



**Distance Learning Applications using
Rane Corporation's
Engineered Conference System
(ECS) Products
By: Mike Slattery**

INTRODUCTION

How does the Rane Acoustic Echo Canceller Work?

Rane Corporation's Acoustic Echo Canceller (AEC) algorithm uses the patented features of the Engineered Conference System. One such feature is the Rane exclusive Smart Last-On™ to precondition the AEC for a microphone gate change. So when a new microphone gates open, the AEC is ready and willing to remove the echo. Rane calls this algorithm QuickAdapt™.

I'm told that I cannot use a standard Push-To-Talk Microphone.

In the past you always had to leave a microphone opened in front of an AEC. This was to allow the AEC to maintain its adaptation. With current multi-channel AECs you must use a five wire Push-To-Talk Microphone, where the microphone is always open and the push-to-talk button is used to open and close the microphone channel after the AEC.

The Rane AEC looks for a microphone mute condition and if one occurs the QuickAdapt™ algorithm takes over. So go ahead and use those standard Push-To-Talk microphones, we don't care.

ECS Features

- Professional audio quality
- Stereo option
- Up to 48 microphones
- QuickAdapt™ Acoustic Echo Canceller algorithm
- Smart Last-On™ rejects unwanted noises like coughs and paper ruffling from becoming the Last-On microphone and triggering a camera to these unwanted locations.
- Digital Hybrid
- Both AMX™ and Crestron™ software available at <http://www.rane.com/raneware.html>
- Low Cost

What is Smart Last-On™?

Smart Last-On™ is a patented process to improve the microphone gating of the automatic mixer by adding delay between the time it takes a microphone to go from a gated Mic to a Last-On Mic. A microphone that gates open on a typical automatic mixer set to Last-On remains open until another microphone gates open. This new gated microphone then becomes the new Last-On Mic. Unlike other automatic mixers, Smart Last-On allows each individual microphone to be set as either Last-On or Gated. A microphone set as Last-On requires the presence of speech for a time exceeding an adjustable delay before it becomes the Last-On Mic. This adjustable delay is called Master Mic Delay, and the Last-On Mic is called Master Mic. For example; If a noise like a cough gates open a microphone and the length of the cough does not exceed Master Mic Delay, the microphone gates off after the cough and the Master Mic does not change.

Another benefit of Smart Last-On™ is Video-Follow-Audio applications. By requesting the Master Mic and Mic Signal status information via the RS-232 port on the ECB 62e, camera presets can be recalled. This greatly reduces the cost of these systems by using only the RS-232 port on the ECB 62e and not the Mic status connector and a bunch of input cards on a control system.

Types of Video-Follow-Audio Systems

- Fully Automatic using the Mic status from the auto-mixer
- Five-Wire Push-To-Talk Microphones wired to an input card on a control or camera system
- Return-Home systems go to a wide-angle room preset when speech or the Push-To-Talk Microphones are not detected within five seconds

To implement a Fully Automatic Video-Follow-Audio system with ECS it is best to poll the ECB 62e for its Master Mic at least every $\frac{1}{2}$ second. If the Master Mic changes, recall the preset for the camera at the new Master Mic location. Setting the Master Mic Delay to 0.5 seconds reduces the chance that unwanted noises will cause the camera preset to change.

Instead of using those expensive five-wire push-to-talk microphones to control camera presets, ECS allows you to use standard three wire push-to-talk microphones. Use the Master Mic feature on ECS to determine the location of the person that pushed the microphone button. If you want the camera to instantly go to the active microphone location, set the threshold levels on the push-to-talk microphones to -30dB and the Master Delay to 0.05 seconds.

Return-Home systems require detecting speech or pushing a microphone button. As long as speech or the microphone button is detected the camera remains on the talker. Five seconds after the talker quits speaking or releases the microphone button, the camera goes to a wide-angle room preset. Along with the Master Mic information from ECS, a Mic Signal status flag can be requested. Use the Mic Signal status flag to set the camera preset to the Master Mic position when it is true (Someone is talking). If the Mic Signal status flag goes false (None is talking), recall the wide-angle room preset.

Distance Learning using Front Speaker for both Program Audio and Speech Reinforcement of the Teachers' Mics

Fig. 1 illustrates using ECS in a Distance Learning application requiring:

- Mono Program audio
- Speech reinforcement of multiple teacher microphones using the front speakers
- Up to 24 student microphones
- Acoustic Echo Canceller
- Audio support for a Video Codec
- Telephone Add-On
- Assistant Listening
- Audio support for the Campus Control Room
- Password protected Remote Diagnostics

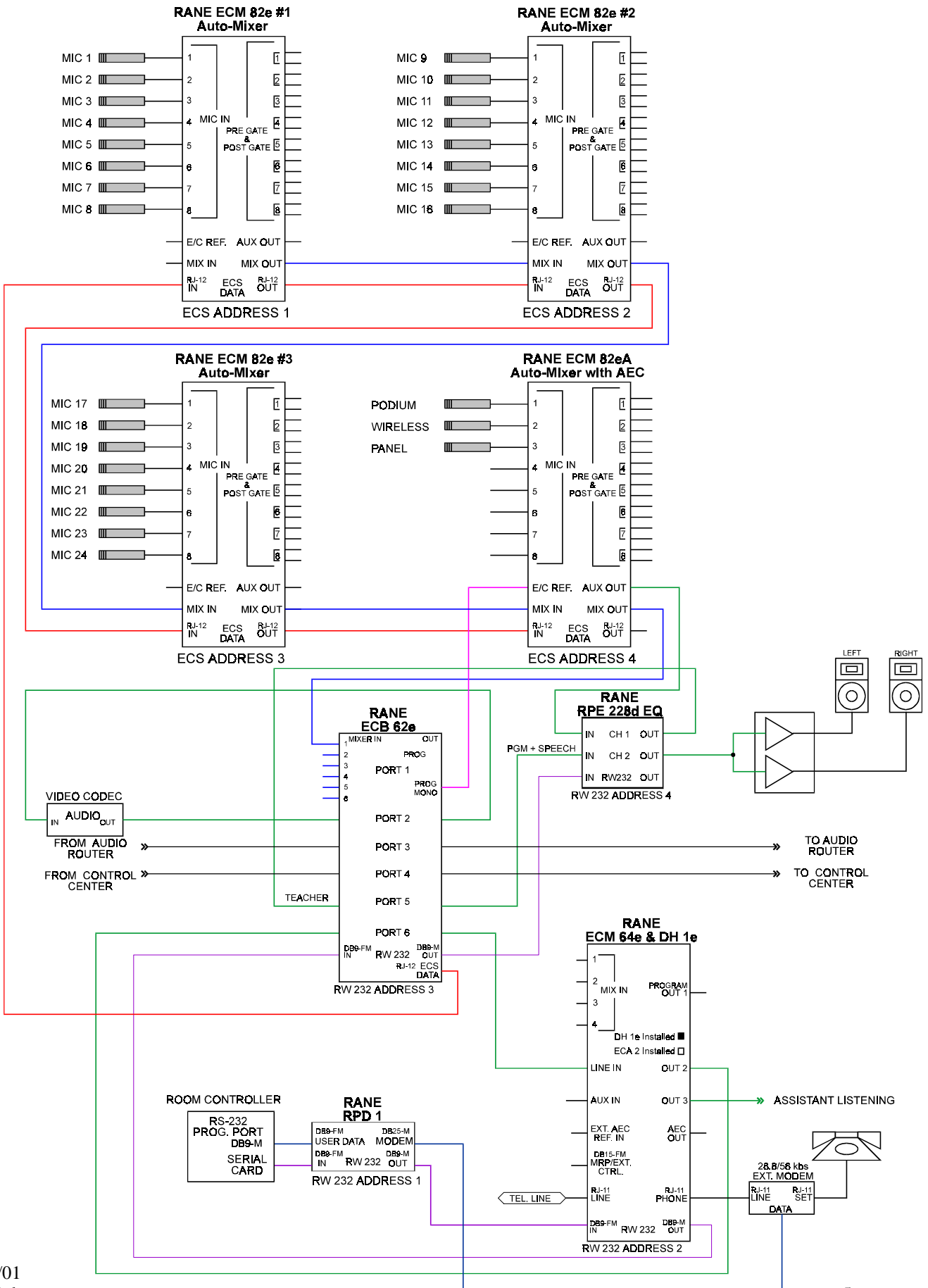
In this application all audio sources including the teachers' microphones are played on front mounted speakers. Placing only the teachers' microphones on the ECM 82eA allows the Aux Output for this mixer to be used for the speech reinforcement of only the teachers' microphones. Since ECS uses Port 1 (Program output) for echo canceller reference and detecting when audio is present at the room speakers, room microphones should not be routed to this output. To solve this problem output Port five is used for the program speakers. One drawback to this design is the teachers' microphones will generally be pointing towards these speakers, it may be difficult to produce adequate speech reinforcement without feedback. A better solution is shown with next system, where the teachers' microphones are reinforced using distributed ceiling speakers.

To improve audio quality separate equalizers are used for both speech reinforcement and program audio. This allows for bandwidth limiting and notch filters to be added to the speech reinforcement audio without affecting the program audio. Speech reinforcement (ECM 82eA Aux Out) is first processed through Channel 1 of the RPE 228d before it is mixed with the program audio in the ECB 62e. Port 5 out on the ECB 62e contains both program and speech reinforcement audio. This output is processed through Channel 2 of the RPE 228d.

Rane Equipment list:

Qty.	Model Number	Description
3	ECM 82e	ECS Auto-Mixer
1	ECM82eA	ECS Auto-Mixer with AEC
1	ECB 62e	ECS Base Unit
1	ECM 64e	Conference System
1	DH 1e	Digital Hybrid for the ECM 64e
1	RPE 228d	Programmable EQ
1	RPD 1	Remote Diagnostic Unit
1	RS 3	Power Supply

Fig. 1



Distance Learning with Program Stereo and Ceiling Speaker Speech Reinforcement of the Teachers' Mics

Fig. 2 illustrates using ECS in a Distance Learning application requiring audio support for:

- Stereo Program audio
- Speech reinforcement of multiple teacher microphones using ceiling speakers
- Up to 24 student microphones
- Acoustic Echo Canceller
- Video Codec
- Telephone Add-On
- Assistant Listening
- Campus Control Room
- Password protected Remote Diagnostics

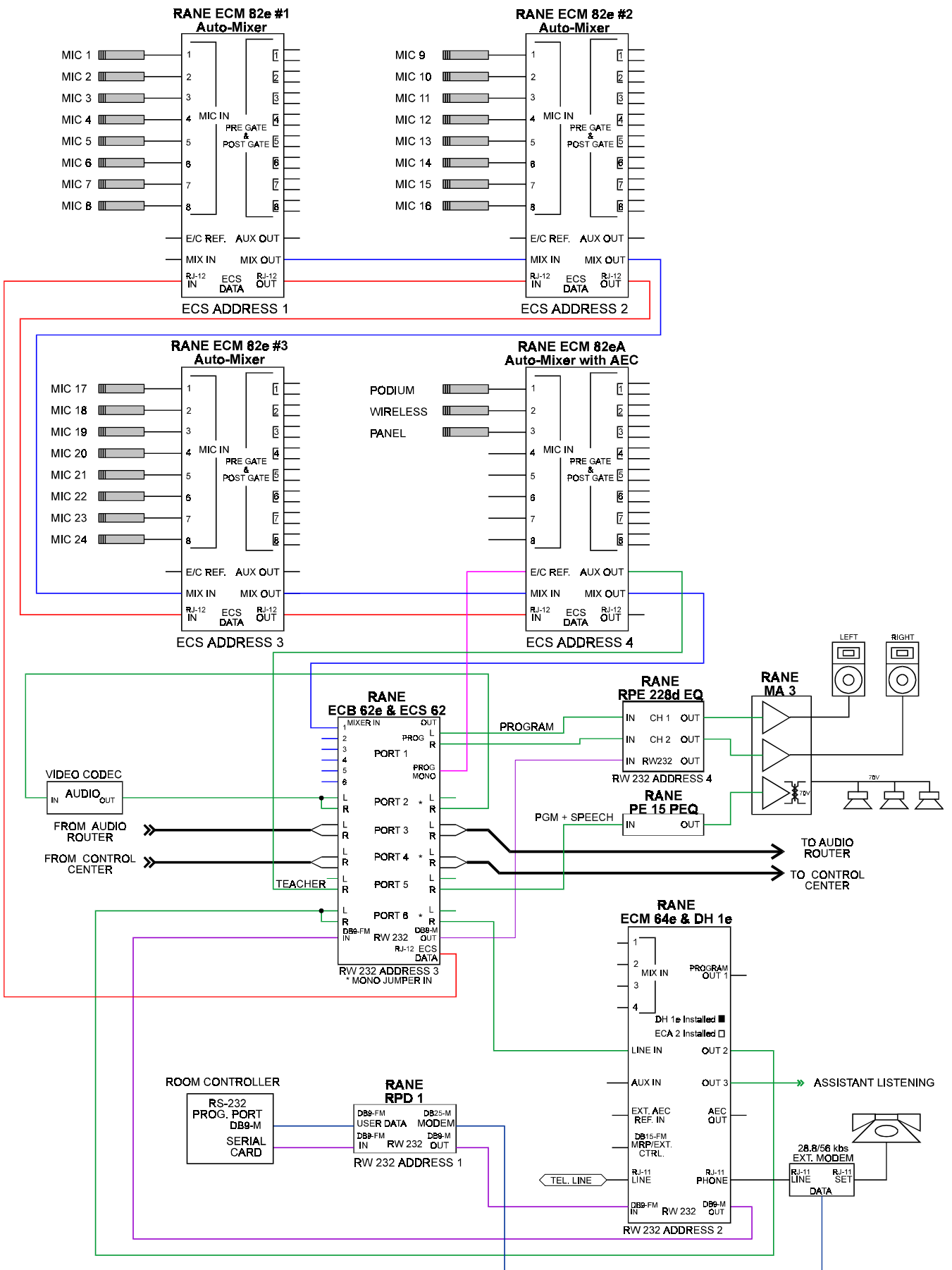
In this application program audio sources including videoconferencing and phone-add are played on the front and ceiling speakers. Routing the teachers' microphones only to the ceiling speakers improves the speech reinforcement. Placing only the teachers' microphones on the ECM 82eA allows the Aux Output for this mixer to be used for the speech reinforcement of the teachers' microphones only.

To improve audio quality separate equalizers are used for both speech reinforcement and program audio. This allows for bandwidth limiting and notch filters to be added to the speech reinforcement audio without affecting the program audio. Using the Rane MA 3 amplifier is a perfect solution for this type of system, since it has three channels with each output having an optional *internal* 70.7 V distribution transformer.

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3	ECM 82e	ECS Auto-Mixer
1	ECM82eA	ECS Auto-Mixer with AEC
1	ECB 62e	ECS Base Unit
1	ECS 62	Stereo Module for the EB62e
1	ECM 64e	Conference System
1	DH 1e	Digital Hybrid for the ECM 64e
1	PE 15	Parametric EQ
1	RPE 228d	Programmable EQ
1	RPD 1	Remote Diagnostic Unit
1	MA 3	3 Channel Power Amp
1	TF 407	70 volt Transformer
1	RS 3	Power Supply

Fig. 2



Distance Learning with Push-To-Talk Student Microphones, Program Stereo, and Ceiling Speaker Speech Reinforcement of the Teachers' Mics

Push-to-talk microphones are very common in distance learning applications. Fig. 3 illustrates using ECS in a Distance Learning application requiring audio support for:

- Stereo Program audio
- Speech reinforcement of multiple teacher microphones using ceiling speakers
- Up to 24 push-to-talk student microphones
- Acoustic Echo Canceller
- Video Codec
- Telephone Add-On
- Assistant Listening
- Campus Control Room
- Password protected Remote Diagnostics

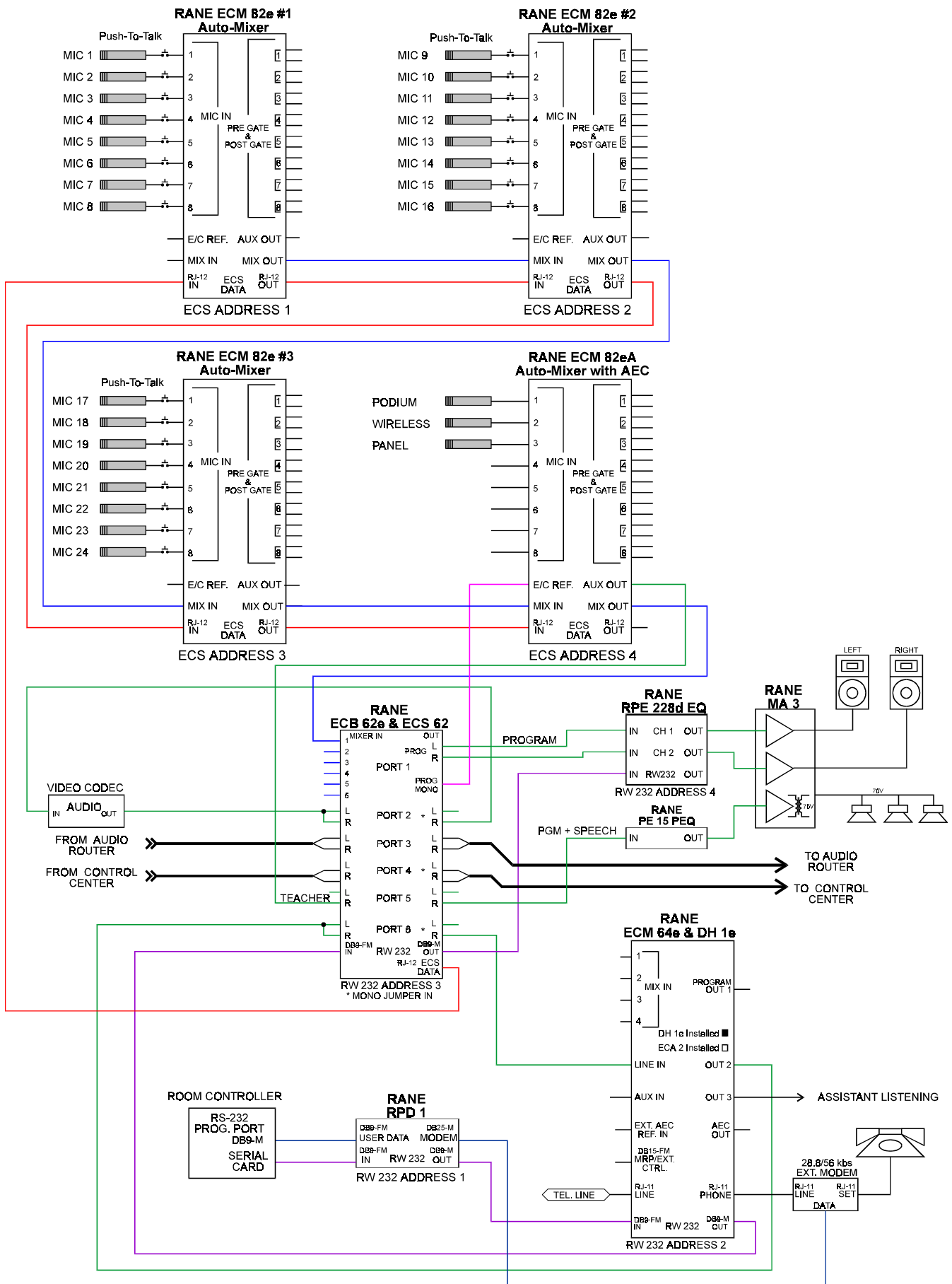
In this application program audio sources including videoconferencing and phone-add are played on the front and ceiling speakers. Routing the teachers' microphones only to the ceiling speakers improves the speech reinforcement. Placing only the teachers' microphones on the ECM 82eA allows the Aux Output for this mixer to be used for the speech reinforcement of the teachers' microphones only.

To improve audio quality separate equalizers are used for both speech reinforcement and program audio. This allows for bandwidth limiting and notch filters to be added to the speech reinforcement audio without affecting the program audio. Using the Rane MA 3 amplifier is a perfect solution for this type of system, since it has three channels with each output having an optional *internal* 70.7 V distribution transformer.

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Qty.	Model Number	Description
3	ECM 82e	ECS Auto-Mixer
1	ECM82eA	ECS Auto-Mixer with AEC
1	ECB 62e	ECS Base Unit
1	ECS 62	Stereo Module for the EB62e
1	ECM 64e	Conference System
1	DH 1e	Digital Hybrid for the ECM 64e
1	PE 15	Parametric EQ
1	RPE 228d	Programmable EQ
1	RPD 1	Remote Diagnostic Unit
1	MA 3	3 Channel Power Amp
1	TF 407	70 volt Transformer
1	RS 3	Power Supply

Fig. 3



Distance Learning with THX Surround Sound and Mix-Minus Speech Reinforcement

Fig. 4 illustrates using ECS in a Distance Learning application requiring audio support for:

- Stereo Program audio with THX Surround Sound
- Mix-Minus speech reinforcement of all microphones using ceiling speakers
- Up to 24 student microphones
- Acoustic Echo Canceller
- Video Codec
- Telephone Add-On
- Assistant Listening
- Campus Control Room
- Remote diagnostics from the Campus Control Center or the Internet

Since this application requires THX Surround Sound, the conferencing audio must be separated from the program audio. This is done to reduce the chance of the surround sound processor interfering with the acoustic echo canceller. In this application program audio sources are processed through the surround sound processor and the conferencing audio is played on the front center and ceiling speakers.

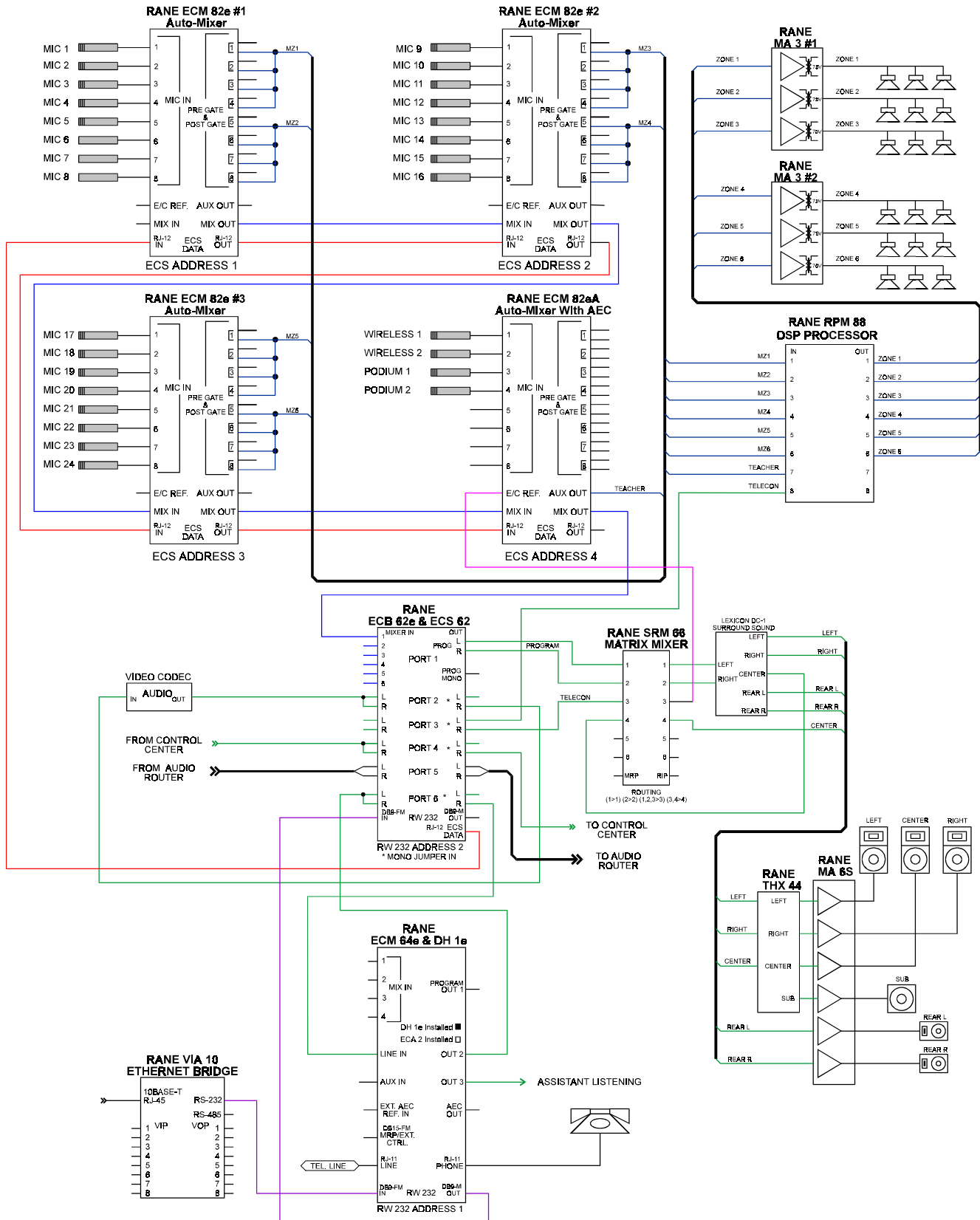
To improve speech reinforcement a six zone mix-minus system is utilized. This allows microphones on one area to be played on ceiling speakers in other areas. To achieve a mix-minus system microphones are grouped together into Mic Zones and routed to speaker zones using a matrix mixer. By tying the Post-Gate outputs on the ECM 82e Mic zones can be created reducing the number of inputs on the matrix mixer. For more information on Mix-Minus speech reinforcement see RaneNote 140 <http://www.rane.com/pdf/note140.pdf> . The matrix mixer for this system is processed in the Rane RPM 88, which also includes all of the equalizers.

This system required that remote diagnostics be accessible via Campus Control Center or the Internet. This meant that the Rane equipment had to be connected to Ethernet. A Rane Via 10 Ethernet Bridge is added to control the Rane equipment via Ethernet. Since the Via 10 communicates using UDP type protocol, Crestron does not currently support the Via 10. For Crestron a relay can be added to switch between the Via 10 and Crestron Control. See Fig. 5 for more information. AMX Netlinx does support UDP type protocol, but you must stop all communication between the AMX and the Via 10 before running RaneWare.

Rane Equipment list:

Qty.	Model Number	Description
3	ECM 82e	ECS Auto-Mixer
1	ECM82eA	ECS Auto-Mixer with AEC
1	ECB 62e	ECS Base Unit
1	ECS 62	Stereo Module for the EB62e
1	ECM 64e	Conference System
1	DH 1e	Digital Hybrid for the ECM 64e
1	SRM 66	6 x 6 Matrix Mixer
1	RPM 88	8 x 8 DSP Processor
1	THX 44	THX EQ
1	VIA 10	Ethernet Bridge
2	MA 3	3 Channel Power Amp
6	TF 407	70 volt Transformer
1	MA 6	6 Channel Power Amp
1	RS 3	Power Supply

Fig. 4



Controlling RW 232 Devices using both a Control System and the Rane Via 10

In most room configurations a control system is connected to an RW 232 device using RS-232. If a system administrator wishes to remotely operate an RW 232 device using Ethernet, an RS-232 AB switch or a relay must be used to select between the RS-232 of the control system and the Via 10. If using a relay, the position of the relay can be performed using one of the open collector outputs of the VOP (Versatile Output Port) on the Via 10.

In this example the RW 232 device is connected to the common pins, the control system is connected to the normally closed pins, and the Via 10 is connected to the normally open pins of a 12 volt DPDT (Double Poll Double Throw) relay. To operate the relay the Via 10 supplies both the +12 volt power and control using the +12 Pin and Pin 8 of the VOP. The Rane supplied VIP/VOP Tester program, called **vipvop.exe**, can then be used to select between the control system and the VIA 10. Both the VIP/VOP Tester and RaneWare program can operate at the same time.

To operate the system using the Via 10, you must first assign an IP address to the Via 10, RaneWare program and the Via 10 VIP/VOP Tester. The easiest way to assign the IP address to the Via 10 is to use a crossover cable between a PC and the Via 10. To assign the Via 10 IP address, first place the Via 10 into a configuration mode by pressing in the **CONFIG** button during power-up of the Via 10. The **PWR** LED will flash. Run the Via 10 Config program, **viaconfig.exe**, enter the IP address and press **Send Addr** button. If successful, unplug the Via 10 and connect it to the network. Enter the same IP address for both the RaneWare program and the Via 10 VIP/VOP Tester. In the RaneWare program select Via-10 for connection type within the System Setup dialog. For more information see page 4 of the Via 10 Manual.

To switch between the control system and the RaneWare program, run the Via 10 VIP/VOP Tester and press the **Connect** button. For RaneWare operation check **VOP 8**. For control system operation uncheck **VOP 8**.

Note that the Via 10 is only a 10Base-T device, so make certain that your hub and Ethernet card supports 10Base-T.

Other features that the Via 10 can support are turning on and off the control system or room, locking the room, and monitoring the control system, audio levels and temperature.

Another method is to use a serial auto switch instead of the relay.

Fig. 5

