

## Application: City Council Chamber

As part of a Bose ControlSpace® system design, the Automatic Microphone Mixer provides the perfect solution for multi-microphone public space installations. This application note describes its use in a typical city council chamber.

Figure 1 below, created using the Bose® ControlSpace Designer software, provides an overview of project elements. In this figure, microphones and other input devices are shown on the left, while loudspeakers and other output devices are shown on the right.

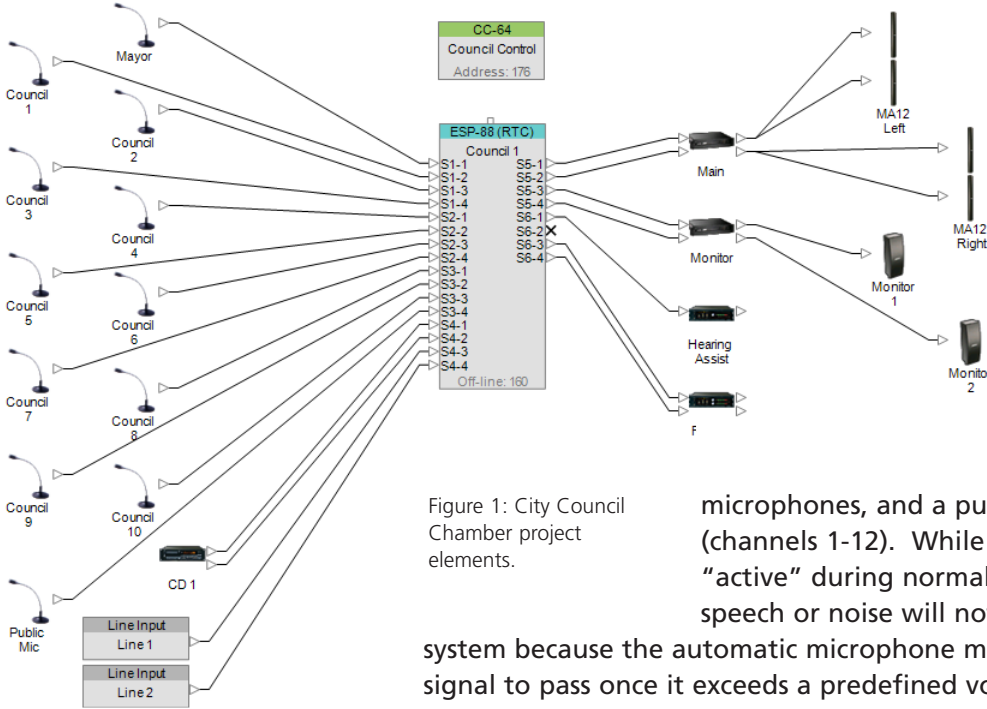


Figure 1: City Council Chamber project elements.

User interfaces appear at the top and at the heart of the system is the ControlSpace ESP-88 Engineered Sound Processor.

In this design, input signals managed by the automatic microphone mixer include those from the Mayor's microphone, ten council member

microphones, and a public podium microphone (channels 1-12). While all microphones remain "active" during normal operation, unwanted

speech or noise will not be reproduced by the system because the automatic microphone mixer will only allow the signal to pass once it exceeds a predefined volume.

This is accomplished by using the following DSP processing configuration:

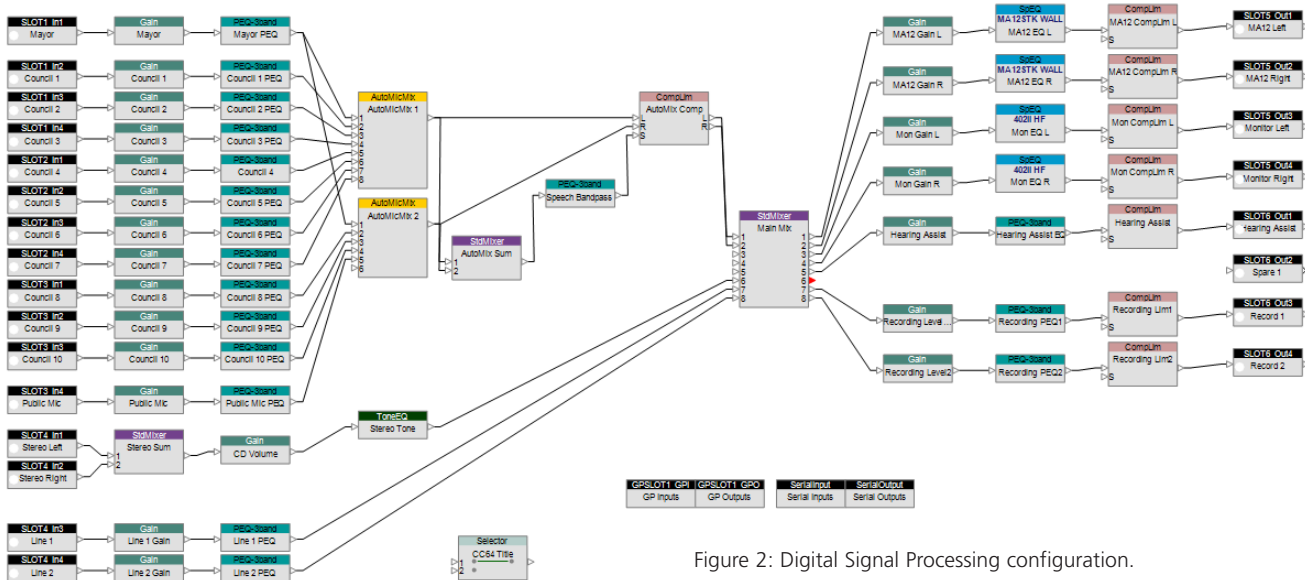


Figure 2: Digital Signal Processing configuration.

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## Automatic Microphone Mixer



### Input Processing

The system's input processing is comprised of:

- signal conditioning
- automatic microphone mixing
- main mixing and routing.

**Signal conditioning** includes independent gain and equalization for each input channel. This streamlines system programming, allowing separate configurations for the user-assigned gain and system gain in order to optimize signal to noise throughout the system. Each channel also incorporates a 3 band parametric EQ.

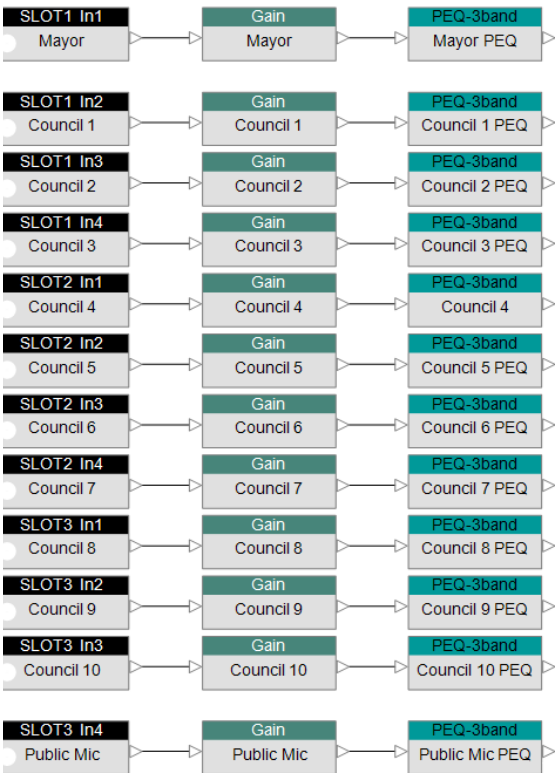


Figure 3: The system manages independent input gain (volume) and equalization for each microphone.

The **automatic microphone mixer** manages twelve system microphones. Processing in this section includes automatic mixing combined with compressor/limiter functions to deliver a consistent volume level. This design incorporates a parametric EQ configured as a band-pass filter (250Hz-4kHz), driving the compressor's side-chain input and keeping the compressor responsive to the speech signal only, rather than bass

frequencies or noise from handling the active microphone. The automatic microphone mixing function spans two signal processing blocks with the Mayor's microphone connected to input number one on both, thus ensuring the highest system priority for that microphone.

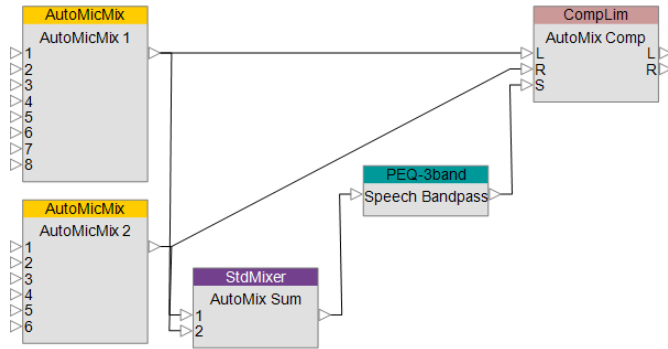


Figure 4: Automatic microphone mixer processing section incorporates a compressor/limiter to maintain a consistent operating level.

The **main mixing and routing** section handles the mixing and routing of all system inputs to the various zones:

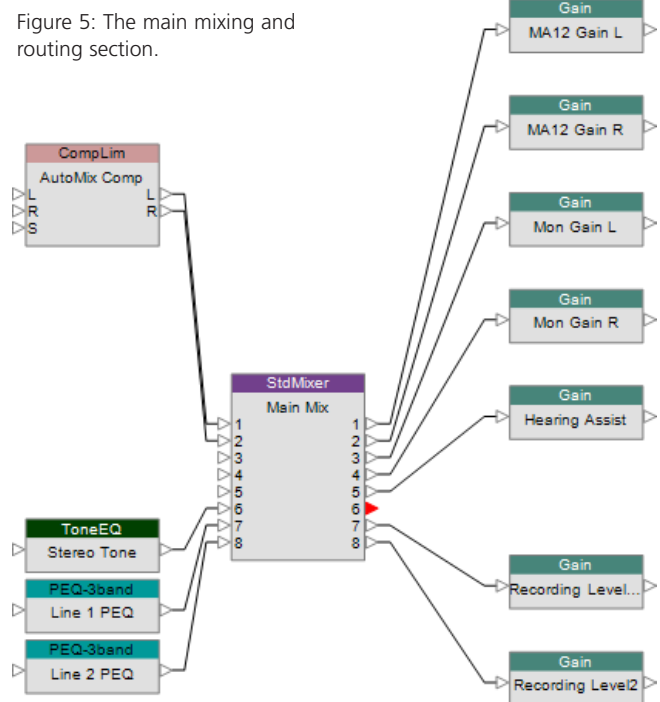


Figure 5: The main mixing and routing section.

# ControlSpace® Automatic Microphone Mixer



## Output Processing

The ControlSpace® Automatic Microphone Mixer output processing is comprised of zone gain, zone EQ, loudspeaker EQ, and protection limiters for each zone.

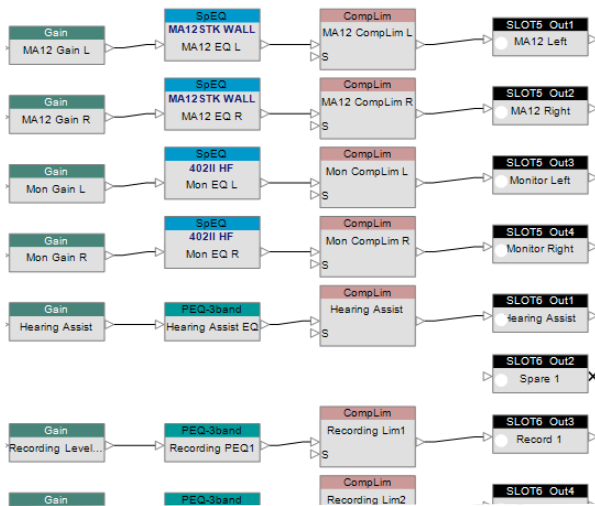


Figure 6: Output processing.

## Microphone Mixers

A threshold detection method is used with all microphones except the public podium. This allows microphone signals above a certain level to pass to the output stage of the mixer. During system commissioning, we will configure all input gain settings.



Figure 7: Automatic microphone mixing settings

“Push-to-Talk” detection is used with the public podium microphone. Bose Professional System installers place a sensor pad underneath the carpet behind the podium. Once someone steps on this pad, a contact closure is provided to the ControlSpace ESP General Purpose Input 1, thus activating the microphone.

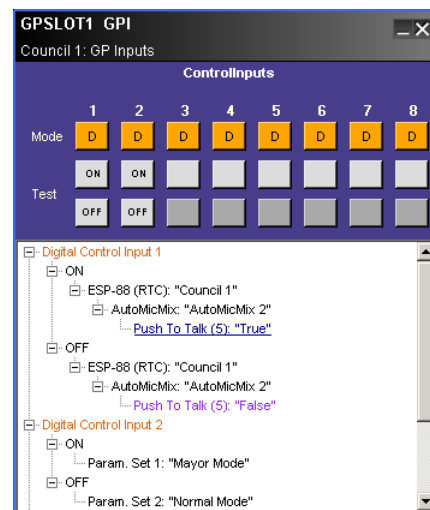


Figure 8: “Push-to-Talk” detection on the public podium microphone

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## Automatic Microphone Mixer

### Override Provisions

The system includes a master override provision called "Mayor Mode." Pressing a push button switch at the Mayor's position will mute all other microphone and input sources. The inverse of "Mayor Mode" is "Normal Mode" which is restored when the button is release. This switch connects to General Purpose Input 2.

Finally, we use an output gain attenuation function called "number of open microphones" (NOM) for this system. When multiple microphones are active, the output gain will be reduced by  $10 \cdot \text{LOG}(\text{NOM})$ . The following graph shows the amount of attenuation applied for a given number of open microphones:

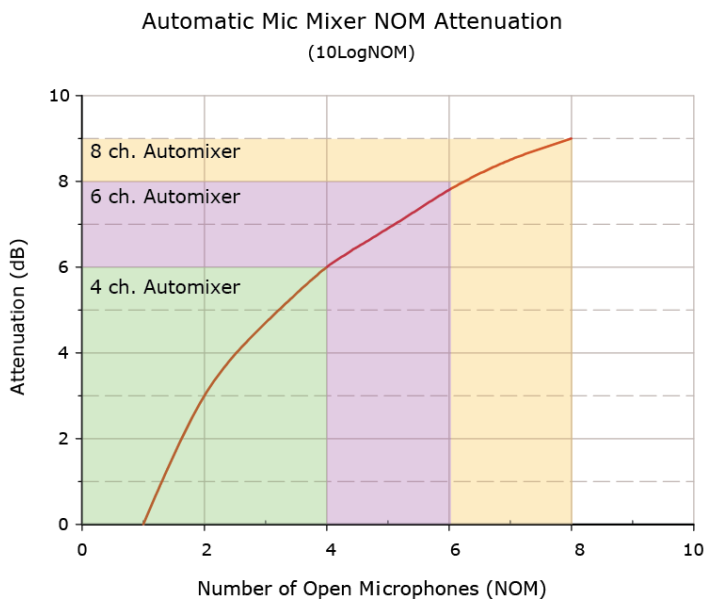


Figure 9: Number of Open Microphones (NOM) attenuation.