

Quick Start

The ECM 64 is a very versatile product with many applications. This section will help you with basic setup, then use the Contents below to find the detail you need for your specific application.

Although the ECM 64 or ECM 64AD are configured to operate ‘out of the box’, to get the best performance please review this manual for proper configuration and alignment (see page Manual-12). The ECM 64AD includes both the DH 1 Digital Hybrid and the ECA 1 Echo Canceller. If you are using the ECM 64 without these options, hardware and software references to them in this manual will not apply.

The ECM 64 is configured using **RaneWare®** software. To become familiar with the ECM 64 signal routing, you can load and run RaneWare on a PC before connecting the ECM 64. In RaneWare, click on the **Device** button and select **Offline ECM 64**. This creates a virtual product which is fully operational, even saving and recalling system files as if it were a real unit. Press F1 at any time to get help, then get information about any feature by clicking on it. Here at Rane, we spend a lot of time putting together very informative help files, so please use them — you’ll help us feel appreciated!

Before connecting any cables to the ECM 64, unplug the RS 3 power supply and turn the amplifier(s) down or off until all connections are complete. Connect balanced audio **INPUTS** and **OUTPUTS** to the handy Euroblock connectors.

Connect the **RW 232 INPUT** jack to a serial (COM) port on a PC-compatible computer using a standard 9-pin RS-232 cable (a short one is supplied with the unit, intended to connect between multiple RW 232 units in a rack). *The cable or adaptor must **not** be a null-modem type.* If this unit is to be used by itself, set the **RW 232 DEVICE ADDRESS** switch to ‘1’ by setting all switches *off* (down), except switch one (labeled ‘1’ on the chassis, the right-most switch). If there is more than one unit, refer to “Setting the Device Address” on page Manual-7 to set a unique number.

After all connections are made, connect the RS 3 remote power supply and line cord. **CAUTION: don’t connect anything but an approved Rane power supply.** If the RS 3 and the ECM 64 are getting power, the yellow **POWER** indicator lights.

Start your computer running Windows®, and launch **RaneWare**. Select **System Setup** from the **System** menu. Be sure to select the **COM** port which is physically connected to the ECM 64 and **RS-232** under **Connection**, and click **OK**. Now, choose **Select** from the **Device** menu. Click on **Poll**, and **Devices Found** displays the number of units. Click the **Stop** button. Select the unit listed in the **Device Selection** window and click **OK**. If no unit was found, refer to the “Troubleshooting” section on page Manual-13.

Several clues indicate communication between the computer and the ECM 64. The yellow **COM** (communications) indicator should flash periodically. The **Memory** numbers (**1-16**) near the top of the RaneWare screen should be *black* rather than gray.

Most echo problems are caused by improper microphone placement and gain. To achieve good acoustic echo canceller performance, setup is critical. Follow the “Alignment Procedure” on page Manual-12.

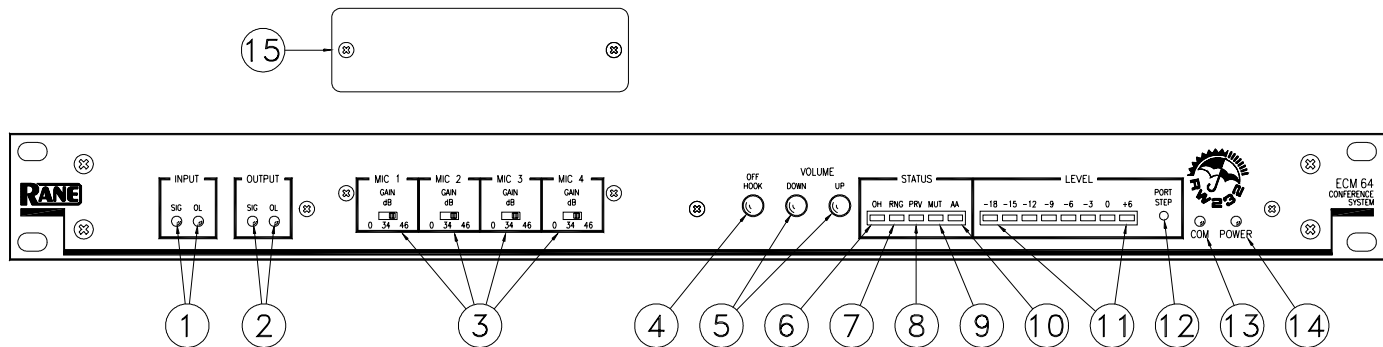
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Hardware

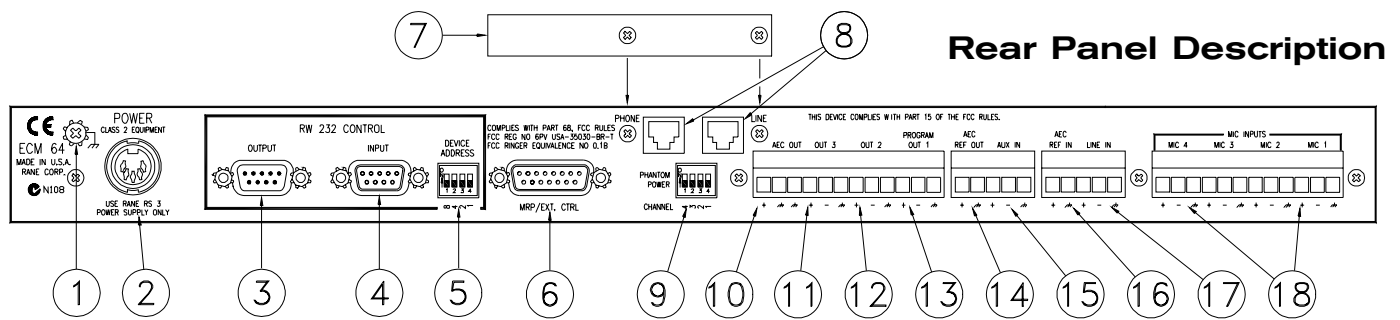
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Front Panel Description



- ① **INPUT SIG and OL level indicators:** SIG lights when the Input signal (before trim) is above -25 dBu for Mics and -19 dBu for Line inputs. OL lights when the Input signal (before trim) is within 2 dB of clipping.
- ② **OUTPUT SIG and OL level indicators:** SIG lights when the Output signal is above -19 dBu. OL lights when the Output signal is within 2 dB of clipping. Use the INPUT and OUTPUT level indicators to check correct signal flow.
- ③ **GAIN Switches:** Selects Input Gain between 0 dB (line level), 34 dB (most mics), or 46 dB.
- ④ **OFF HOOK button:** Toggles between Off Hook (conference mode) and On Hook. The front panel OH indicator lights when the ECM 64 is in conference mode and the telephone line has been seized. This button can be disabled using the FP Lock in RaneWare.
- ⑤ **VOLUME UP & DOWN buttons:** When UP is pressed Out 1's level is increased. When DOWN is pressed, Out 1's level is decreased. These buttons can be disabled using the FP Lock in RaneWare.
- ⑥ **OH Indicator – Off Hook:** When lit, the ECM 64 is in conference mode. The DH 1 must be installed to light this indicator.
- ⑦ **RNG Indicator - Ring:** When lit, there is an incoming call.
- ⑧ **PRV Indicator - Privacy:** When lit, the ECM 64 is in privacy mode and all Mic Inputs are muted.
- ⑨ **MUT Indicator - MUTE:** When lit, all ECM 64 Outputs are muted.
- ⑩ **AA Indicator – Auto Answer:** When lit, the ECM 64 has been placed in Auto Answer and will accept an incoming call when the number of rings matches the set ring count.
- ⑪ **LEVEL meter:** Selectively displays any one of the inputs or outputs by using RaneWare or the PORT STEP button (see ⑫). This display is also used for status display, PORT STEP meter selection and errors.
 - During download programming, the **-6 LED** flashes by itself indicating program data is transferring.
 - During RW 232 operation, if the **-3 LED** flashes by itself, an RW 232 receive parity error occurred.
 - During download programming, if the **0 LED** lights by itself, the download program checksum does not match. The ECM 64 will not accept the program.
 - If the **+6 LED** lights by itself either the system not ready, an RW 232 overflow has occurred or a flash memory error has occurred. To remedy, cycle the power off, then back on.
- ⑫ **PORT STEP button:** Pressing this for 1 second causes the LEVEL meter to flash its currently monitored Input or Output. If this button is pressed and held for 3 seconds, the monitored port can be changed by pressing the button in 1 second steps. The LEVEL Meter LEDs will step Mic Mix (-18), Line In (-15), Aux In (-12), Hybrid In (-9), Out 1 (-6), Out 2 (-3), Out 3 (-0) and Hybrid Out (6), then back to Mic Mix (-18).
- ⑬ **COM indicator:** flashes randomly when receiving valid data from the control system or PC. *If the DEVICE ADDRESS is set to 0, this indicator flashes steadily at ½ second intervals.*
- ⑭ **POWER indicator:** Lights when the ECM 64 operating system is running.
- ⑮ **Security cover:** Installs over the GAIN switches once they are set.



- ① **Chassis ground point:** A #6-32 screw is supplied for chassis grounding purposes. Although the RS 3 supplies a third wire ground, some installations may require that all audio equipment be tied together using a grounding bus.
- ② **POWER input jack:** This 5-pin DIN connects to the included RS 3 power supply. **Warning! Connect the power supply DIN connector to the ECM 64 BEFORE connecting to AC power, otherwise damage may occur.**
- ③ **RW 232 CONTROL - OUTPUT:** This DB-9 male connects to downstream RW 232 units.
- ④ **RW 232 CONTROL - INPUT:** This DB-9 female connects to the RS-232 output of the controller (or PC), or the OUTPUT of another RW 232 unit connected to the controller. Rane uses a standard RS-232 interface using Rane's RW 232 protocol operating at 19.2 kb. Units connect by daisy-chaining the products on a serial bus, OUTPUT to INPUT.
- ⑤ **RW 232 CONTROL - DEVICE ADDRESS:** Sets the RW 232 address for the ECM 64. Each RW 232 unit connected together requires a different address. If the RW 232 Control Device Address is set to an invalid address, the COM indicator continually flashes. *The Device Address can be changed without power cycling the unit. See page #.*
- ⑥ **MRP/EXT. CTRL:** is a DB-15 female connector used for remote functions. See Memory Recall Port / External Control on page Manual-7.
- ⑦ **DH 1 cover plate:** is supplied with ECM 64 units that do not include the DH 1 Digital Hybrid. The ECM 64AD includes the DH 1, therefore the plate is not supplied.
- ⑧ **PHONE and LINE:** These 4-pin RJ-11 jacks magically appear when the DH 1 is installed, included with the ECM 64AD. The PHONE jack connects to a standard two-wire POTS telephone. This connection is disconnected when the ECM 64 is Off Hook. The LINE jack connects to a standard two-wire POTS line.
- ⑨ **PHANTOM POWER switches:** select Phantom Power to each individual MIC Input.
- ⑩ **AEC OUT:** is an unbalanced line-level Output. This delivers direct access to the ECA 1 Acoustic Echo Canceller's Output, when installed. The ECA 1 is included in the ECM 64AD. This may be useful in larger system configurations.
- ⑪ **OUT 3:** is a balanced line-level Output for general purpose, typically connected to a VCR's input.
- ⑫ **OUT 2:** is a balanced line-level Output for general purpose, typically connected to a Video Codec's input.
- ⑬ **PROGRAM (OUT 1):** is a balanced line-level Output, typically connected to the room's program loudspeaker amplifier. This Output can also be assigned to the ECA 1 Acoustic Echo Canceller Reference in RaneWare.
- ⑭ **AEC REF OUT:** is an unbalanced line-level Output. This connects to what is being sent to the ECA 1 Acoustic Echo Canceller's Input, when installed. The ECA 1 is included in the ECM 64AD. This may be useful in larger systems.
- ⑮ **AUX IN:** is a balanced line-level Input, typically connected to a VCR's output.
- ⑯ **AEC REF IN:** is an unbalanced line-level Input. Use this when the Reference for the ECA 1 Acoustic Echo Canceller needs to come from an external source. In RaneWare select EXT. IN as the AEC REF.
- ⑰ **LINE IN:** is a balanced line-level Input, typically connected to the video codec's output.
- ⑱ **MIC INPUTS:** Four Mic or Line balanced Inputs via a 12-pin Euroblock. These Inputs route to the matrix mixers and the ECA 1 Acoustic Echo Canceller Input.

Typical ECM 64AD Installation

The ECM 64AD is preprogrammed to operate out of the box using the following system configuration. Run RaneWare, choose Device > Restore Memories from File, and load the ECM 64 file AP1.C64. In this example we will not use custom names, just the defaults to keep things clearer.

In this configuration:

- Mic Mix is routed to the AEC IN
- Out 1 is used for the AEC REF
- Line, AUX and HYBRID are routed to Out 1 (to the loudspeaker amplifier)
- AEC OUT, AUX and HYBRID are routed to Out 2 (to the video codec)
- Mic Mix, Line, AUX and HYBRID are routed to Out 3 (to the record VCR)
- AEC OUT, Line and AUX are routed to HYBRID.

The AP1.C64 file uses two Memories:

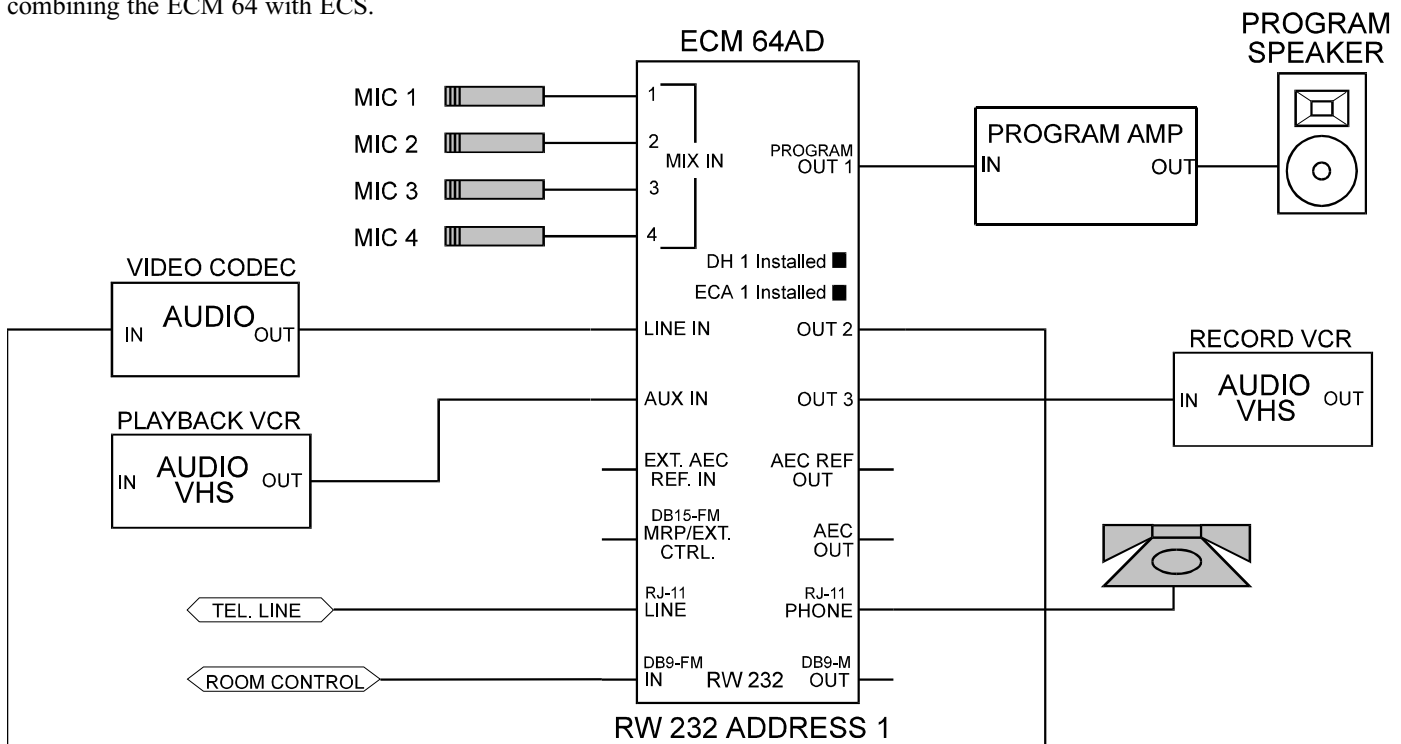
- Memory 1 is set for the above application
- Memory 2 allows local speech reinforcement.

In Memory 1, since Out 1 is used for the AEC Reference, Mics cannot be sent to Out 1 for local speech reinforcement. If Mics are sent to both the AEC Input and the AEC Reference, the AEC will not perform properly.

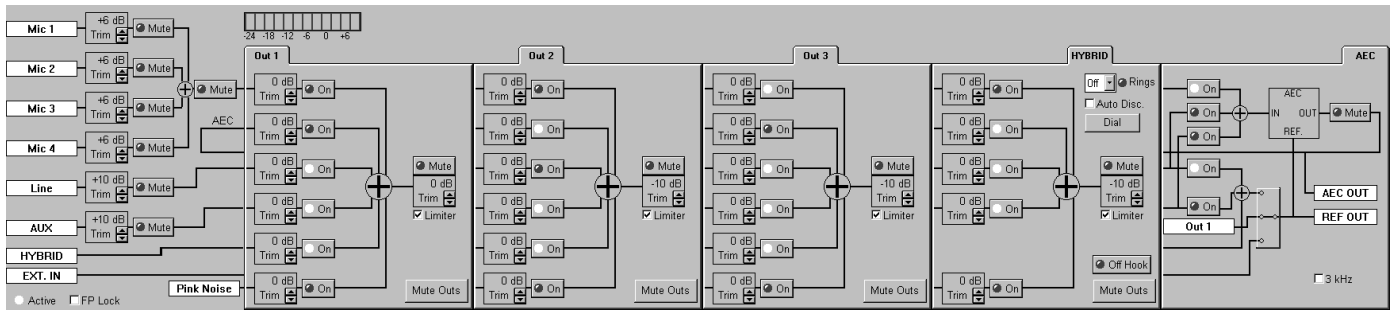
The Memory 2 application solves this problem by changing the AEC Reference from Out 1 to the mix of Line In and Aux In. Since Out 1's Limiter is no longer part of the AEC Reference, Memory 2 disables Out 1's Limiter.

See **Memory & Security** on page Manual-9 for more information.

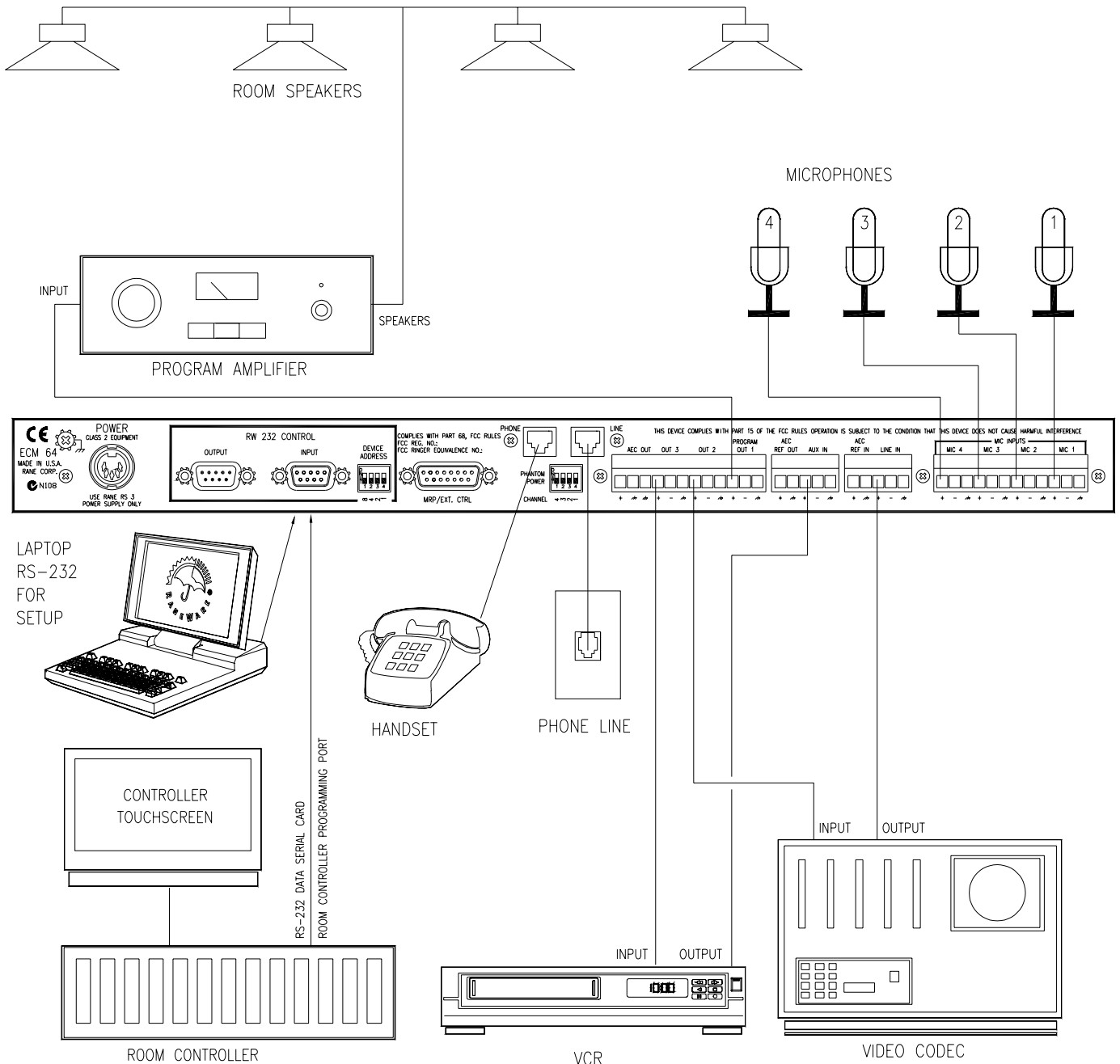
Refer to the Appendix for an example of a larger system combining the ECM 64 with ECS.



Typical ECM 64AD Installation



AP1.C64 RaneWare Screens



Wiring Diagram for Typical ECM 64AD Installation

Site Survey

Before you start any installation, be aware of these guidelines. For the ECM 64 to operate properly the following must be closely observed:

Ambient Noise Level - Air conditioning equipment (listen for rushing air from registers and rattling air ducts), fan noise from computer equipment, outside traffic noise, etc. Ideal is NC 25 - NC 30 (35 to 40 dBA).

Room Absorption and Reverberation Time - For proper operation, sound reflections must be held to a minimum. Use sound absorption materials and non-parallel walls or geometrical diffusers when possible. Ceilings should have an NRC (Noise Reduction Coefficient) rating of .75 to .80 and walls should have an NRC rating of .80 to .90.

Microphone and Loudspeaker placement - Boundary-type microphones spaced 4 to 6 feet apart work best. These microphones can reject about 12 dB of audio from the rear. Never aim a microphone directly at any loudspeaker. Loudspeakers are best placed at the front center of the room. Ceiling speakers can be used if placed one foot or greater behind the microphone, or four feet or greater in front of the microphone. Angled ceiling speakers work best.

Make certain that there is adequate rack space - Keep all ECS equipment in the same rack, along with plenty of ventilation and power outlets.

Loudspeaker Audio Processing - If near-end speech is not fed to the loudspeaker power amp, and any non-linear processing is done (limiters, delays, etc.) between the ECM 64 and the power amp, it is best to connect the same audio running to the power amplifier also to the AEC REF IN on the ECM 64, and in RaneWare set the AEC REF to External In.

Ceiling Microphones - These microphones are not recommended. If you must, the ceiling must be less than 10 feet in height, and the room must have very low noise with a high NC rating. Never place a microphone within 4 feet of an air conditioning register. Using techniques such as out-of-phase microphones or speakers may work in some rooms, but at best you will only gain about 6 dB of speaker to microphone cancellation.

Telephone Line - The telephone line should be a direct line to the telephone company's CO (Central Office). This line should not be shared by others, as this may cause ground loops.

ECM 64 Connection

Overview

Balanced 'Euroblock' audio connections are used throughout, except for the acoustic echo canceller connections.

To show the difference between hardware and software in this manual, hardware connections will be serifed ALL CAPS LIKE THIS and named the same as the control or connector on the ECM 64 front or rear panel. RaneWare controls and commands will be in Sans-serif type like this and match the defaults shown in RaneWare. Be aware that Inputs and Outputs may be given custom names in RaneWare and may not match the text in this manual after they are changed.

There are three methods to control the ECM 64: the front panel, RS-232 (RW 232), or contact closure.

Front Panel

There are three front panel functions:

1. VOLUME UP & DOWN
2. OFF HOOK.
3. PORT STEP

VOLUME UP & DOWN changes OUT 1's level. This may be superseded with a room controller such as AMX or Crestron.

OFF HOOK toggles between Off Hook (conference mode) and On Hook when the DH 1 is installed. This may be disabled by software. The OH indicator lights when Off Hook is in conference mode.

PORT STEP selects the currently monitored input or output of the level meter. See ⑫ on page Manual-2.

RS-232

RS-232 control is provided through the DB-9 female INPUT connector. RW 232 uses the same protocol as RS-232. Use a standard RS-232 cable to connect this RW 232 INPUT to the RS-232 connector on a PC-compatible or control system. If a Rane RW 232 device is already connected to the PC or control system, use the supplied short DB-9 connector to link the RW 232 OUTPUT of the upstream device to the ECM 64 RW 232 INPUT. Check that the RW 232 devices are set to different addresses (see **RW 232 Communications Interface** on page Manual-24). *Note: do not use a null-modem cable for RS-232 control.*

Memory Recall Port (MRP) / External Control

External contact closure control is provided through the DB-15 female MRP/EXT. CTRL connector providing:

- Recall of internal Memories
- Level control for OUT 1 using external up / down buttons
- Control and status signals for Off Hook, Privacy and Mute.

Complete programmability of the MRP is possible using RaneWare by selecting Device > Edit MRP Configuration.

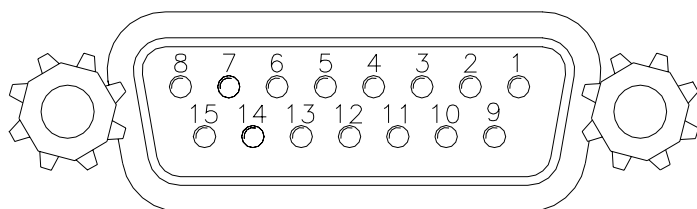
Rane does not supply an external control device to operate the ECM 64. Custom wiring recommendations:

- Use momentary or toggle-type switches to ground (pin 15) to operate the MRP Data pins.
- Use momentary switches to ground (pin 15) to operate the control pins.
- Status pins use open-collector type drivers that can sink 100 ma to ground.
- +5 Volts (pin 14) can be used as the power source for lamps, relays or LEDs connected to the status pins.

Connector type DB-15 female

Pin Description

1	MRP Data 1
2	MRP Data 2
3	MRP Data 3
4	MRP Data 4
5	Off Hook control
6	Out 1 Volume Up control
7	Ring status
8	Out 1 Volume Down control
9	Privacy control
10	Mute control
11	Off Hook status
12	Privacy status
13	Mute status
14	+5 Volts (1 amp maximum)
15	Gnd



MRP/EXT. CTRL

Setting The Device Address

The Device Address is set using a binary code which may be determined using the following table, our Windows Address Calculator program, or by adding the place values (1-15) silk-screened on the chassis. *Ignore all numbers printed directly on the switch.* For example, turning ON the switches labeled '1' and '2' yields address '3'. In the following table, 0 means switch *down* (OFF) and 1 means switch *up* (ON).

Rane also provides a special calculator to assist in setting the dip switches. After installing the software, in the RaneWare program group, launch the RaneWare 232 Address Calculator. This binary calculator converts decimal numbers into corresponding dip switch settings. *Since the ECM 64 only has a four position dip switch instead of an eight position, ignore the four left most digits.*

Address	Dip Switch	Address	Dip Switch
1	0001	9	1001
2	0010	10	1010
3	0011	11	1011
4	0100	12	1100
5	0101	13	1101
6	0110	14	1110
7	0111	15	1111
8	1000		



Device Address Calculator

Software Operation

Overview

RaneWare controls and commands will be in Sans-serif type like this and match the defaults shown in RaneWare. Be aware that Inputs and Outputs may be given custom names in RaneWare and may not match the text in this manual after they are changed.

The ECM 64 hardware is controlled by software using an addressable RS-232 protocol called RW 232™. RaneWare® is the software, and the family of products that the software controls. RW 232 describes the protocol and the DB-9 hardware used to communicate between units. This interface operates with any RS-232 serial port, allowing control system communication with up to 16 RW 232 products at a time, each with a unique address. Rane's RW 232 products can be controlled from remote locations with the optional **RPD 1 Programming & Diagnostics Unit** (see the RPD 1 data sheet) or over a network with the **Via 10 Ethernet Bridge** (see the Via 10 data sheet).

For those that want to write their own software to control the ECM 64 see the following:

- **Device Control Language** page Manual-16
- **RW 232 Communications Interface** page Manual-24
- **Example Packet Expansion code for RW 232 Messages** page Manual-25

Panja/AMX demo software is downloadable from Rane's web site at <http://www.rane.com>, on the Conferencing page. Also see RaneNote 139, "Using SR 1L's with Other Rane Products."

System Requirements

- RaneWare works under Microsoft Windows®, on a PC or laptop with an unused serial port.
- The following is recommended as a minimum system:
 - 80386SX with a 80387 coprocessor, 33 MHz
 - Unused serial port
 - 4M RAM
 - Color monitor
- RW 232 needs a DB-9 cable less than 50' long, connecting from the serial port of a computer to the RW 232 CONTROL INPUT port. This cable is wired straight through, *not null modem*. No interface boxes are required; just a cable and the computer. See the **ECS Hardware Manual**.
- RaneWare can be fully demonstrated and operated without any unit attached (called 'offline').
- A RaneWare CD-ROM comes with each unit. RaneWare is a single program with different windows capable of controlling not only the ECS units, but also the RPE 228d equalizer, the RPM 26v multifunction processor, the Via 10 Ethernet Bridge, and the RPD 1 Programming and Diagnostics Unit. New products and revisions may be added in the future. Software updates can be obtained at Rane's web site, www.rane.com.

Software Installation

The CD should auto-start when inserted unless that feature is disabled on your computer. If it doesn't, you may install by navigating to the installer file.

Go to the Start menu, Select Run....

Select Browse....

Navigate to the CD-ROM drive

or

Navigate to the file you downloaded from www.rane.com

Select the RW***.EXE file.

Click OK. Installation begins.

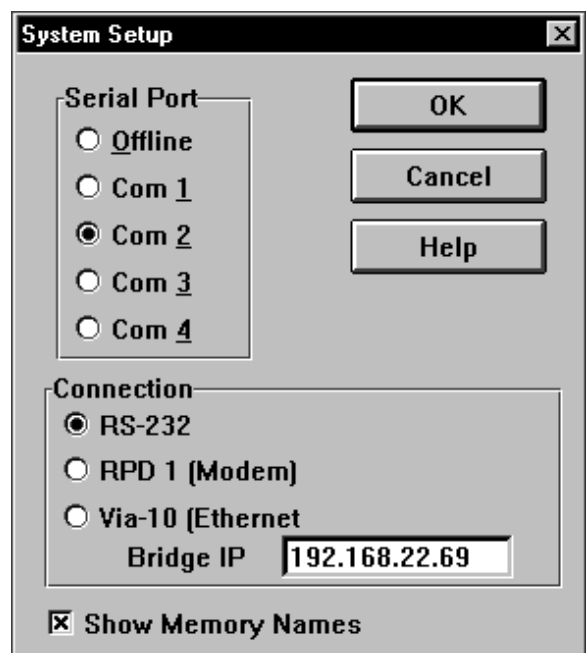
Starting RaneWare

Once RaneWare is installed, a RaneWare program group is created. When the software is first installed, Rane's Software License Agreement is displayed. Read it and close it. Then, the Help screen appears. Here, any questions may be answered. Subsequent activations do not bring up the License Agreement or the Help screen unless they are asked for. Close the Help file, and welcome to RaneWare!

If any question arises about a particular control on any software screen, position the pointer over the control and press F1 on your keyboard for Help.

The System Setup screen asks to which Com port RW 232 is attached. If you don't have a unit connected, you can still use RaneWare Offline. Click OK, then Polling begins the first time the program is run. This process checks for units connected to the serial port. Polling may also be invoked by selecting Device > Select > Poll. If a Device is found, you are in control! (If a device is hooked up and it is not found, read the Troubleshooting section of the Help file.) RaneWare polls addresses 1 thru 250. If the connected products are found, you may click the stop button at any time to end polling.

Device Selection



System Setup Dialog

After Polling, the Device Selection window displays any connected RW 232 units, as well as Offline versions of all Rane RW 232 products.

The quickest way to get to the RW 232 Device Edit screen, if not already displayed, is to click the Device button on the far right side of the toolbar. When pressed, a list of the first fifteen connected devices appears. Click one of the devices—either an offline device or an actual device—and the selected device’s edit screen appears. The selected device name is displayed at the top within the title bar.

Alternatively, after Polling, the same device list appears in the Device Selection window. Select the connected or offline device from the list and click OK. The connected unit’s Device Address is displayed within brackets [] to the left of the device name. Double-clicking on the device name is equivalent to selecting the device and clicking OK.

If the installation changes by adding more RW 232 units, choose Device > Select, and the Poll button to make the computer recognize currently connected units.

ECM 64 Devices can also be given custom names, tailored to your installation. Simply choose Device > Name Device, and the following screen appears.

Memory & Security

Device, Input and Output Names Dialog

ECM 64 can operate all the time through a computer if a system controller is not installed. To preserve Memory security with a computer operator, the software can be locked (under Device), and a system password can be assigned (under System > Change Password).

The default password is “please”.

Memories can be customized with names, through System > Site Control Panel Setup.

The Site Control Panel is all an operator needs to recall Memories. If only a few presets are required, blanking an entry in the Site Control Panel Setup removes the screen button. A password is not required to use this screen.

Memory names are stored in the computer, not in the ECM

64, along with other installation-specific information. Select System > Save Job File to support multiple installations.

Returning to Device Edit from the Site Control panel requires a password. Right-click on the title bar to Select Device Edit (password required), or Exit the program.

If more than 16 Memories are needed, they can be saved to disk and recalled later.



Memory Selection Toolbar

All of Rane’s RW 232 products have 16 *programmable* Memories with one *working* Memory called Memory 0. Recalling a Memory replaces the working Memory with the selected Memory. The selected Memory is then displayed next to the Store button. *All control changes are made to working Memory*, not to the selected Memory. The selected Memory flashes whenever working Memory does not match it. To save these settings in one of the 16 Memories, simply click Store, and the Memory number key. After Storing, clicking any Memory number instantly recalls it. The 16 Memories are stored within the units non-volatile Memory, and recalled by: Selecting a Memory using RaneWare,

or from a control system by

- Sending a Program channel from memory command, *or*
- Sending a Program all channels from memory on all devices command

Recalling settings allows the room controller to make routing changes without affecting the input and output levels. There are three separate Memory recall options that are available to a room controller:

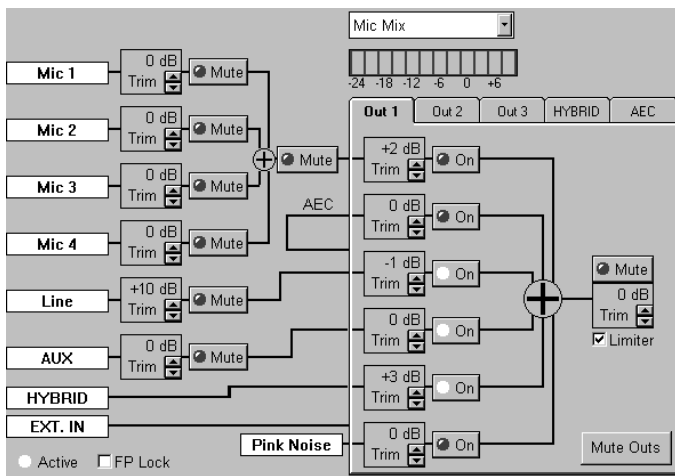
- Recall all
- Recall Input settings only
- Recall Output settings only

See **Program channel from memory** on page Manual-17 in the **Device Control Language**.

Saving & Printing

From the Device menu, both memories and names can be saved and retrieved to and from a file. To save both memories and names, select Device > Backup Memories to File. Retrieval of Memories and Names are performed separately. This allows you to create systems that operate the same but have separate Names. To retrieve Memories from a file select Device > Restore Memories from File. To retrieve Names from a file select Device > Restore names from File.

A printout report of Mic Mix, Out 1 through Out 3, Hybrid, AEC and stored phone numbers per memory is available under Device > Print Device Report.



ECM 64 Input and Output Controls

Inputs

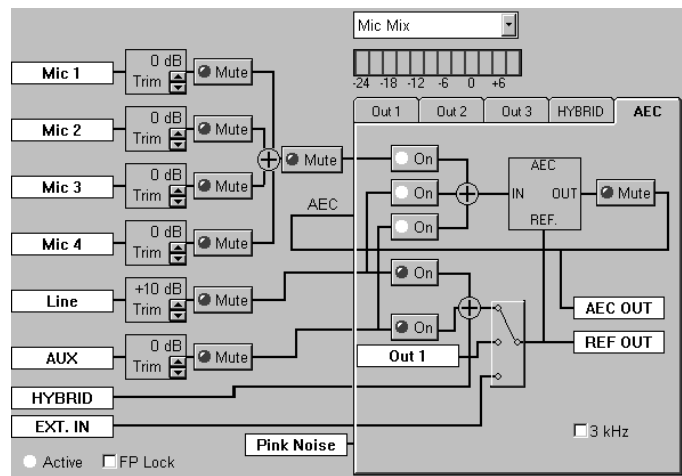
Each Input has programmable Trim and Mute controls. The Input Trim operates from -15 to $+16$ dB in 1 dB steps. The Input is calibrated so if it is set to 0 dB, a 0 dBu input gives a 0 dB Meter level. For a -10 dBu input, set the Input Trim to $+10$ dB.

Outputs

Each Output has a programmable six-channel matrix mixer, a programmable Output Trim, a Mute button and a Limiter checkbox. Unlike other systems that only have crosspoint trims or crosspoint routing controls (like the ECB 62 and SRM 66), each Output on the ECM 64 has both crosspoint trims and routing controls for ease and flexibility.

Each Crosspoint Trim has a range from -15 to $+16$ dB in 1 dB steps and an On/Off button for routing. The Output Trim operates from -114 to $+4$ dB in 1 dB steps and is calibrated to represent the actual level. Setting the Output Trim to 0 dB, with a 0 dB Meter level, produces a 0 dBu Output Level; and setting the Trim to 4 dB produces a $+4$ dBu Output Level.

The Limiter tracks the Output Trim level and engages at 5 dB above the set level. The Limiter attack rate is 10 millisecond using 1 dB steps. The Limiter release rate is 50 millisecond using 1 dB steps.



AEC Page

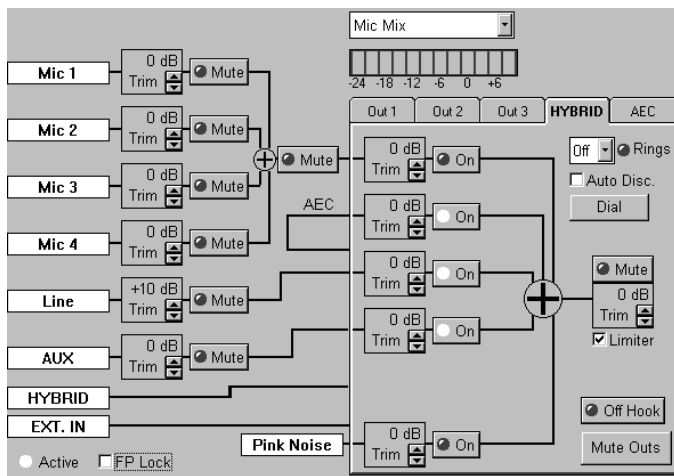
Acoustic Echo Canceller

The ECA 1 is an optional continually adaptive Acoustic Echo Canceller (AEC) module. This module is required when the ECM 64 is used for audio teleconferencing. The ECA 1 is included in the ECM 64AD, along with the DH 1. The AEC performs full-duplex audio teleconferencing by subtracting the room loudspeaker audio from audio received by the room microphones. This is accomplished by routing the room loudspeaker audio to the AEC Reference (REF.) and room microphones to the AEC IN.

The ECM 64 allows selection of different audio inputs and reference audio feeds to create a flexible system design. The AEC Input selects Mic Mix, Line In and Aux In, in any combination. Most applications will require Mic Mix at a minimum. The AEC Reference selects between Internal Mix (consisting of Line In, Aux In and Hybrid In), Out 1 and EXT. IN. *Note: do not use Out 1 for AEC Reference if Near-End Mics are routed to Out 1 for speech reinforcement.*

Since the ECA 1 automatically adapts to the room, training is not required.

The status of the ECA 1 can be checked in Device > Peripheral Status. If operating properly, the Acoustic Echo Canceller's Rev Level is displayed. Otherwise, Peripheral Status displays **Not Installed**.



Digital Hybrid Controls

Digital Hybrid

The DH 1 Digital Hybrid is an optional module, included in the ECM 64AD. This internal module allows audio conferencing over a standard POTS 2-wire phone line. A 32 millisecond Line Echo Canceller is utilized to remove line echo caused by the four-wire to two-wire conversion. In a standard telephone the echo caused by this conversion is actually beneficial to the user as side-tone. With a conference system line echo can cause all types of problems including feedback and echo canceller problems.

When the Digital Hybrid is in an Off Hook state, the ECM 64 is in a conference call using the telephone line. During Off Hook, the RJ 11 connector labeled PHONE is disconnected from the telephone line that is connected to the LINE connector. The term 'Off Hook' represents the handset being removed from the hook switch.

For best performance, always connect the RJ 11 connector labeled LINE directly to a POTS-type line by itself. Do not connect other equipment such as phones and modems in parallel or in front of the ECM 64. Only connect other equipment to the RJ 11 connector labeled PHONE.

Features include:

- Auto-Answer and Ring Detect
- Auto Disconnect
- Off Hook status
- DTMF Dialing with six programmable speed numbers
- DTMF Decoding (See Opstat page Manual-19)

You can check the status of the digital hybrid in Device > Peripheral Status. If operating properly the Digital Hybrid's Rev level is displayed. Otherwise, Peripheral Status displays Not Installed.

When the DH 1 is installed, the Limiter is always enabled, no matter how the Limiter's checkbox is set. The DH 1 always limits the phone line to -10 dBm. Setting the Hybrid's Output Trim above -10 dBm causes any audio levels above -10 dBm to become compressed. Note that setting the Output Trim to -4 dB (adding 6 dB of compression) increases the level of softer talkers.

Digital Hybrid	1.0
Acoustic Echo Canceller	1.0
OK	

Peripheral Status and Dial Dialogs

Dial		
<input checked="" type="radio"/> Stored #1	20 Characters Max	Edit
<input type="radio"/> Stored #2	Text Ok	Edit
<input type="radio"/> Stored #3	Rane 1.425.355.6000	Edit
<input type="radio"/> Stored #4	'.' = 1 Second Pause	Edit
<input type="radio"/> Stored #5	9,1[425]355.6000	Edit
<input type="radio"/> Stored #6	Flash !1 or !2	Edit
<input type="radio"/> Entered	Hold !3 Off Hold !4	
<input type="button" value="Dial"/> <input type="button" value="Cancel"/> <input type="button" value="Help"/>		

The Auto Disconnect checkbox tells the ECM 64 to monitor the phone line for loss of DC voltage and the lack of received audio within three minutes. If any of these two actions occur, the ECM 64 instructs the Digital Hybrid to go On Hook. Always use Auto Disconnect when setting the Digital Hybrid in Auto Answer. You may want to disable Auto Disconnect once you have placed a call. There is always the possibility that the ECM 64 may disconnect the call when you are not expecting it.

For Rev 1.2 or greater there are added special function DTMF dialing operators:

Operator

- | | |
|----|------------------------------|
| !1 | Performs a 100 ms Flash Hook |
| !2 | Performs a 500 ms Flash Hook |
| !3 | Places the caller on Hold |
| !4 | Removes the caller from Hold |

Alignment Procedure

Quick Overview

- a. Setup Mic gains
- b. Setup Line In and Aux In Input levels
- c. Select matrix routing and if necessary the matrix level
- d. Adjust the output levels
- e. Select the input mix for the acoustic echo canceller.
- f. Select the reference for the acoustic echo canceller.

Mic Setup

The ECM 64 is shipped with its Mic gains set for 34 dB and Mic trims set to +6 dB. If using boundary-type mics, this setting may be good enough. To improve on this setting it is best to use a sound level meter like the Radio Shack 33-2050.

1. Remove the front security cover.
2. On the rear select the correct function for phantom power. Shipped with phantom power on.
3. Select the front panel gain setting. Typically 34 dB. Shipped in the 34 dB position.
4. Start with Mic 1 and mute all other mics.
5. Set Meter to Mic Mix.
6. Make certain that this is the correct mic by tappin on it. The Meter should go about full scale. If not, recheck mic wiring.
7. Place the sound level meter next to the mic and point both towards the loudspeaker.
8. Route the Pink Noise to Out 1 and adjust the amplifier level for 80 dBA, using the slow response on the sound level meter.
9. Adjust the Mic Trim so that the 0 dB LED on the ECM 64 meter just comes on.
10. Turn off the pink noise source. Go to step 4 and replace Mic 1 with next mic.

Troubleshooting

POWER LED is Off:

Check POWER connection on rear panel, and that the remote supply is connected to a live AC source.

No communication between the unit and computer:

Set the DEVICE ADDRESS to a unique small number, and try polling for units in RaneWare (under Device > Poll). The unit should be found quickly.

Check that the COM port selected in RaneWare (under Setup > System Setup) is the one on your computer that is connected to the unit. Also check that the cable is a standard RS-232 cable (not a null modem type). If an adapter is used, *it must not be null modem*. The cable must be connected to the RW 232 INPUT jack on the rear of the unit.

Audio hum or noise:

Try Muting the unit. If this helps significantly, the problem may be with the Input connection, or the equipment driving the Input. If Muting has little effect, the problem is likely either the Output connection, or equipment driven by the Output.

The ECM 64 is intended to connect to equipment with balanced audio I/O and chassis-grounded shield/common. This kind of audio interconnection should maximize audio quality. Connecting equipment with signal grounded shields or unbalanced connections may result in hum or noise due to induced currents in the signal path. It may be possible to reduce or eliminate these problems, although some experimentation may be required:

Try disconnecting the audio cable shields at one end, particularly between chassis grounded and signal grounded equipment.

Try combinations of lifting grounds on units supplied with ground lift switches (or links).

Verify that all chassis are tied to a good earth ground.

Some units with outboard power supplies do *not* ground the chassis through the line cord. Make sure these units are grounded by tying the Chassis Ground Point to a known earth ground. A star washer guarantees proper contact. For more information on balanced interconnection and grounding, please refer to RaneNote 110, “*Sound System Interconnection*” or Journal of the AES Vol. 43 No. 6 (June 1995).

ECM 64 Options

Two internal cards are available for the ECM 64. The ECM 64AD already includes both options.

ECA 1 Acoustic Echo Cancellor

The ECA 1 is a continually adaptive Acoustic Echo Cancellor (AEC) module, required when the ECM 64 is used for audio teleconferencing.

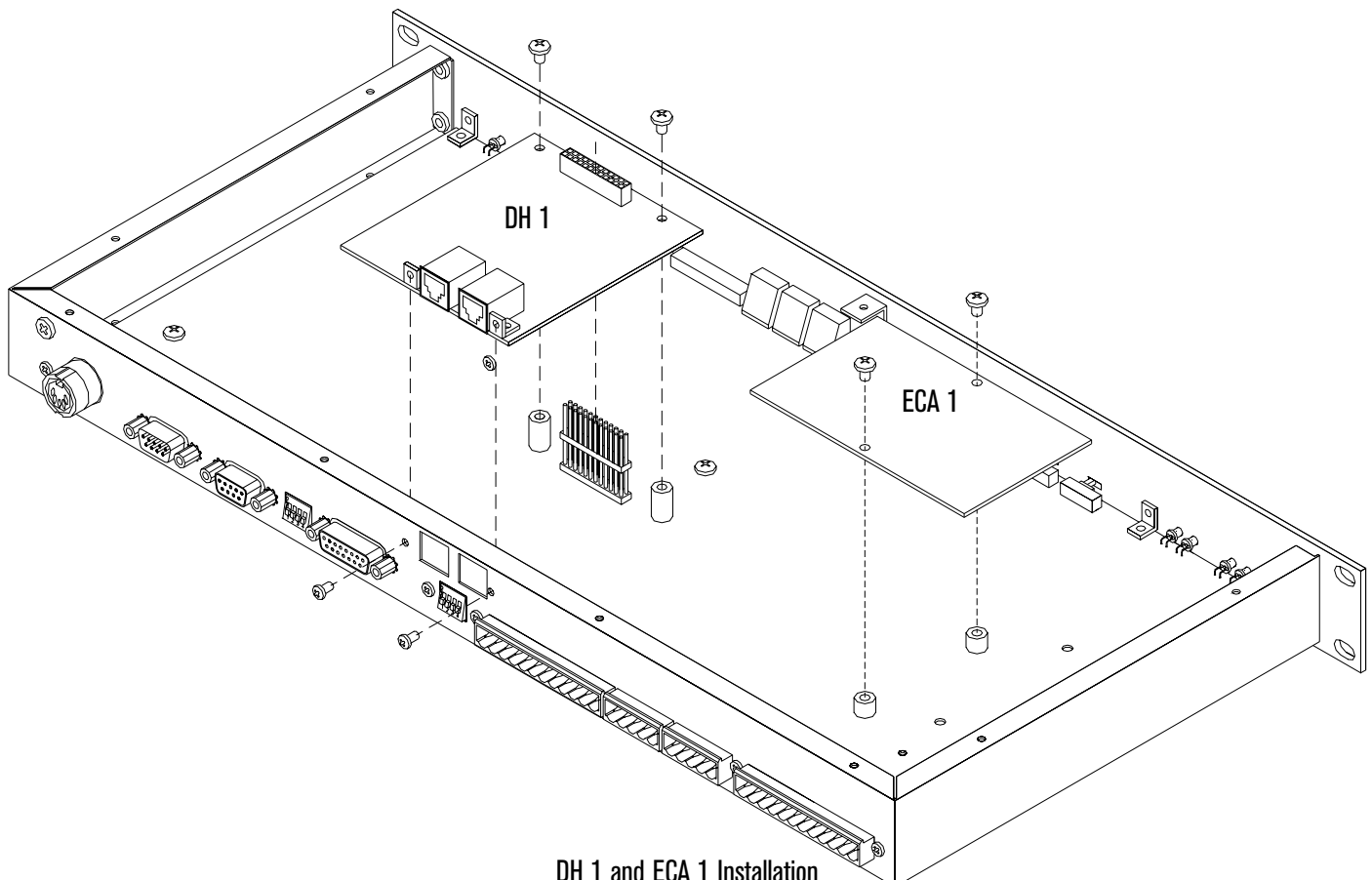
The ECA 1 installs by temporarily removing the top cover of the ECM 64 and seating the module onto factory installed standoffs on the motherboard. The connectors on the ECA 1 and the motherboard are keyed, so there is only one direction that the ECA 1 can be installed (see below). **Warning:** To protect against damage from electrostatic discharge (ESD) proper control measures must be followed.

See page Manual-10 for Acoustic Echo Cancellor operation.

DH 1 Digital Hybrid

The DH 1 Digital Hybrid allows audio conferencing over a standard POTS 2-wire phone line. A 32 millisecond Line Echo Cancellor is utilized to remove line echo caused by the four-wire to two-wire conversion. In a standard telephone the echo caused by this conversion is actually beneficial to the user as side-tone. With a conference system line echo can cause all types of problems including feedback and echo canceller problems.

The DH 1 installs by first temporarily removing the top cover of the ECM 64 and the rear phone jack cover on the back of the ECM 64. See the diagram on page Manual-6. Seat the DH 1 module from its bottom side onto the ECM 64 J10 header. Make certain that the header pins are properly aligned with the DH 1 before applying force to seat the card. **Warning:** To protect against damage from electrostatic discharge (ESD) proper ESD control measures must be followed when installing the DH 1.



DH 1 and ECA 1 Installation

Advanced Application

Connecting the ECM 64 to a larger ECS

In this application the system required:

- Full duplex audio for a Video Codec and a telephone connection
- Automatic mic mixing with acoustic echo cancelling of 15 table top, 2 podium and 2 wireless microphones
- Speech reinforcement of 2 podium and 2 wireless mics
- Playback of stereo audio sources from an audio router, a VCR and a DVD player
- Recording of the audio sources
- Assisted listening of the audio sources

Rane Equipment:

- 1 - ECM 64 Conference System with
 - 1 - DH 1 Digital Hybrid (included in ECM 64AD)
- 1 - ECB 62 Base Unit with
 - 1 - ECS 62 Stereo Expansion card
- 2 - ECM 82A Automatic Mic Mixer with
 - 2 - ECA 1 Acoustic Echo Cancellers (included)
- 2 - RPD 228d Programmable Equalizers

Refer to the diagram on the following page.

While designing a large audio system for a client that requires 19 mic inputs, the client informs you he only has enough audio budget for 2 ECM 82As. Before telling your client there is no way, here is a solution. Since the ECM 64 has 4 Mic Inputs, use these for the speech reinforcement mics. In RaneWare, route the Mic Mix to Out 1, and connect OUT 1 to Input 8 of an ECM 82A. Set the ECM 64's Output Trim of Out 1 to -10 dB in RaneWare. Turn the ECM 82A Input 8's Phantom Power off and set the Input Gain to +6 dB.

For speech reinforcement of the podium and wireless mics, route the Mic Mix to Out 3 of the ECM 64 in RaneWare.

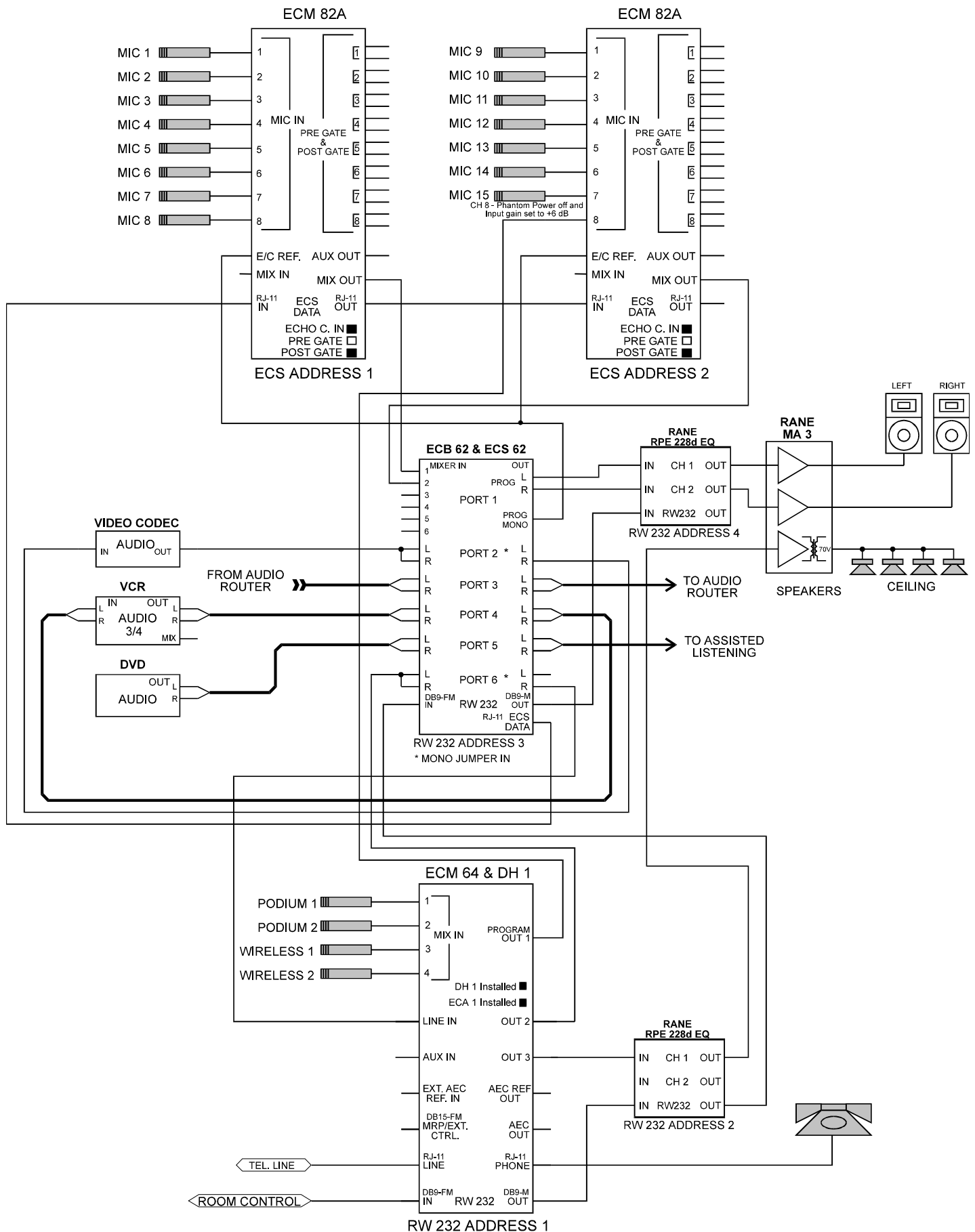
To perform a telephone conference:

- Route the HYBRID audio to Out 2 of the ECM 64
- Connect OUT 2 to PORT 6 IN on the ECB 62
- Route PORT 6 IN to PORT 1 OUT (Program) and PORT 2 OUT (Codec)
- Route PORT 1 and PORT 2 IN to PORT 6 OUT
- Connect ECB 62's PORT 6 OUT to the ECM 64's LINE IN
- Route LINE IN to the HYBRID

For this application load AP2.C64 using
Device > Restore Memories From File and
Device > Restore Names From File.

Memory 1 – Only sends the ECM 64's four mics to the ceiling speakers.

See **Memory & Security** on page Manual-9 for more information.



ECM 64 and Larger ECS Installation

Device Control Language

Data Structures

Abbreviations used: Definition:

\$: signifies hexadecimal number
 ADDR: Device Address
 CHNUM: Channel Number code
 COMSTAT: Communications Status code
 DCL: Device Control Language
 DT: Device-Type code (predefined)
 ID: Manufacturer's ID code (predefined)
 MEMNUM: Memory Number code
 OPSTAT: Operational Status code
 SPL: Stored Parameter List (product dependent)

ECM 64 Stored Parameter List (SPL):

System Parameters:

<i>Index</i>	<i>Hex</i>	<i>Name / System Parameters</i>	<i>Encoding Method</i>	
0	\$00	Meter Display	0-7 (byte)	0 = Mic Mix 1 = Line In 2 = Aux In 3 = Hybrid Rx 4 = Out 1 5 = Out 2 6 = Out 3 7 = Hybrid Tx
1	\$01	Auto Answer Ring Count	0-9 (byte)	0 = Auto Answer Off; 1 = Answer after 1st ring
2	\$02	Auto Disconnect	1/0 (byte)	1 = On, 0 = Off
3	\$03	Privacy	1/0 (byte)	1 = On, 0 = Off
4	\$04	Mute	1/0 (byte)	1 = On, 0 = Off
5	\$05	(Reserved)	1/0 (byte)	1 = On, 0 = Off
6	\$06	AEC 3 kHz	1/0 (byte)	1 = On, 0 = Off
7	\$07	AEC Mute	1/0 (byte)	1 = On, 0 = Off
8	\$08	AEC In Mic Mix	1/0 (byte)	1 = On, 0 = Off
9	\$09	AEC In Line	1/0 (byte)	1 = On, 0 = Off
10	\$0A	AEC In Aux	1/0 (byte)	1 = On, 0 = Off
11	\$0B	AEC Ref. (Mix In/Out1/Ext)	0/1/2 (byte)	0 = Mix In, 1 = Out 1, 2 = Ext.
12	\$0C	AEC Ref. Line In	1/0 (byte)	1 = On, 0 = Off
13	\$0D	AEC Ref. Aux In	1/0 (byte)	1 = On, 0 = Off
14-20	\$0E - \$14	Reserved (Fill with 0s)	0 (byte)	0

Inputs Parameters:

<i>Index</i>	<i>Hex</i>	<i>Name / System Parameters</i>	<i>Encoding Method</i>	
21	\$15	Mic 1 (Mute)*	1/0 (byte)	1 = Mute
22	\$16	Mic 2 (Mute)*	1/0 (byte)	1 = Mute
23	\$17	Mic 3 (Mute)*	1/0 (byte)	1 = Mute
24	\$18	Mic 4 (Mute)*	1/0 (byte)	1 = Mute
25	\$19	Line In (Mute)*	1/0 (byte)	1 = Mute
26	\$1A	Aux In (Mute)*	1/0 (byte)	1 = Mute
27	\$1B	Mic 1 Level	0 to 31 (byte)	-15 to +16 dB
28	\$1C	Mic 2 Level	0 to 31 (byte)	-15 to +16 dB
29	\$1D	Mic 3 Level	0 to 31 (byte)	-15 to +16 dB
30	\$1E	Mic 4 Level	0 to 31 (byte)	-15 to +16 dB
31	\$1F	Line In Level	0 to 31 (byte)	-15 to +16 dB
32	\$20	Aux In Level	0 to 31 (byte)	-15 to +16 dB

* Only these function are recalled when setting CHNUM to 1 or 2.

Output 1 Parameters:

<i>Index</i>	<i>Hex</i>	<i>Name / System Parameters</i>	<i>Encoding Method</i>	
33	\$21	Output (Mute)*	1/0 (byte)	1 = Mute
34	\$22	Output Level	0 to 118 (byte)	-114 to +4 dBu
35	\$23	Output Limiter (On/Off)*	1/0 (byte)	1 = On, 0 = Off
36	\$24	Input Select*	0 - 63 (byte)	Bitwise where Bit 0 = Mics, Bit 1 = AEC, Bit 2 = Line In, Bit 3 = Aux In, Bit 4 = Phone, Bit 5 = Noise
37	\$25	Mic Level	0 to 31 (byte)	-15 to +16 dB
38	\$26	AEC Level	0 to 31 (byte)	-15 to +16 dB
39	\$27	Line-level	0 to 31 (byte)	-15 to +16 dB
40	\$28	Aux Level	0 to 31 (byte)	-15 to +16 dB
41	\$29	Phone Level	0 to 31 (byte)	-15 to +16 dB
42	\$2A	Noise Level	0 to 31 (byte)	-15 to +16 dB

Output 2 Parameters:

<i>Index</i>	<i>Hex</i>	<i>Name / System Parameters</i>	<i>Encoding Method</i>	
43	\$2B	Output (Mute)*	1/0 (byte)	1 = Mute
44	\$2C	Output Level (dB)	0 to 118 (byte)	-114 to +4 dBu
45	\$2D	Output Limiter (On/Off)*	1/0 (byte)	1 = On, 0 = Off
46	\$2E	Input Select*	0 - 63 (byte)	Bitwise where Bit 0 = Mics, Bit 1 = AEC, Bit 2 = Line In, Bit 3 = Aux In, Bit 4 = Phone, Bit 5 = Noise
47	\$2F	Mic Level	0 to 31 (byte)	-15 to +16 dB
48	\$30	AEC Level	0 to 31 (byte)	-15 to +16 dB
49	\$31	Line-level	0 to 31 (byte)	-15 to +16 dB
50	\$32	Aux Level	0 to 31 (byte)	-15 to +16 dB
51	\$33	Phone Level	0 to 31 (byte)	-15 to +16 dB
52	\$34	Noise Level	0 to 31 (byte)	-15 to +16 dB

Output 3 Parameters:

<i>Index</i>	<i>Hex</i>	<i>Name / System Parameters</i>	<i>Encoding Method</i>	
53	\$35	Output (Mute)*	1/0 (byte)	1 = Mute
54	\$36	Output Level (dB)	0 to 118 (byte)	-114 to +4 dBu
55	\$37	Output Limiter (On/Off)*	1/0 (byte)	1 = On, 0 = Off
56	\$38	Input Select*	0 - 63 (byte)	Bitwise where Bit 0 = Mics, Bit 1 = AEC, Bit 2 = Line In, Bit 3 = Aux In, Bit 4 = Phone, Bit 5 = Noise
57	\$39	Mic Level	0 to 31 (byte)	-15 to +16 dB
58	\$3A	AEC Level	0 to 31 (byte)	-15 to +16 dB
59	\$3B	Line-level	0 to 31 (byte)	-15 to +16 dB
60	\$3C	Aux Level	0 to 31 (byte)	-15 to +16 dB
61	\$3D	Phone Level	0 to 31 (byte)	-15 to +16 dB
62	\$3E	Noise Level	0 to 31 (byte)	-15 to +16 dB

Hybrid Parameters:

<i>Index</i>	<i>Hex</i>	<i>Name / System Parameters</i>	<i>Encoding Method</i>	
63	\$3F	Output (Mute)*	1/0 (byte)	1 = Mute
64	\$40	Output Level (dB)	0 to 118 (byte)	-114 to +4 dBu
65	\$41	Output Limiter (On/Off)*	1/0 (byte)	1 = On
66	\$42	Input Select*	0 - 63 (byte)	Bitwise where Bit 0 = Mics, Bit 1 = AEC, Bit 2 = Line In, Bit 3 = Aux In, Bit 4 = Phone, Bit 5 = Noise
67	\$42	Mic Level	0 to 31 (byte)	-15 to +16 dB
68	\$44	AEC Level	0 to 31 (byte)	-15 to +16 dB
69	\$45	Line-level	0 to 31 (byte)	-15 to +16 dB
70	\$46	Aux Level	0 to 31 (byte)	-15 to +16 dB
71	\$47	Reserved (Set to 0)	0 (byte)	
72	\$48	Noise Level	0 to 31 (byte)	-15 to +16 dB

* Only these function are recalled when setting CHNUM to 1 or 2.

Device Type (DT):

\$32 = ECM 64

Manufacture's Identification code (ID):

\$08 = Rane Corporation

Channel Number codes (CHNUM):

Typically set to 0, unless otherwise stated.

Memory Number codes (MEMNUM):

\$00 = *live* or working memory, \$01 = preset memory #1, \$02 = preset memory #2, ... , \$10 = preset memory #16 (ECM 64 has 16 preset memories)

Communications status codes (COMSTAT):

\$00 = no error

\$01 = invalid data

\$02 = invalid command code

\$03 = device locked

\$04 = device *not* locked

\$05 = channel(s) muted

\$06 = channel(s) *not* muted

\$07 = checksum error

\$08 = not connected

Operational Status codes (OPSTAT):

\$00 = Opstat Ok

\$07 = RW232 RX Overflow

\$09 = RW232 Parity Error

\$0A = Not Ready

\$0B = Flash Error

Send data to channel (81 hex):

Transmit ADDR header (\$FB XX \$FB XX, where XX = ADDR) (See Note 9)

Get DT

Get ID

Transmit \$00 \$XX (where \$XX = number of data bytes to follow including checksum)

Transmit \$81 (command code)

Transmit \$00 (CHNUM)

Transmit MEMNUM

Transmit 2 bytes; the starting SPL param byte index (See Note 5)

Transmit SPL

Transmit Checksum

Get COMSTAT

Program channel from memory (82 hex):

Transmit ADDR header (\$FB XX \$FB XX, where XX = ADDR) (See Note 9)

Get DT

Get ID

Transmit \$00 \$04 (where \$04 = number of data bytes to follow including checksum)

Transmit \$82 (command code)

Transmit \$00 (CHNUM) (\$00 = program device, \$01 = program inputs settings only, \$02 = program outputs settings only)

(See Note 4)

Transmit MEMNUM

Transmit Checksum

Get COMSTAT

Program all channels from memory on all devices (82 hex):

Transmit \$FB 00 \$FB 00
Transmit \$00 \$03 (where \$03 = number of data bytes to follow including checksum)
Transmit \$82 (command code)
Transmit MEMNUM
Transmit Checksum

Lock device (85 hex):

Transmit ADDR header (\$FB XX \$FB XX, where XX = ADDR) (See Note 9)
Get DT
Get ID
Transmit \$00 \$02 (where \$02 = number of data bytes to follow including checksum)
Transmit \$85 (command code)
Transmit \$79 (checksum)
Get COMSTAT

Unlock device (86 hex):

Transmit ADDR header (\$FB XX \$FB XX, where XX = ADDR) (See Note 9)
Get DT
Get ID
Transmit \$00 \$02 (where \$02 = number of data bytes to follow including checksum)
Transmit \$86 (command code)
Transmit \$78 (checksum)
Get COMSTAT

Mute Output (87 hex):

Transmit ADDR header (\$FB XX \$FB XX, where XX = ADDR) (See Note 9)
Get DT
Get ID
Transmit \$00 \$03 (where \$03 = number of data bytes to follow including checksum)
Transmit \$87 (command code)
Transmit Output #
Transmit Checksum
Get COMSTAT

Mute all Outputs of all devices (87 hex):

Transmit \$FB 00 \$FB 00
Transmit \$00 \$02 (where \$02 = number of data bytes to follow including checksum)
Transmit \$87 (command code)
Transmit Checksum

UnMute Output (88 hex):

Transmit ADDR header (\$FB XX \$FB XX, where XX = ADDR) (See Note 9)
Get DT
Get ID
Transmit \$00 \$03 (where \$03 = number of data bytes to follow including checksum)
Transmit \$88 (command code)
Transmit Output #
Transmit Checksum
Get COMSTAT

UnMute all Outputs of all devices (88 hex):

Transmit \$FB 00 \$FB 00
Transmit \$00 \$02 (where \$02 = number of data bytes to follow including checksum)
Transmit \$88 (command code)
Transmit Checksum

Send Globals (8C hex):

Transmit ADDR header (\$FB XX \$FB XX, where XX = ADDR) (See Note 9)

Get DT

Get ID

Transmit \$00 \$72 (where \$72 = number of data bytes to follow including checksum)

Transmit \$8C (command code)

Transmit Global Parameters

Transmit Checksum

Get COMSTAT

Global Parameters (114 bytes):

<i>Type</i>	<i>Bytes</i>	<i>Description</i>
Unit Name	16	ASCII string
Input Names	56	ASCII string (Mics 1-4, Line, Aux, Hybrid)
Output Names	32	ASCII string (Out 1-3, Hybrid)
Font Panel	1	1 if front panel switches are disabled
Locked	1	1 if unit is locked (read-only)
Elapsed Time	4	Time of use in seconds (read-only)
Reserved	4	

Stored Number Parameter List SNPL (120 bytes):

Encoding Method: Null terminated ASCII string, or 20 characters max.

<i>Index</i>	<i>Hex</i>	<i>Parameters</i>
--------------	------------	-------------------

00-19	\$00-\$13	DTMF Number 1
-------	-----------	---------------

20-39	\$14-\$27	DTMF Number 2
-------	-----------	---------------

40-59	\$28-\$3B	DTMF Number 3
-------	-----------	---------------

60-79	\$3C-\$4F	DTMF Number 4
-------	-----------	---------------

80-99	\$50-\$63	DTMF Number 5
-------	-----------	---------------

100-119	\$64-\$77	DTMF Number 6
---------	-----------	---------------

A ‘,’ within the DTMF number inserts a 500 millisecond delay.

A non-digit within the DTMF number is allowed for separation (425.355.6000).

Send Stored DTMF Numbers (\$8D)

Transmit ADDR header (\$FB XX \$FB XX, where XX = ADDR) (See Note 9)

Get DT

Get ID

Transmit \$00 \$X2 (where \$X2 = number of data bytes to follow including checksum)

Transmit \$8D (command code)

Transmit the starting SNPL index (0 = Beginning of the first SNPL)

Transmit SNPL

Transmit Checksum

Get COMSTAT

Reset Unit (91 hex):

Transmit ADDR header (\$FB XX \$FB XX, where XX = ADDR) (See Note 9)

Get DT

Get ID

Transmit \$00 \$03 (where \$03 = number of data bytes to follow including checksum)

Transmit \$91 (command code)

Transmit RESET (\$00 = Reset unit, \$01 = Reset unit and set all data to default. Warning: If Firmware has been downloaded, program returns to original version.)

Transmit Checksum

Get COMSTAT

Hybrid Parameter List (HPL)

<i>Hybrid</i>	<i>Command</i>	<i>Data</i>	<i>Description</i>
0	Dial DTMF Number	(char) string	Null terminated ASCII string, 20 (char) max
1	Dial Stored Number	1-6	Dial stored number (1 – 6)
2	Off Hook	1/0	1= Off Hook / 0 = On Hook

A ‘,’ within the DTMF number inserts a 1 second delay.

A non-digit within the DTMF number is allowed for separation (425.355.6000).

For Rev 1.2 or greater there are added special function DTMF dialing operators:

Operator

!1	Performs a 100 ms Flash Hook
!2	Performs a 500 ms Flash Hook
!3	Places the caller on Hold
!4	Removes the caller from Hold

Send Hybrid Command (92 hex)

Transmit ADDR header (\$FB XX \$FB XX, where XX = ADDR) (See Note 9)

Get DT

Get ID

Transmit \$00 \$XX (where \$XX = number of data bytes to follow including checksum)

Transmit \$92 (command code)

Transmit Hybrid command

Transmit Data

Transmit the checksum

Get COMSTAT

Send MRP Table (93 hex)

Transmit ADDR header (\$FB XX \$FB XX, where XX = ADDR) (See Note 9)

Get DT

Get ID

Transmit \$00 \$12 (where \$12 = number of data bytes to follow including checksum)

Transmit \$93 (command code)

Transmit 16 byte table

Transmit the checksum

Get COMSTAT

Get OPSTAT (00 hex):

Transmit ADDR header (\$FB XX \$FB XX, where XX = ADDR) (See Note 9)

Get DT

Get ID

Transmit \$00 \$02 (where \$02 = number of data bytes to follow including checksum)

Transmit \$00 (command code)

Transmit \$FE (checksum)

Get STATUS

Get Checksum

Get COMSTAT

STATUS consist of 20 bytes returned in this order:

<i>Byte</i>	<i>Parameter</i>	<i>Value</i>
1	OPSTAT	See OPSTAT
2	Preset Memory	1 - 16
3	Working/Stored Flag	1/0 (See Note 6)
4	Working/Dirty Flag	1/0 (See Note 7)
5	Meter Display	0 - 7, 0 = Mic Mix, 1 = Line In, 2 = Aux in, 3 = Hybrid Rx, 4 = Out 1, 5 = Out 2, 6 = Out 3, 7 = Hybrid Tx.
6	Meter Level	-45 to +9 dB
7	Off Hook Flag	1/0, 1 = Off Hook
8	New Ring Flag	1/0, 1 = Ring detected - Cleared when read
9	Privacy Flag	1/0, 1 = Privacy On
10	Mute Flag	1/0, 1 = Mute On
11	Suppression Flag	1/0, 1 = Suppression active
12	AEC Installed	Firmware Rev or 0 if not installed
13	Hybrid Installed	Firmware Rev or 0 if not installed
14	DTMF Number	(Char) Set to 0 after read.
15	Prog. Out Level	0 - 118 Value for SPL 34
16 - 20	Reserved	0, Not used

Flash COM LEDs on all units (00 hex):

Transmit \$FB 00 \$FB 00

Transmit \$00 \$02 (where \$02 = number of data bytes to follow including checksum)

Transmit \$00 (command code)

Transmit \$FE (checksum)

Get Data From Channel (01 hex):

Transmit ADDR header (\$FB XX \$FB XX, where XX = ADDR) (See Note 9)

Get DT

Get ID

Transmit \$00 \$08 (where \$08 = number of data bytes to follow including checksum)

Transmit \$01 (command code)

Transmit \$00 (CHNUM)

Transmit MEMNUM

Transmit 2 bytes; the starting SPL param byte index (See Note 5)

Transmit 2 bytes; the number of SPL param bytes (See Note 5)

Transmit Checksum

Get COMSTAT

Get Device Type and Manufacture's Identification Codes (02 hex):

Transmit ADDR header (\$FB XX \$FB XX, where XX = ADDR) (See Note 9)

Get DT

Get ID

Transmit \$00 \$02 (where \$02 = number of data bytes to follow including checksum)

Transmit \$02 (command code)

Transmit \$FC (checksum)

Get COMSTAT

Get Globals (03 hex):

Transmit ADDR header (\$FB XX \$FB XX, where XX = ADDR) (See Note 9)

Get DT

Get ID

Transmit \$00 \$02 (where \$02 = number of data bytes to follow including checksum)

Transmit \$03 (command code)

Transmit \$FB \$FB (checksum, See Note 1)

Get Global Parameters

Get Checksum

Get COMSTAT

Get Device Serial/Identification Number (04 hex):

Transmit ADDR header (\$FB XX \$FB XX, where XX = ADDR) (See Note 9)

Get DT

Get ID

Transmit \$00 \$02 (where \$02 = number of data bytes to follow including checksum)

Transmit \$04 (command code)

Transmit \$FA (checksum)

Get 3 byte number (MSB first)

Get Checksum (for serial ID)

Get COMSTAT

Get Software Revision (05 hex):

Transmit ADDR header (\$FB XX \$FB XX, where XX = ADDR) (See Note 9)

Get DT

Get ID

Transmit \$00 \$02 (where \$02 = number of data bytes to follow including checksum)

Transmit \$05 (command code)

Transmit \$F9 (checksum)

Get Hardware Revision

Get Software Revision (x10)

Get Checksum (for both revisions)

Get COMSTAT

Get MRP Table (0B hex)

Transmit ADDR header (\$FB XX \$FB XX, where XX = ADDR) (See Note 9)

Get DT

Get ID

Transmit \$00 \$02 (where \$02 = number of data bytes to follow, including checksum)

Transmit \$0B (command code)

Transmit \$F3 (checksum)

Get 16 entries

Get Checksum (for entries)

Get COMSTAT

Get Stored DTMF Numbers (0C hex)

Transmit ADDR header (\$FB XX \$FB XX, where XX = ADDR) (See Note 9)

Get DT

Get ID

Transmit \$00 \$04 (where \$04 = number of data bytes to follow through the start parameter)

Transmit \$0C (command code)

Transmit the SNPL Index (0 = Beginning of the first SNPL)

Transmit the number of SNPL Indexes

Transmit the checksum

Get SNPL

Get Checksum (for SNPL)

Get COMSTAT

Notes

1. When the value \$FB occurs anywhere except in an ADDR header, it is repeated.
2. The data size is the number of bytes, prior to the \$FB repetition, between the command code and the checksum inclusively.
3. The checksum applies to the “data size” bytes through the byte immediately before the checksum, inclusive. Repeated \$FB's are counted only once. The sum is the two's complement negative of the LS Byte of the arithmetic sum. For example, if the sum is \$1234, the checksum is \$CC.
4. The parameter bytes are indexed using a 2-byte number (MSB first) starting with 0. The number of parameter bytes also uses a 2-byte number with the same format. When sending parameters, the number sent is determined by the data size.
5. The working/stored flag is set if the working memory doesn't match the stored memory from which it originated.
6. The working/dirty flag is set when the unit is powered up, or when a memory is recalled. It is cleared when the working parameters are sent or received.

RW 232 Communications Interface

RW 232 is loosely based on PA-422. One key hardware difference is that RW 232 does not utilize hardware handshaking via DTR/DSR. The beginning of a message always takes the form:

\$FB xx FB xx (where xx = ADDR)

Note: When \$FB appears in the body of the message, it is always repeated.

Input port: 9-pin female input port (DB-9F) on device

Output port: 9-pin male output port (DB-9M) on device (for serial linking to the input port on the next device. Upto 16 devices can be linked in this manner.)

Device address means: 4-position DIP switch on device (valid device addresses are 1 through 15)

Baud Rate: 19.2 kilobaud

Character frame bits: 1 start bit, 8 data bits, 1 parity bit (even), and 1 stop bit

Cabling: Use standard RS-232 serial printer or modem cables.

Warning: *NULL modem cables will not work!*

Host or computer interface: Standard PC serial COM port (DB-9M, or DB-25M with adapter)

Note: Only three lines, Tx, Rx, and Ground, are used.

References

Rodgers, Robert L., “PA-422 Communications Interface and Device Control Language”, Journal of the Audio Engineering Society, Vol. 38, Number 9, 1990 September, pp. 619-639.

Audio Engineering Society, Inc., “AES Recommended practice for sound-reinforcement systems-Communications interface (PA-422)”, Journal of the Audio Engineering Society, Vol. 39, Number 9, 1991 September, pp. 664-679.

Standards documents: AES15-1991 (Audio Engineering Society) ANSI S4.49-1991 (American National Standards Institute)

Example Packet Expansion Code for RW 232 Messages

```
// 09-10-96 - Devin Cook (Derived from RW232.CPP code)
// This code only deals with the Body of an RW 232 message (Command/Data)
// The steps needed to fully communicate with an RW 232 device are as follows:
// 1. Send the Address: [FB xx FB xx]
// 2. Get the returned Device Type and Device ID flags
// 3. Send the FB expanded Body
// 4. Get and check the returned ComStat byte
// Take a simple command and expand it into a full packet.
// Input:
// Buff - BYTE array with the unexpanded message and lots of extra room
// MsgLen - Unexpanded message length
// Steps required are:
// 1. Add Packet size. This is simply the Command length + 1 for the checksum
// 2. Duplicate 0xFBs
// 3. Calculate Checksum
// 4. Add Checksum to packet (Check for a 0xFB Checksum!)
// 5. Copy Packet back to the buffer
// 6. Return the new Packet Size
// Note: The buffer must be large enough to accept the expanded data. No checking is done to verify it is, so be careful!
// A packet into this routine consists of the one byte Command and any Data
int CmdToPacket(BYTE Buff[ ], int MsgLen)
{
    BYTE L_MSB = ((MsgLen+1) >> 8) & 0xFF; // Grab MSB of Size
    BYTE L_LSB = (MsgLen+1) & 0xFF; // Grab LSB of Size
    // FBs is the number of 0xFB bytes in the messages
    int FBs = 0;
    // Don't forget to check message length for FBs
    if (L_MSB == 0xFB)
        FBs++;
    if (L_LSB == 0xFB)
        FBs++;
    // Calculate Checksum of Message Length bytes along with bytes in the packet
    int CheckSum = L_MSB + L_LSB;
    for (int x=0;x<L;x++)
    {
        CheckSum += Buff[x];
        if (Buff[x] == 0xFB)
            FBs++;
    }
    CheckSum = (256-CheckSum) & 0xFF;
    // Don't forget to up the FB count for a FB checksum!
    if (CheckSum == 0xFB)
        FBs++;
    // New Length is: 2 (For 2 length bytes) + L (Old message Length) + Repeated FBs count + 1 (For CheckSum)
    int NewLen = 2 + MsgLen + FBs + 1;
    // Create a temporary holding tank for Packet Expansion
    BYTE Packet[MAX_CMD_BUF];
    BYTE *Ptr = Packet;
    // Stick message length in the packet (Watching for FBs of course)
    *(Ptr++) = L_MSB ;
    if (L_MSB == 0xFB)
        *(Ptr++) = 0xFB;
    *(Ptr++) = L_LSB ;
    if (L_LSB == 0xFB)
        *(Ptr++) = 0xFB;
    // Expand the original packet into the new buffer
    for (x=0;x<L;x++)
    {
        *(Ptr++) = Buff[x];
        if (Buff[x] == 0xFB)
            *(Ptr++) = 0xFB;
    }
    // Add the Checksum byte (or Bytes if Checksum == FB)
    *(Ptr++) = CheckSum ;
    if (CheckSum == 0xFB)
        *(Ptr++) = 0xFB;
    // Copy the expanded packet back into the original buffer
    memcpy(Buff,Packet,NewLen);
    return NewLen;
}
```

Compliance Notices

FCC Notice

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of the equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense. Changes or modifications not expressly approved by Rane Corporation could void the user's authority to operate the equipment.

Canadian EMC Notice

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations. Cet Appareil numerique de la classe B respecte toutes les exigences du Reglement sur le material brouilleur du Canada.

FCC Part 68 - Compliance

FCC Part 68 Registration Number: 6PV USA-35030-BR-T Ringer Equivalence Number (REN): 0.1B
This equipment complies with Part 68 of the FCC rules. The FCC Part 68 registration number and Ringer Equivalence Number (REN) is posted on the rear of the equipment. This information must be provided to your telephone company, if requested.

USOC Jacks: This product uses RJ11C type terminal jacks.
The quantity of devices which may be connected to a telephone line and still operate properly is determined by REN. An excessive number of RENs connected to a telephone line may result in devices not ringing to an incoming call. Typically, the number of RENs should not exceed five. Consult with your telephone company to obtain the maximum RENs for your area.

Should this equipment cause harm to the telephone network, the telephone company will notify you in advance that temporary disconnect of service might be required. If it is not practical for the Telephone Company to give an advance notice, they will notify the customer as soon as possible. In addition, you will be advised of your right to file a complaint with the FCC.

It is possible that the Telephone Company may make changes to their equipment, operations, facilities and/or procedures that could affect the operation of this equipment. Should this happen, the telephone company will provide advance notice of such changes for you to make the necessary modifications in your equipment.

If this equipment is causing problems, contact Rane Corporation, 10802 47th Avenue West, Mukilteo, WA 98275, (425) 355-6000 for repair and warranty information. The Telephone Company may instruct you to remove the equipment from the network until the problem is resolved.

No user serviceable parts are contained within this product. If problems occur, contact Rane Corporation for service. Use of this equipment is prohibited on Telephone Company provided coin service. Connecting to Party Line service is subject to State tariffs.

IC Compliance

IC Certification Number: 3614 10632 A Ringer Equivalence Number (REN): 0.1B;
Standard Connecting Arrangement RJ11C

Notice: The Industry of Canada label identifies certified equipment that meets certain telecommunications network standards, including protective operation and safety requirements, as prescribed in the appropriate Terminal Equipment Technical Requirements documents(s). By this label, The Industry of Canada does not guarantee the equipment will operate to the user's satisfaction.

Before connecting this equipment to the telephone network, the user should ensure that the equipment is acceptable to the local Telephone Company. An acceptable method of connecting to the telephone network must be followed. All electrical ground connections of the power utilities, metal water pipes, and telephone lines must be connected together. Proper grounding precaution may be particularly important in rural areas. Extending the telephone service of a single line may be accomplished by means of a certified telephone extension cord. In addition, extension of telephone service must not degrade the telephone service.

Caution: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

Repairs of Industry of Canada certified equipment must be performed by an authorized Canadian service facility specified by Rane Corporation. Unauthorized user modifications or repairs to this equipment may result in the Telephone Company requesting that the user disconnect the equipment from the telephone service.

NOTICE: The **Ringer Equivalence Number (REN)** assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the Ringer Equivalence Numbers of all the devices does not exceed five.