connectors. These connectors maximize reliability and ease of use.

Control/Status Connections

Direct remote control and status outputs are provided on two DB25 connectors on the rear of the XAP 800.

Expansion Bus Connection

The Expansion Bus consists of two RJ45 connectors. An 18" cable is provided. Additional Expansion Bus cables are available.

Serial RS-232

The serial RS-232 communications port is connected via a standard DB9 connector. The RS-232 baud rate can be programmed for 9,600, 19.2K, 38.4K, or 57.6K baud rate. Flow control can be set for either hardware or none.

Pass Codes

To prevent unwanted access via the front panel or modem, the unit can be programmed to require an access code. The RS-232 password is set from a PC. Should the RS-232 password be forgotten, it can be reset from the front panel.

Meters

The XAP 800 has an LED meter and an LCD. Whenever the input, output, or room loss menus are accessed, the meter displays the level of the parameter selected. When not in the input, output, or room loss menus, the default meter is shown. The default meter can be changed to any input, output, or room loss parameter by pressing the Meter button.

Power

A universal power connector is provided. The XAP 800 will operate on all global voltages and cycles.

Expansion Bus Connections

Communication Functions of the Expansion Bus

The Expansion Bus is a high-speed network protocol that provides two primary system functions: 1) communication among units, and 2) audio linking. All functions of the XAP 800 are available across a system of linked XAP 800 units, which allows automixing of up to eight XAP 800 units, 64 microphones, and 32 line inputs.

The XAP 800 takes advantage of its DSP infrastructure in accomplishing this task. Networked XAP 800 units communicate to one another via the Expansion Bus (see Figure 36). Control, status, and addressing functions are performed via the network bus. To accomplish this, configure the first XAP 800 as the MASTER unit. All additional units are then programmed as SLAVES. The master unit then provides communication supervision for all other units on the network.

Serial connection to the master XAP 800 permits programming, operation and diagnostics to all XAP 800 units networked together. This permits a single connection for the installer and user, decreasing costs and complexity.

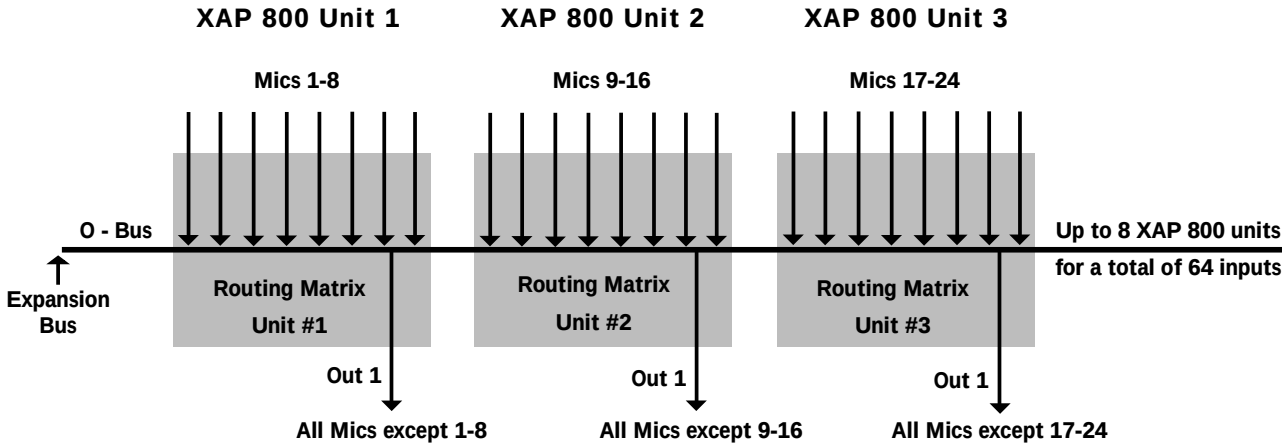


Figure 36. Mix-Minus Configuration of the O Bus

Expansion Bus Audio Functions

The Expansion Bus network architecture allows up to eight XAP 800s and up to 96 inputs, 96 outputs, and 64 microphones to be controlled as if part of a single unit.

Expansion Bus This digital mix-minus bus allows audio routing to and from any destination on the Expansion Bus network. It contains 12 independent digital audio buses labeled O-Z and four PA Adapt/echo cancellation reference buses. Each audio bus can route mic or line-level inputs, in any combination, across the Expansion Bus network. These buses are divided into two groups—O-R buses and S-Z buses— based on their capabilities and default settings.

O-R Buses These four audio buses are defaulted as the mic mix buses; they can communicate the NOM count (see page 25) across the network to other XAP 800s. Otherwise, these buses are identical to buses S-Z.

S-Z Buses These eight buses are defaulted as auxiliary mix buses. They are used to route auxiliary audio, such as from a CD player, telephone interface, or video codec, to and from other units on the network. These buses are also used as mic mix buses when NOM count is not required.

PA Adapt/AEC Reference Buses These buses provide a system-wide bus for input channels to receive a reference input for PA Adaptive Mode. See page 23 for more information about PA Adaptive mode.

In addition, there are four global mixer groups (A-D). They support first-mic priority, maximum number of mics, etc., and work across all linked XAP 800s. Unlike the audio buses, they contain only mic status and gate parameters. All gated mics are default routed to the A mixer and to the O bus for routing.

Connecting to the Expansion Bus

Each XAP 800 comes standard with one Expansion Bus cable. The maximum (cable) distance allowed between any two XAP 800 units on an Expansion Bus network is 80 feet. Gentner Communications recommends that category five twisted-pair (10BaseT LAN) cable be used.

13 XAP TH1 Telephone Interface

Teleconferencing

The XAP TH1 telephone interface is designed for use with the XAP 800. It adds a telephone line to the XAP 800 conferencing system. The XAP TH1 uses the latest digital technology to maintain the highest possible audio quality.

The XAP TH1 is a single-line digital interface which uses digital-signal processing (DSP) to separate the transmit and receive audio. This DSP system eliminates distortion, weak signals, and feedback. It continually filters low and high frequency noise to provide pure sound.

The XAP TH1 connects to the XAP 800 via the RS-232 port on each unit. A XAP 800/XAP TH1 system can also be controlled with a remote controller such as a Panja (AMX) or Crestron. The diagram below illustrates a typical conferencing system using the XAP 800 and XAP TH1.

Typical Installation in XAP 800 System

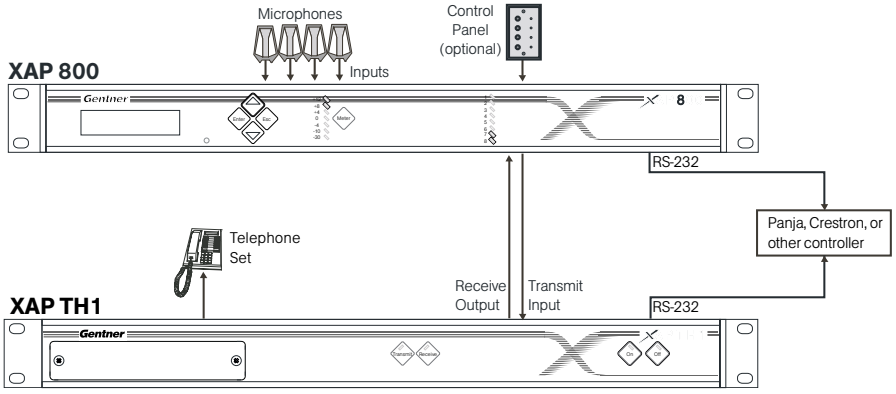


Figure 37.
XAP 800/XAP TH1 Installation

Appendices

Appendix A: Specifications

DIMENSIONS (WxHxD)
17¼" x 1¾" x 10¼" (43.8 x 4.5 x 26.0 cm)

WEIGHT
7 lb/4.5 kg dry
12 lb/5.9 kg shipping

POWER REQUIREMENTS
Auto-adjusting power module, 100-240VAC; 50/60Hz
Fuse: 2 amp, 250VAC, slow blow type
Power Consumption: 30W, typical
95 BTU/Hr
Phantom Power: 24V, selectable

ECHO CANCELLATION
Tail Time: 130ms (works with 12dB of room gain)

NOISE CANCELLATION
Attenuation: 15dB

AUDIO PERFORMANCE
Frequency Response: 20Hz to 20kHz ± .5dB
Noise: (EIN 20Hz to 20kHz) -126dB
THD: <0.003%
SNR: >100dB
Dynamic Range: 100dB (A-weighted)
Headroom: 20dB

MIC/LINE INPUTS
Connector: Removable terminal block; 0dBu nominal adjustable, balanced, bridging
Impedance: 7kOhms

LINE INPUTS
Connector: Removable terminal block; 0dBu nominal adjustable, balanced, bridging
Impedance: > 20kOhms

LINE OUTPUTS
Connector: Removable terminal block; 0dBm nominal level adjustable, balanced
Impedance: 50 Ohms

OTHER CONNECTORS
RS-232: DB9 female (DCE) 9,600/19,200/38,400/57,600 baud
Control/Status A: DB25 female
Inputs A: active low (pull to ground)
Outputs A: Open collector, 20V max, 40mA each
Control/Status B: DB25 female
Inputs B: active low (pull to ground)
Outputs B: Open collector, 20V max, 40mA each (2)

OPERATING TEMPERATURE
32 - 100ºF / 0 - 38ºC

OPERATING HUMIDITY
15% to 80%, non-condensing

APPROVALS
FCC Part 15, CSA NRTL/C, CE

Audio Functions

Filters: All pass; low pass; high pass; low shelving; high shelving; parametric EQ; notch; CD horn EQ; crossover; Bessel, Butterworth, and Linkwitz-Riley crossovers; compressors; matrix mixer w/cross point level control; automatic gain control; and automatic mic mixer.

Signal Delay: Adjustable up to 500ms. G-Ware calculates distances.

Appendix B: Glossary

Acoustic Echo Cancellation A process in which acoustical echo is removed from a signal.

Adaptive Ambient This portion of the mixer monitors the varying ambient noise level in the room and changes the threshold level at which a microphone gates on.

Ambient Noise The existing room-level noise, such as that caused by ventilation systems, paper shuffling, and background chatter.

Amplitude Plot A plot of amplitude (-18 to 18dB) vs frequency (20Hz to 20kHz) on a logarithmic scale.

Attack This signal parameter determines how quickly compression is enabled. It is calibrated in milliseconds.

Attenuation A reduction of signal amplitude.

Audio Processor A device that modifies an audio signal in response to certain requirements.

Automatic Gain Control (AGC) Automatically increases or decreases audio gain to maintain a consistent audio level.

Automatic Gating Automatically gates microphones on or off based on input levels and other parameters programmed into the XAP 800.

Bandwidth The difference between the lower and upper 3dB endpoints of an audio band. Also, the range or differences between the limiting frequencies of a continuous frequency band.

Baud Rate Data speed in bits per second.

Chairman Override Provides gating priority for all microphones selected for the chairman override group. When a mic in this group gates on, all microphones not included in this group gate off.

Clipping A condition in which a signal levels off at a predetermined level. Clipping is usually caused by overdriving a signal, and can result in distortion.

Compression An induced reduction in the dynamic range of part or all of an audio signal. Compression is usually used to tailor the frequency response of a signal and to protect individual loudspeaker components from the damaging effects of transients.

Constant Directivity Horn Equalizer (CD Horn EQ) Horn drivers commonly used in arrays in arenas and auditoriums have an inherent 6dB/octave high frequency rolloff. The XAP 800's CD Horn EQ compensates for this characteristic.

Crossover A device that passes designated frequency segments of an audio signal to various loudspeaker elements in a sound system.

Crossover, Bessel A crossover using a low-pass filter design characterized by a linear phase response. This results in a constant time delay throughout the passband.

Crossover, Butterworth A crossover using a low-pass filter design characterized by a maximally flat magnitude response. This results in no amplitude ripple in the passband.

Crossover, Linkwitz-Riley A fourth-order crossover consisting of a cascaded second-order Butterworth low-pass filter. Offers a vast improvement over the Butterworth crossover and is the de facto standard for professional audio active crossovers.

Decay Rate (slow, medium, fast) Programs how quickly the audio level is attenuated once a channel has been gated off.

DSP Digital signal processor.

Echo Canceller Reference The output or Expansion Bus reference the echo canceller uses to remove echo.

Expansion Bus Consists of two RJ-45 connectors on the rear panel of the XAP 800. An Expansion Bus allows multiple XAP 800s to be networked together using category five twisted-pair (10BaseT LAN) cable.

Filter A device that passes and blocks audio signals based on requirements of the system.

Filter, All Pass A filter that provides only phase shift or phase delay without appreciably changing the magnitude characteristic. The filter produces a flat amplitude response. It is useful in custom crossover applications to compensate for speaker driver deficiencies.

Filter Display A group of nodes plotted on a logarithmic scale. The XAP 800's filter display can be accessed through the Inputs 1-8, From Processing, or To Processing windows.

Filter, High Pass A filter that passes high signal frequencies while attenuating low frequencies.

Filter, High Shelving Provides boosting or attenuation of frequencies above a designated frequency. The transition between the spectrum above and below the designated frequency occurs at a fixed 6dB/octave rate.

Filter, Low Pass A filter that passes low frequencies while attenuating high frequencies.

Filter, Low Shelving Provides boosting or attenuation of frequencies below a designated frequency. The transition between the spectrum above and below the designated frequency occurs at a fixed 6dB/octave rate.

First Mic Priority Increases the audio level required to gate on additional microphones after the first mic is on. This helps ensure that only one mic gates on when a person speaks.

Gain The amount a signal is increased over a given reference, typically 0. Normally specified in dB (decibels). On the XAP 800, gain is adjustable from -60 to 20dB in .5dB increments.

Gain Structure The configuration of parameters which define gain adjustment of a signal. The optimal input gain setting is one which is adjusted as high as possible above the noise floor without introducing clipping.

Gate Ratio Specifies how much louder the microphone audio level must be above the ambient sound level before a microphone gates on.

GPIO (general purpose input/output) The Control/Status Port A on the rear of the XAP 800 unit.

G-Ware Software The XAP 800's setup and configuration software.

Hold Time The length of time that a microphone remains on after the voice (input) level drops below the gate ratio. This prevents the microphone from gating off during brief pauses in speech.

Last On Mode Sets the last-activated mic to Last On, Mic 1-8, or Off. The Last On setting leaves the last-activated mic gated on until another mic input gates on.

Macro A computer command consisting of a sequence of other commands.

Macro Mode The section of G-Ware that allows you to customize and execute macro commands for a XAP 800 unit or network.

Manual Gating Provides the ability to gate a microphone on or off manually.

Matrix Mixer A mixer that allows routing of any input or combination of inputs to an output or any combination of outputs. In the case of the XAP 800, the matrix mixer permits level control at each cross point in the matrix.

Maximum Number of Mics/Filibuster Sets the maximum number of mics that can be gated on simultaneously.

Microphone Activation A condition in which a microphone is gated on.

Microphone Mixing A scenario where microphone inputs are combined and used as a group.

Microphone 1 Mode Reverts mic assignment to a designated mic when all mics gate off.

Mute A condition in which an audio signal is attenuated below the audible threshold.

Noise Cancellation A process through which ambient noise is removed from a signal.

Number of Open Mics (NOM)/Constant Gain Mode Adjusts the output level based on the number of mics gated on and routed to an output.

Off Attenuation The amount of level reduction a microphone is given when the microphone is not gated on.

PA Adaptive Mode The XAP 800 recognizes how much loudspeaker audio is picked up by the microphones and then uses this level as the new ambient level when audio is present at the power amplifier. This prevents loudspeaker audio from gating ON a microphone, while still allowing people in the room to gate ON microphones as they speak.

PA Adaptive Reference This G-Ware setting determines which output (typically for a loudspeaker) is used as a reference for an input.

Paging Zone A subset of a paging system. Intended to isolate paging system outputs to specific geographical areas.

Parametric Equalizer (PEQ) A multi-band variable equalizer with control of gain, center frequency, and bandwidth. A properly configured PEQ enables the XAP 800 to offset speaker or room acoustic deficiencies.

Phantom Power Power supplied by the XAP 800 to power most condenser microphones. The XAP 800 provides 24 volts of phantom power. This feature can be switched off for devices not requiring phantom power.

Phase Plot A plot of phase angle (-180 to 180 degrees) vs frequency (20Hz to 20kHz) on a logarithmic scale.

Pink Noise An audio test signal containing all the frequencies in a given audio spectrum, with equal energy in each octave.

Preset One of 32 configurable memories in the XAP 800. A preset can be programmed with a variety of routing, level, gating, delay, filter, and equalizer settings to meet specific application requirements.

Q Quality factor. It is the ratio of the center frequency divided by the bandwidth. Q reflects an inverse relationship to the bandwidth, and adjusts from .02:1 to 40:1 on the XAP 800.

Ratio The amount of compression applied to the output signal compared with the input signal as the signal exceeds the threshold level.

Release Release is a parameter which determines how quickly compression is released after the input signal drops below the threshold.

Reverberation Reflections of sound waves in a room or other acoustical venue.

Serial Command A bit description designed to execute an instruction or command.

Signal Delay Used for acoustically aligning speakers in an audio system to provide balanced sound throughout the room.

Signal Generator A device for generating a reference tone for sound system calibration purposes.

Speech Leveler A processing control that works with the AGC to target speech audio. After targeting speech audio, it equalizes the audio levels of someone who is speaking close to a mic and someone who is speaking from farther away.

Table View Displays the numerical values of the filter parameters for all nodes of the active filter display.

Threshold The upper or lower level at which a signal processing mechanism begins or terminates operation.

White Noise Acoustical noise with equal energy throughout a given frequency range.

XAP 800 System Parameters Worksheet

System-Wide Parameters

Program Parameter	Selection Range		Program Parameter	Selection Range	
Timeout	0 - 15 (**5**)		Mixer Mode	**Master**, Slave	
Lock Front Panel	On, **Off**		RS-232 Baud Rate	9.6, 19.2, **38.4**, 57.6 kbps	
Set Passcode	Any 5 Front Panel Keys		RS-232 Flow Control	On, **Off**	
Device ID No.	**0** - 7		Modem Mode	On, **Off**	
Unit ID No.	Factory Programmed		Clear Modem Password	**Enter**	
			Default Meter	Input/Output Channel 1-12 **(Out 12)**	

Mixer Group Parameters

		Internal/Unit Mixer Groups				Global/Site Mixer Groups			
Program Parameter	**Selection Range**	**1**	**2**	**3**	**4**	**A**	**B**	**C**	**D**
Maximum No. of Mics	Off, 1-8 (**4**)								
First Mic Priority	**On,** Off								
Last Mic Mode	Last On, **Off**, Mic 1 - Mic 8								

Define PA Adapt/AEC Expansion Bus References

Reference #:	Define as Output: (1-12)	On Unit: (Device ID 0-7)
E1		
E2		
E3		
E4		

Hints:
Each Expansion Bus PA Adapt reference can only be defined once across the system (all linked XAP 800s).
Before defining, verify that the given reference has not already been defined on another unit.
See the Input - Output Parameters worksheet(s) to define a PA Adapt reference to a local output on this unit.

Application Notes

Date	Note

XAP 800 System Parameters Worksheet

XAP 800 Input/Output Parameters Worksheet

Input Channel		1	2	3	4	5	6	7	8	9	10	11	12
Program Parameter	**Selection Range**												
Input Type	**Mic 55dB**, Mic 25dB, Line												
Phantom Power	**On**, Off												
Input Gain Adjust	-60dB to +20 dB (**0**)												
AGC	On, **Off**												
Mute	On, **Off**												
Input Filters 1-4	*See Processing Filters Worksheets*												
Input Activation	**Auto**, Manual												
Chairman Mic	On, **Off**												
Gate Ratio	0 - 50 dB (**15**)												
Off Attenuation	0 - 50 dB (**12**)												
Hold Time	.1 - 8.0 seconds (**.3**)												
Decay Rate	Slow, **Medium**, Fast												
Manual Ambient	0dB to -70dB (**-30**)												
Adaptive Ambient	**On**, Off												
PA Adaptive Mode	On, **Off**												
PA Adapt Reference	Output 1-12, AEC/Expansion Bus Ref E1-E4									See System Parameters to define E1-E4.			
Mixer Group Select	Internal 1-4 or Global A-D (A)									See System Parameters to define Mixers.			
Acoustic Echo Cancellation	**On**, Off, adapt reference, non-linear process.												
AEC Reference	Output 1-12, AEC/Expansion Bus Ref E1-E4												
Noise Cancellation	On, **Off**, 6-15dB cancellation depth												
Speech Leveler	**Off**,On												
Output Channel		1	2	3	4	5	6	7	8	9	10	11	12
Program Parameter	**Selection Range**												
Output Gain Adjust	-60dB to 20 dB (**0**)												
Mute	On, **Off**												
NOM	**On** or Off												

Processing Channel		A	B	C	D	E	F	G	H
Program Parameter	**Selection Range**								
Processing Filters 1-15	*See Processing Filters Worksheets*								
Delay	0-500ms (**0ms**) .02ms steps								
Compressor	On, **Off**								
Threshold	-30dB to +20dB **(0dB)**								
Ratio	**1:1** - 1:20								
Attack Time	0.5ms to 100ms in 0.5ms steps **(1ms)**								
Release Time	5ms to 2sec/Increment of 5ms **(1s)**								
Processing Attenuation	0dB to -60dB **(0dB)**								

Gentner XAP 800

XAP 800 Input/Output Parameters Worksheet

XAP 800 Processing Filter Parameters Worksheet #1

Channel			A	B	C	D	E	F	G	H	1	2	3	4	5	6	7	8
Filter #	**Filter Parameter**	**Selection Range**																
1	Filter Type	Abrev. *(See Key)*																
	Center or Knee Frequency	Hz																
	Gain/Slope	dB or dB/Octave																
	Bandwidth	Octaves																
	Filter Sub-Type	LP/HP *(See Key)*																
2	Filter Type	Abrev. *(See Key)*																
	Center or Knee Frequency	Hz																
	Gain/Slope	dB or dB/Octave																
	Bandwidth	Octaves																
	Filter Sub-Type	LP/HP *(See Key)*																
3	Filter Type	Abrev. *(See Key)*																
	Center or Knee Frequency	Hz																
	Gain/Slope	dB or dB/Octave																
	Bandwidth	Octaves																
	Filter Sub-Type	LP/HP *(See Key)*																
4	Filter Type	Abrev. *(See Key)*																
	Center or Knee Frequency	Hz																
	Gain/Slope	dB or dB/Octave																
	Bandwidth	Octaves																
	Filter Sub-Type	LP/HP *(See Key)*																
5	Filter Type	Abrev. *(See Key)*																
	Center or Knee Frequency	Hz																
	Gain/Slope	dB or dB/Octave																
	Bandwidth	Octaves																
	Filter Sub-Type	LP/HP *(See Key)*																
6	Filter Type	Abrev. *(See Key)*																
	Center or Knee Frequency	Hz																
	Gain/Slope	dB or dB/Octave																
	Bandwidth	Octaves																
	Filter Sub-Type	LP/HP *(See Key)*																
7	Filter Type	Abrev. *(See Key)*																
	Center or Knee Frequency	Hz																
	Gain/Slope	dB or dB/Octave																
	Bandwidth	Octaves																
	Filter Sub-Type	LP/HP *(See Key)*																

Note:
Input channels can select from All Pass, High Pass, Low Pass and Parametric EQ filters only.
Processing channels can select from all available filters.

Key:	**Filter Type**	**Frequency**	**Gain/Slope**	**Bandwidth**	**Filter Sub-Type**	**Filter Type**	**Frequency**	**Gain/Slope**
	Parametric EQ (PEQ)	20Hz to 20kHz	-80dB to +15dB	.05 to 5.0 Octaves		All Pass (AP)	20Hz to 20kHz	
	CD Horn EQ (CD)	20Hz to 20kHz				Low Pass (LP)	20Hz to 20kHz	
	Bessel Crossover (BC)	20Hz to 20kHz	12, 18, 24dB/oct		LP (Low Pass) or HP (High Pass)	High Pass (HP)	20Hz to 20kHz	
	Butterworth Crossover (BT)	20Hz to 20kHz	12, 18, 24dB/oct		LP (Low Pass) or HP (High Pass)	Low Shelving (LS)	20Hz to 20kHz	0 to +/-15dB (.5dB)
	Linkwitz Riley Cross. (LR)	20Hz to 20kHz	12, 18, 24dB/oct		LP (Low Pass) or HP (High Pass)	High Shelving (HS)	20Hz to 20kHz	0 to +/-15dB (.5dB)

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XAP 800 Processing Filter Parameters Worksheet #1

XAP 800 Processing Filter Parameters Worksheet #2

Channel			A	B	C	D	E	F	G	H	1	2	3	4	5	6	7	8
Filter #	**Filter Parameter**	**Selection Range**																
8	Filter Type	Abrev. *(See Key)*																
	Center or Knee Frequency	Hz																
	Gain/Slope	dB or dB/Octave																
	Bandwidth	Octaves																
	Filter Sub-Type	LP/HP *(See Key)*																
9	Filter Type	Abrev. *(See Key)*																
	Center or Knee Frequency	Hz																
	Gain/Slope	dB or dB/Octave																
	Bandwidth	Octaves																
	Filter Sub-Type	LP/HP *(See Key)*																
10	Filter Type	Abrev. *(See Key)*																
	Center or Knee Frequency	Hz																
	Gain/Slope	dB or dB/Octave																
	Bandwidth	Octaves																
	Filter Sub-Type	LP/HP *(See Key)*																
11	Filter Type	Abrev. *(See Key)*																
	Center or Knee Frequency	Hz																
	Gain/Slope	dB or dB/Octave																
	Bandwidth	Octaves																
	Filter Sub-Type	LP/HP *(See Key)*																
12	Filter Type	Abrev. *(See Key)*																
	Center or Knee Frequency	Hz																
	Gain/Slope	dB or dB/Octave																
	Bandwidth	Octaves																
	Filter Sub-Type	LP/HP *(See Key)*																
13	Filter Type	Abrev. *(See Key)*																
	Center or Knee Frequency	Hz																
	Gain/Slope	dB or dB/Octave																
	Bandwidth	Octaves																
	Filter Sub-Type	LP/HP *(See Key)*																
14	Filter Type	Abrev. *(See Key)*																
	Center or Knee Frequency	Hz																
	Gain/Slope	dB or dB/Octave																
	Bandwidth	Octaves																
	Filter Sub-Type	LP/HP *(See Key)*																
15	Filter Type	Abrev. *(See Key)*																
	Center or Knee Frequency	Hz																
	Gain/Slope	dB or dB/Octave																
	Bandwidth	Octaves																
	Filter Sub-Type	LP/HP *(See Key)*																

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XAP 800 Processing Filter Parameters Worksheet #2

XAP 800 Room Preset/Configuration Worksheet

Preset Setup

Preset #						
Description:						
Command List:						
For extra large presets, continue commands in next column. Refer to macro worksheet for details on all listed macros.						
DB-25 Remote Control Port "B" Setup						
DB-25 Port "B" Pin #	1 3 5 7 9 11 13 15 17 19	1 3 5 7 9 11 13 15 17 19	1 3 5 7 9 11 13 15 17 19	1 3 5 7 9 11 13 15 17 19	1 3 5 7 9 11 13 15 17 19	1 3 5 7 9 11 13 15 17 19
Preset Mask =						

Key: **H = Pin Active/High State** **L = Pin Inactive/Low State** **X = Pin state is irrelevant**

Room Configuration Setup

Room Configuration No./Name and Description:						
Configuration's Presets:						
Each configuration is recalled by activating its listed presets.						

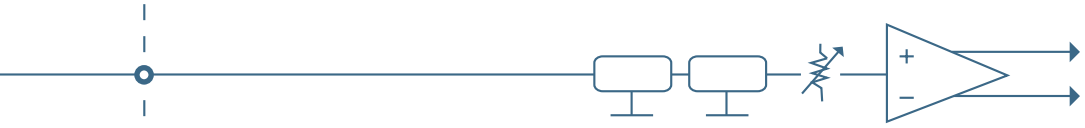
Room Preset Configuration Worksheet

XAP 800 Macro Worksheet

Macro Setup

Macro #/Name						
Description:						
Command List:						
Macro #/Name						
Description:						
Command List:						
Macro #/Name						
Description:						
Command List:						
Macro #/Name						
Description:						
Command List:						
Macro #/Name						
Description:						
Command List:						
For extra large macros, continue commands in next column.						

XAP 800 Macro Worksheet



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