ControlSpace®
Automatic Microphone Mixer

APPLICATION NOTE

Application: House of Worship

As part of a Bose ControlSpace® system design, the Automatic Microphone Mixer provides an elegant solution for multi-microphone installations. This application note describes its use in a typical house of worship.

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

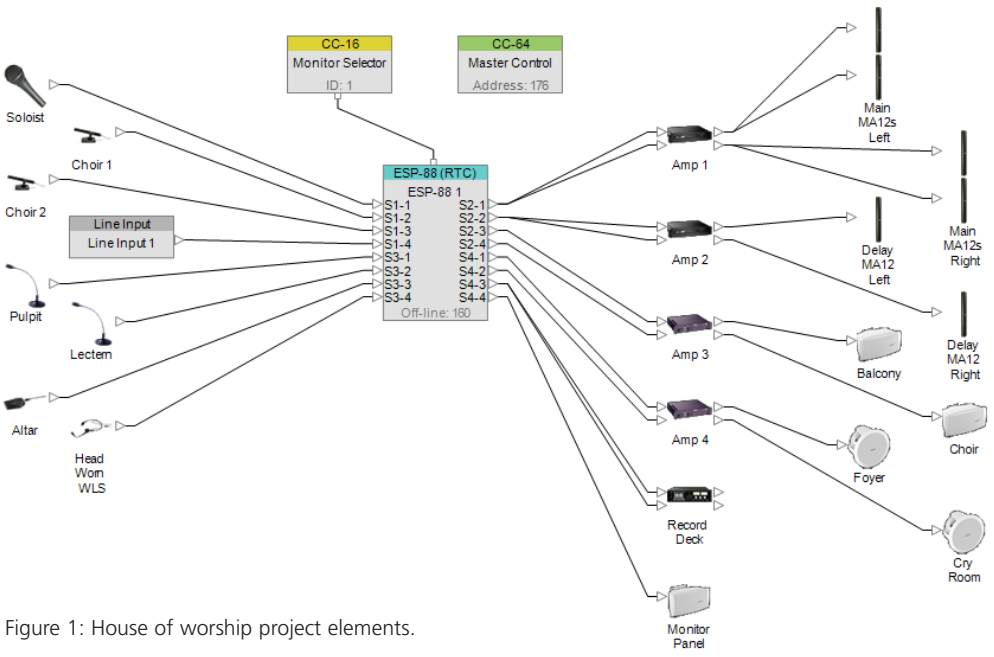


Figure 1: House of worship project elements.

In this design, input signals managed by the automatic microphone mixer include those from the pulpit, lectern, altar, and wireless microphones (channels 4-8). 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:

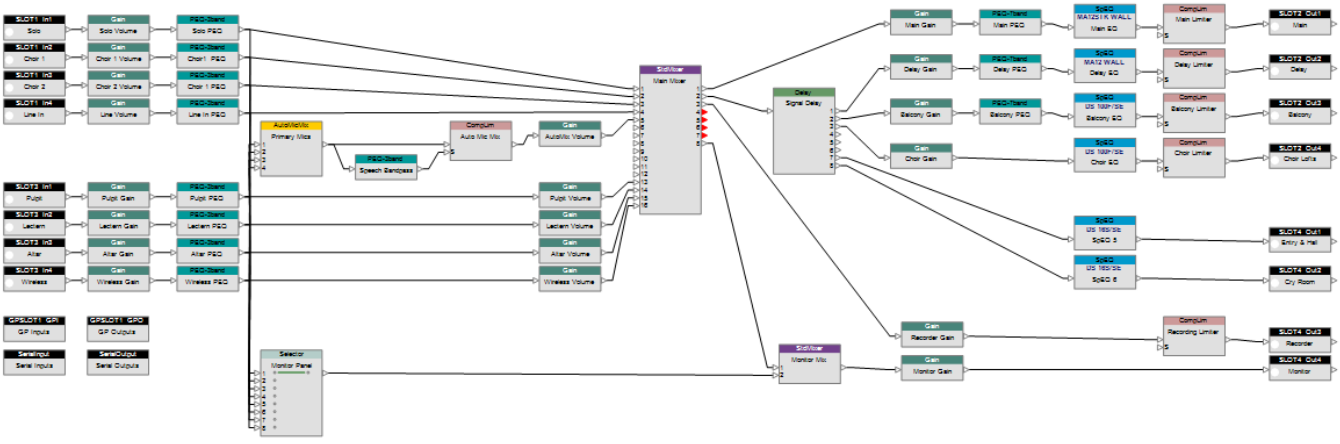


Figure 2: Digital Signal Processing configuration.

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.

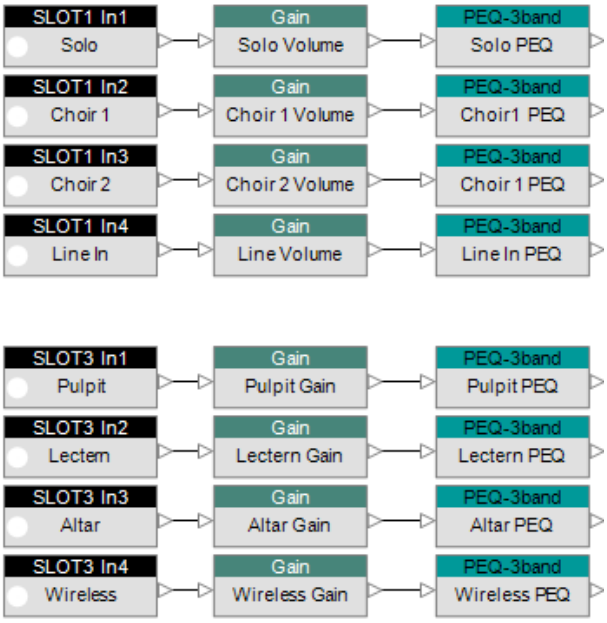


Figure 3: The system manages independent input gain (volume) and equalization for each microphone.

The **automatic microphone mixer** manages four 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-2kHz), driving the compressor's side-chain input and keeping it responsive to the speech signal only, rather than bass frequencies or noise from handling the active microphone.

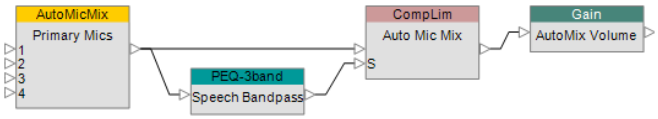
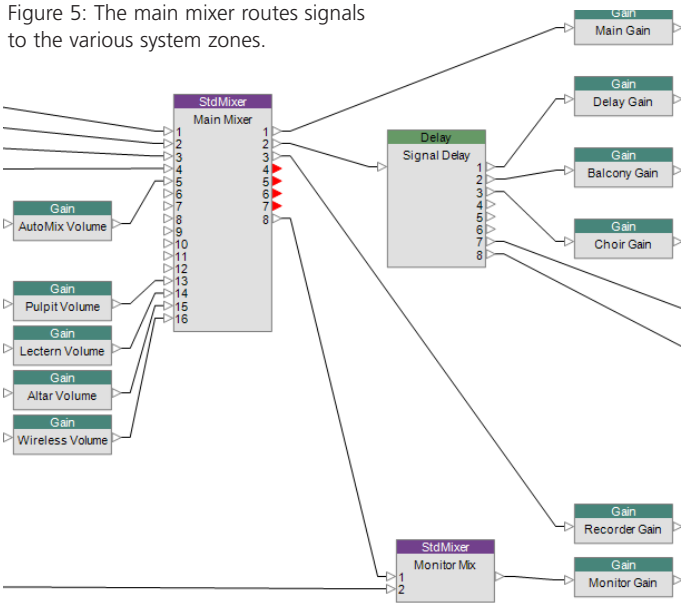


Figure 4: Automatic microphone mixer processing section incorporates a compressor/limiter to maintain a consistent operating level.

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

Figure 5: The main mixer routes signals to the various system zones.



Output Processing

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

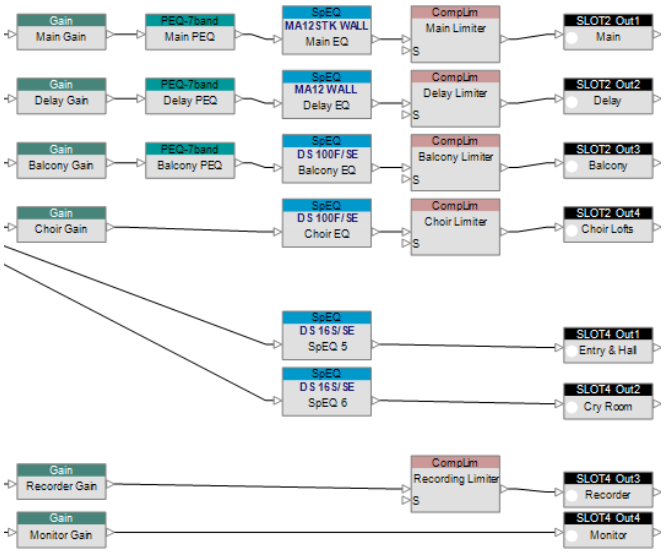


Figure 6: Output processing.

Microphone Mixers

A threshold detection method is used with pulpit, altar and wireless microphones (channels 1, 3 and 4). 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.

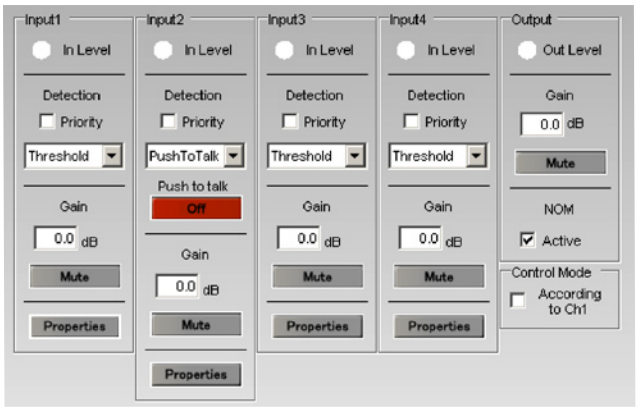


Figure 7: Automatic microphone mixing settings

"Push-to-Talk" detection is used with the lectern 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.

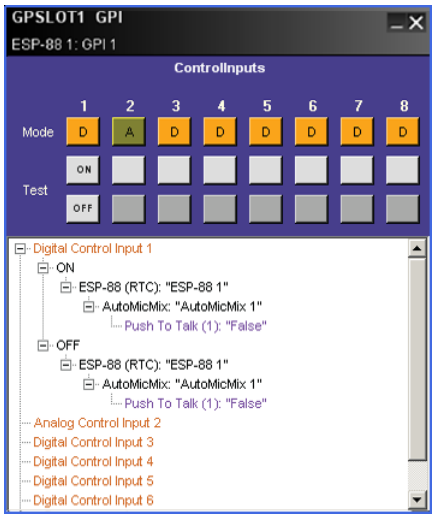


Figure 8: "Push-to-Talk" detection on the public podium microphone

APPLICATION NOTE

Attenuation

The ControSpace® system uses 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*LOG(NOM). The following graph shows the amount of attenuation applied for a given number of open microphones:

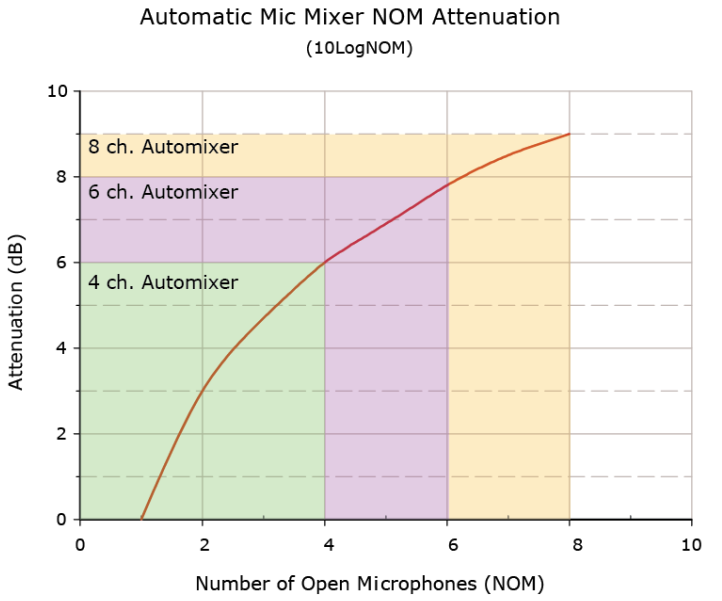


Figure 9: Number of Open Microphones (NOM) attenuation.