



USING THE EF400 AND EF1210 WITH SHURE AUTOMATIC MIXERS

The combination of ASPI Digital echo cancellers and Shure automatic microphone mixers can make very powerful and economical conferencing systems. Conferencing systems of any size and function can be designed using a combination of products from Shure and ASPI Digital.

This document describes the recommended configurations of systems using ASPI Digital echo cancellers and Shure automatic microphone mixers for a variety of different products. The EF400 and EF1210 are compatible with the SCM810, SCM410, and FP410 models of automatic mixers. The EF400 is also compatible with the AMS8100.

DESIGNING THE ROOM

The EF400 and EF1210 are designed to provide maximum flexibility in the design of the sound system. The system can be designed almost as if the echo cancellation were not there. For instance, the design for a boardroom with zoned reinforcement should not change depending on whether it will have conferencing capabilities. You can design the system around the features and functionality of the Shure mixers, and then place the echo canceller right after the mics (in the case of the EF1210), or right in front of the codec (in the case of the EF400). Sample block diagrams of different types of systems are described below and shown in Figure 1.

EF1210 - No Sound Reinforcement

When using the EF1210, one EF1210 is needed for each automatic mixer. The mixers may be linked, and the output of the mixers is sent directly to the video codec. The mixer connected to the codec should be in “Global” linking mode, so that all mics are sent to the codec. The output of the codec should be sent to all EF1210s as an AEC reference. The zone output of one of the EF1210s can be used to provide the remote audio to the amplifier and loudspeakers.

EF400 - No Sound Reinforcement

When using the EF400 with Shure automixers, simply connect the output of the mixer to the mic/line input of the EF400. If multiple mixers are used, they can be linked together. The mixer connected to the EF400 should be set for “Global” linking, so that it provides the mix from all linked devices. Only one EF400 is needed for the system, regardless of how many mixers are used. The remote output of the EF400 is sent to the video codec.

EF1210 with Sound Reinforcement

When the EF1210 is used in a sound reinforcement system, the automatic mixers should still be linked, but set for “Local” linking so that a mix of each zone’s microphones can be treated separately. A matrix mixer (the size depends on how many mixers are used) can send the appropriate mix of microphones, program audio, and remote audio to each zone’s loudspeakers. A matrix with full crosspoint gain may be useful to provide different levels of reinforcement between different zones. The matrix should also provide a mix of all mics to the codec.

Note that the AEC reference inputs to the EF1210 do not include the sound reinforcement speech for each zone. The AEC reference should only contain program audio and remote speech.

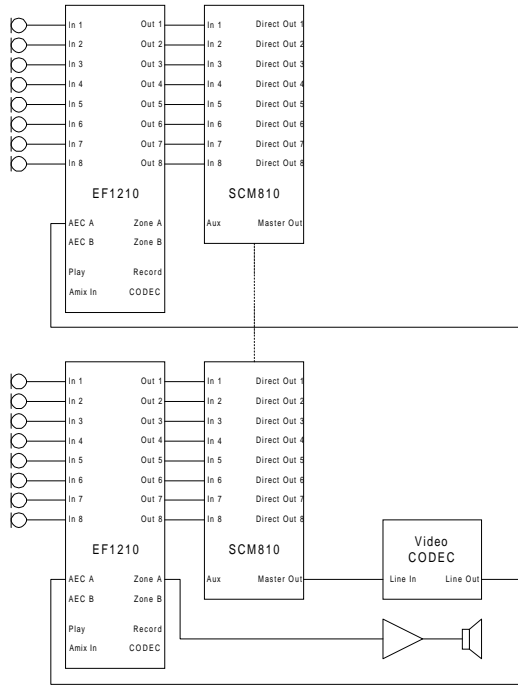


Figure 1a: EF1210 and SCM810 without sound reinforcement.

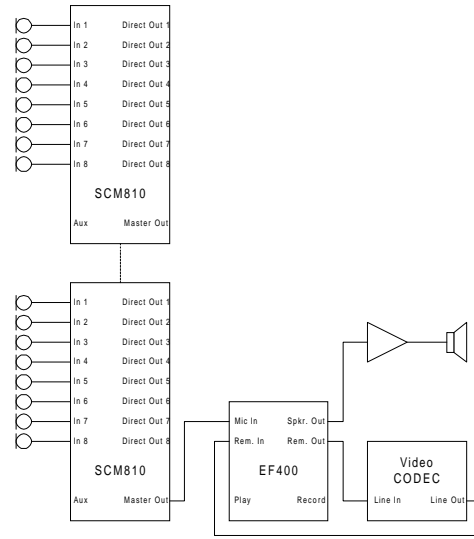


Figure 1b: EF400 and SCM810 without sound reinforcement.

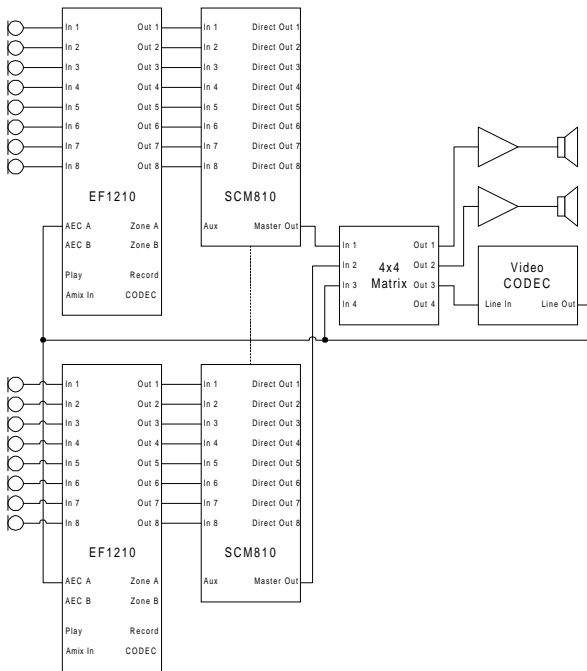


Figure 1c: EF1210 and SCM810 with sound reinforcement.

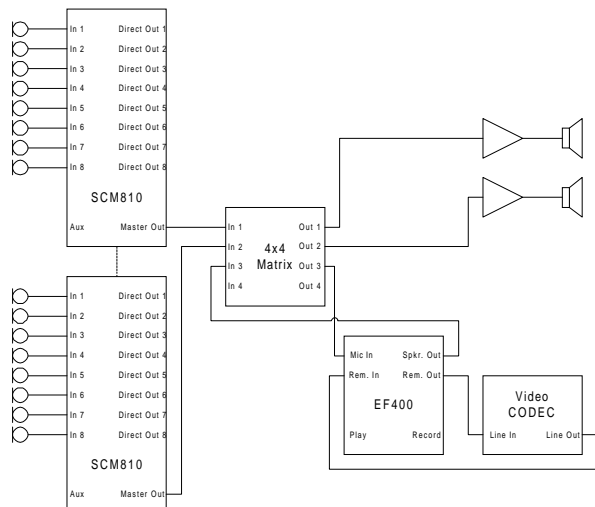


Figure 1d: EF400 and SCM810 with sound reinforcement.

EF400 with Sound Reinforcement

The configuration of a sound reinforcement and conferencing system with an EF400 is very similar to an EF1210 system. The only major difference is that the EF400 is placed between the matrix and the video codec, while the EF1210 is placed between the microphones and the mixers. The mixers should be set for “Local” linking mode in this type of system as well. The matrix provides the appropriate mix of microphones, remote audio, and program audio to the loudspeakers and video codec.

Splitting the EF1210

The EF1210 may be split into two separate rooms using the two AEC reference inputs. This may be used to provide an economical solution for two adjacent rooms, or for room combining applications. If the EF1210 is split equally, two SCM410s may be used. If one of the rooms has more than four mics (say one room has 6 and the other has 2), one SCM410 and one SCM810 may be used. The figure below shows how two SCM410s could be configured to split a single EF1210 between two totally independent rooms.

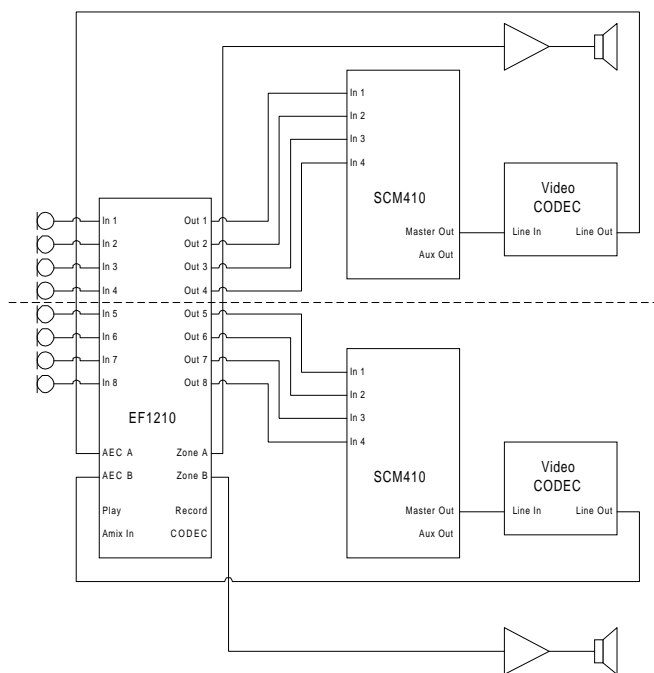


Figure 2: Using the EF1210 with 2 SCM410s for two different rooms.

It is possible to use the EF1210 in zoned reinforcement systems with less than 8 mics in each zone. In this case, however, it is not necessary to use both AEC reference inputs. All the echo cancellers should get the same reference, which is the remote speech and program audio. The sound reinforcement signals should not be used as part of the reference. Since all the channels are using the same reference, it is possible to send any channel to any mixer. For example, in a system with 16 mics and four zones, four SCM410s could be used with two EF1210s. In a larger system (24 mics with four zones), four SCM810s could be used with three EF1210s. Six channels could be sent to each SCM810. Because all the channels are using the same reference, it doesn't matter that some mixers are getting channels from two different EF1210s.

GETTING OPTIMUM ECHO CANCELLATION WITH THE EF400

Automatic mixers present a challenge to single channel echo cancellers. They effectively cause constant changes in the acoustic properties of the room by turning microphones on and off. The echo canceller must adapt quickly and constantly to keep up with these changes. This is the case when using an automatic mixer with the EF400. The EF400 adapts very quickly and therefore works better with automatic mixers than any other single channel echo canceller. However, some precautions may enhance the performance of the EF400 when used with an automatic mixer, especially in difficult rooms.

Avoid Last Mic Lock-On

Last mic lock-on should be turned off (so that all mics are off after their hold time has expired). This is required in most situations for the EF400 to work properly.

Use less off attenuation.

When off attenuation is infinite, the AEC sees no echo in the room when all of the microphones are off. When a mic is activated, there is suddenly a great deal more echo to cancel. Using the 15 dB off attenuation option on Shure mixers makes these changes less drastic.

Isolate microphones from loudspeakers.

Providing isolation between microphones and loudspeakers has two benefits. First, it reduces the echo received by the echo canceller, which makes its job easier. When using automatic mixers, it also makes the loudspeaker signal less likely to cause microphones to activate. This is important because it reduces the likelihood that random microphones will activate from the loudspeaker, changing the echo path while only the far end is talking. Reducing the number of microphone activations caused by the loudspeaker signal will improve the echo canceller's performance.

Provide remote reference channel to mixer.

Shure's MaxBus technology provides another way to prevent the loudspeaker signal from activating microphones. If an extra mixer channel is available, the remote (far end) signal can be fed to a line level input. This input should then be permanently muted, using the logic connections. When the remote end talks, the muted channel will be activated. The MaxBus technology will prevent other channels in the mixer from activating on the same signal, but will allow local speech in the room to activate microphones.

Since the EF1210 performs echo cancellation on the individual channels before mixing, it is not affected by the automatic mixer. Therefore, these precautions are not necessary (although it is always beneficial to provide good isolation between loudspeakers and microphones).

SPECIAL EQUIPMENT AND APPLICATIONS

Using Push-To-Talk Microphones

For optimal AEC performance, the push-to-talk switch should not mute the microphone element directly. Rather, it should provide a contact closure or TTL signal to the logic controls of the automatic mixer. If built-in switches are required, the Shure MX392, MX412D, and MX418D models of microphones are recommended. These should be configured in "Automatic Mixer Mode", which provides a logic signal but does not mute the microphone element. In many cases (such as with ceiling mounted mics), an external switch can be connected directly to the mixer's logic port.

When using push-to-talk mics in a system with the EF400, the “Mute In” logic function should be reconfigured to simply inhibit gating. This prevents the mics from being activated, rather than muting them entirely. This modification can be made by shorting jumper X1007 on the SCM410, or jumper X111 on the SCM810 and AMS8100 (as described in the respective manuals). When an EF1210 is used, this modification is optional. In general, the EF1210 will have better performance with push-to-talk microphones than the EF400.

Alternatively, the mute functions on the EF1210 may be used to provide push-to-talk or other muting functionality through RS-232 control.

Using Direct Outs

If direct outs of each microphone channel are needed for recording or other purposes, the EF1210 is recommended. Since the EF1210 provides echo cancellation on each channel, each of these direct outs will have the echo removed. The EF400 may be used, but the direct outs from the automatic mixer may have audible acoustic echo since the echo cancellation is performed after the mix. Generally, the EF1210 and the SCM810 are recommended if direct outs are needed.

Dynamics Processing

A dynamics processing device, such as the DP11EQ, may be useful for providing constant levels to and from the room. For instance, compression may be used on the output of a codec (or multiple codecs in a bridge) to provide consistent levels from various remote systems. The DP11EQ may be used with any combination of EchoFree echo cancellers and Shure automatic mixers.

Dynamics processors may complicate things for echo cancellers, depending on how drastic the curves are. While in the nonlinear parts of the curve, the processor will be changing gain frequently. With very subtle amounts of dynamics processing, this may not affect the echo canceller. But to be on the safe side, we recommend placing the DP11EQ outside the echo path.

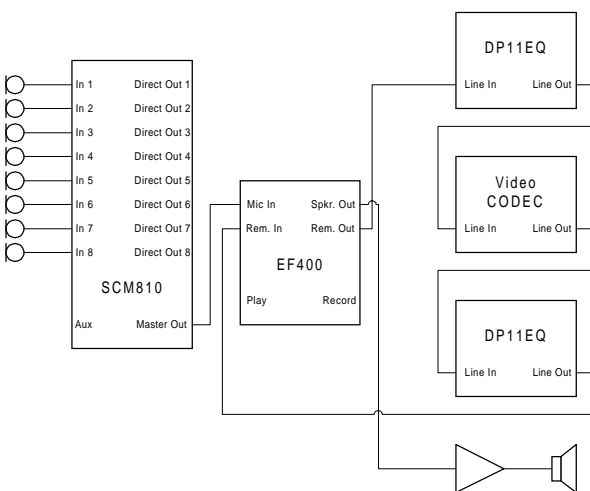


Figure 3a: Recommended placement of DP11EQ in an EF400 system.

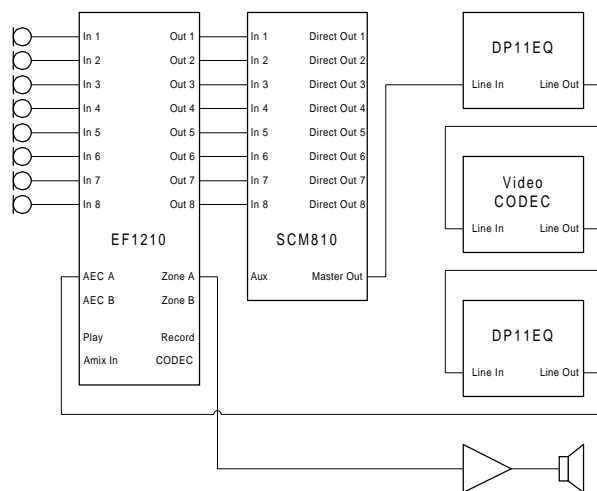


Figure 3b: Recommended placement of DP11EQ in an EF1210 system.

Feedback Reduction

A feedback reducer, such as the Shure DFR11EQ, may be useful for reducing feedback in systems with both sound reinforcement and conferencing. Any combination of ASPI Digital echo cancellers and Shure mixers will work with the DFR11EQ. Feedback reduction is not needed in systems without sound reinforcement.

The adaptive notch filters used to reduce feedback in the DFR11EQ change the room response as they change frequency. The echo cancellers in the EF400 and EF1210 should not have trouble keeping up with these changes. However, if the sound reinforcement system is turned up near feedback, these adaptive notches may move around much more and affect the performance of the AEC.

CONFIGURING THE MIXERS

SCM810

On the input channels to the SCM810, set the MIC/PHM/LINE 3-position slide switches behind the connectors according to the type of microphone (or other device) being used on each channel. For the EF1210, these should all be set to LINE.

We strongly recommend the following settings for the DIP switches on the SCM810 rear panel when used with the EF400. These settings are also recommended (but not as crucial) for the EF1210.

Table 1: Recommended SCM810/AMS8100 DIP Switch Settings

Switch #	1	2	3	4	5,6	7
Setting	Up	Down	Up	Up	Up,Up	Up
Switch Function	Auto	Last mic off	0.4 second Hold Time	15 dB Off Attenuation	Limiter Off	Global Linking

The hold time (switch 4) and linking mode (switch 7) are not critical to the performance of the AEC. However, the mixer connected to the EF400 should generally be in global mode so that all microphones in the system are sent to the remote site. When multiple mixers are linked, the others may be set for local linking.

SCM410

We strongly recommend the following settings for the DIP switches on the SCM410 rear panel when used with the EF400. These settings are not as important for the EF1210, but are still recommended.

Table 2: Recommended SCM410 DIP Switch Settings

Switch #	1	2	3	4
Setting	Up	Down	Down	See text
Switch Function	Last Mic Off	Line Level Out	Limiter Off	Phantom Power

The phantom power (switch 4) setting will vary depending on the application. Phantom power should always be OFF when used with the EF1210. For most applications using the EF400,

this switch will be ON (in the up position). To disable phantom power on some channels but not others, remove resistor R1005, R2005, R3005, or R4005 for channels 1 through 4, respectively.

The EF1210 provides line level outputs, but the SCM410 has mic level inputs. Modify the SCM410 for line level inputs by removing resistors R1005, R1006, R2005, R2006, R3005, R3006, R4005, and R4006 (as described in the SCM410 manual).

FP410

The outputs of the mixer should be set to line level. The inputs should be set to line level for use with the EF1210. The inputs can be set to mic or line level for the EF400, depending on the input source (usually mics). These switches are on the back panel, next to the connectors. Phantom power should always be off when used with the EF1210, but will probably be on when used with the EF400.

On the front panel, the MANUAL/AUTO slide switch should be set to auto, and the LIMITER IN switch should be off for use with the EF400.

Some of the switches beneath the battery cover may also need to be adjusted. We recommend setting OFF ATTEN to 13 dB, HOLD TIME to 0.4 sec, and LAST MIC LOCK-ON to out for use with the EF400 (this is not as important with the EF1210). The other switches do not affect the operation of the EF1210 or EF400.

AMS8100 with EF400

The configuration for the SCM810 is also recommended for the AMS8100 when used with the EF400.

The AMS8100 cannot be used with the EF1210, due to the unique design of the AMS microphones and AMS8100 input circuitry. The EF1210 is designed to operate between the microphones and the mixer, and cannot interface with this circuitry.

EF1210 vs. EF400: WHICH IS BEST?

The EF400 and EF1210 are both versatile enough to work in the vast majority of situations. There are some circumstances, however, when one of these products is more appropriate than the other.

The EF400 is particularly suitable for:

- Small systems (four or less mics).
- Roll about videoconferencing.
- Large systems with strict budgets.
- Replacement of obsolete echo cancellers.
- Upgrading from internal video codec AEC.

We recommend using the EF1210 for:

- Large amounts of ambient noise.
- Rooms with very difficult acoustics or harsh gating requirements.
- Push-to-talk mics or direct outs.
- Large systems (more than four mics) where quality is at a premium.
- Room combining, or splitting one EF1210 between two rooms.

NEED MORE HELP?

Whether you're new to ASPI Digital products, or trying them in new applications, you may have questions about how they should fit into your system. ASPI Digital's Applications Engineers are ready to help. We'll look at your situation and recommend a system that provides the performance you need, and fits your budget. Just call us at (800) 932-ASPI (2774) or drop us an email at help@aspi.com. Or, if you like, you can fax us at (404) 892-2512 with a block diagram and detailed description of equipment in the room. We'll get back to you within a day or two with some recommendations that will provide the best quality conferencing possible.