KS/NE
Sound System
User Manual

Revised October 27, 2012

Contents

Chapter 1

System Usage

This chapter covers usage of the system, from preparation to tear-down. Later chapters are supplemental, but this chapter is not: it contains information that will help you get the most out of the system and avoid damaging it. *Please* be familiar with this chapter when using the system.

1.1 Setup

1.1.1 Necessary Items

You will need the following items:

- Main sound system rack case
- Remote microphone stand
- Concrete block or other 20 cm (8 inch) evelation for the microphone stand
- 8 non-rechargeable lithium AA batteries (*Energizer Ultimate Lithium*) for use in the microphones
- At least 16 AA batteries for use in SoundMate receivers (new or used, alkaline or Lithium)
- Box for storage of extra miscellaneous items
- Spare microphone stand in case the remote stand fails (or know where to find one)

1.1.2 Placement & Connections

- Most connections are made at the lower rear of the case.

1. Hang the 2 SoundSpheres.
   - They may be labeled EAST/WEST or NORTH/SOUTH.
   - They should be the same height from the floor, if possible.
   - Generally, as high as possible is best. At the least, they should be high enough that the inside peak of the top reflector is visible (or nearly so) from the edges of the seating area.
2. Consider checking fans and filters (not necessary every year).
   - 1 case fan mounted on the rear door
   - TOA D-901 mixer fan at the rear
   - TOA DA-250F amplifier fans (2) at the rear and filters (4) at the front
3. Place the system in the second row of the brothers' seating. Required connections are listed on page 25 and mentioned in the following steps.
4. Remove the front cover (loosen the 2 screws on the side slots and lift up and out).
5. Connect the AC power (power cord is in the bottom storage area).
6. Make sure that the CyberPower power supply is off.
7. Connect the 2 speaker outputs (labeled `SS1` and `SS2`) and 70V output.
8. Attach the 2 antennas for the Galaxy AS-QUAD (the antennas should be in the storage drawer).
9. Place the transmitter; use either:
   (a) the Telex SoundMate ST-200 on a shelf on or near the wall or
   (b) the EDM LCD-CS-EP mounted at its predetermined location.

   A transmitter should **not** be placed within 2 meters of the sound system case.

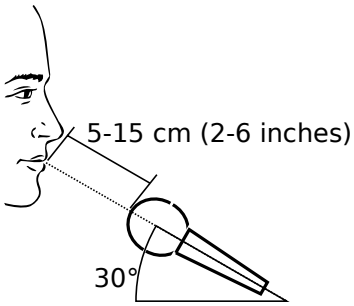
   If using the SoundMate transmitter, make sure that the antenna is not touching any metal.

10. Connect the transmitter input to the XLR output labeled `Transmitter` (use one of the black XLR cables).

11. Connect the transmitter to power using the included power transformer. It is not powered through the system power supply, and should be left on indefinitely[1].

12. Place the microphone stand at the platform. Use a concrete block to elevate the stand about 20 cm (8 inches). Loosen the collar near the top (carefully; it holds the key that keeps the inside stand from rotating freely). The control cable is in the storage area at the bottom of the case.

13. Connect the 30 cm (12 inch) gooseneck to the microphone stand. Adjust the microphone angle, gooseneck, and stand. The microphone should be angled up about 30° from level. Adjust for an approximate distance from mouth to microphone capsule of 5 to 10 cm (2 to 4 inches).



1.1.3 Check Device Settings

Verify that the current device settings are correct according to this list.

- Galaxy AS-QUAD
  - All volumes: set to the *MAX* dot (not fully clockwise)
- TOA DA-250F
  - CH1: *-18 dB*

[1] This is to avoid annoying those using the receivers; see the note in section 2.1.8.

  - CH2: *-18 dB*
  - CH3: *-10 dB*
  - CH4: *-∞ dB (fully counter-clockwise)*

- Telex SoundMate ST-200
  - Channel: *J*
  - Balanced Input (on rear): *600Ω Line Level*

1.1.4 Room Equalization

You can read more about room equalization in the Appendix (3.2.1).

First, decide whether it is necessary to perform a new room equalization analysis. Was the previous year's room curve adequate? Has the room changed significantly, with regard to sound, since last year? Will different SoundSpheres be used, or have they been moved?

If little has changed and last year's curve was good, then load the saved curve without reanalyzing the room:

1. [CEQ280a equalizer] Press the `RECALL` button.

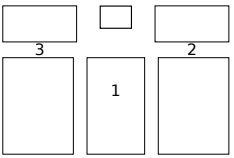
```
RECALL      PROGRAM *001
EXIT       Antioch
```

2. Press the up/down buttons until the correct name is displayed, then press the `RECALL` soft-button (the one near the display).
3. Now skip the remainder of this section.

Otherwise, perform a new room analyzation.

Because room equalization requires an audio measurement, this should be done when there is no extra noise in the room. This procedure requires the use of pink noise, which might annoy people in the vicinity; it helps to have an assistant, and it is important for them to be quiet while taking samples.

This diagram indicates the positions to use for samples during this procedure:



1. Get the SAMSON RTA microphone from the storage drawer and the grey XLR cable from the storage area at the bottom of the case; connect the cable to the microphone and the RTA port at the back of the case (**currently the case RTA port is disconnected: remove the rear case door and connect directly to the `RTA INPUT` port on the Peavey CEQ280a**).

2. Place the microphone at room position 1 (the center of the seating area). The microphone height should be equivalent to ear level (while sitting).

3. [D-901 mixer] Load the `Setup1` preset (which will enable pink noise):

   (a) Press button `2` (`Setup1`) in the `PRESET` section.

   ```
   [PRESET] ▶ LOAD
    No. 2      OK?
   ```

   (b) Press `ENTER` (push the `CHANGE PARAMETER` knob).

   ```
   [PRESET]
   Now Loading...
   ```

4. [CEQ280A equalizer] Adjust/verify RTA microphone sensitivity:

   (a) Press the `RTA` button.

   (b) If necessary, use the left button to move the cursor to the extreme left, and then the up/down buttons to adjust the microphone sensitivity to `40`.

   ```
   LEVEL-  --------------------------EQ   0
   DSPL _  --------------------------MIC 40
   ```

5. [CEQ280A] Perform automatic room equalization:

   (a) Press the `RTA` button.

   ```
   AUTO  RTA PARAMETER:
   EXIT  *MED DECAY   DISPLAY RANGE 24dB
   ```

   (b) Press the `AUTO` soft-button, and move the cursor to the `CURVE1` MIC setting (if necessary).

   ```
   NEXT MIC:   AVR1   INSTR *CURVE1  CURVE2
   EXIT  CURVE3   CURVE4   CURVE5   CREATE
   ```

(c) Press the NEXT soft-button, and move the cursor to the CURVE2 curve setting (if necessary). The older CURVE1 may optionally be used instead; see page 29 for more information.

```
NEXT AUTO EQ TO:   RM1  RM2   RM3  FLAT
EXIT  CURVE1  *CURVE2   CURVE3   CREATE
```

(d) Press the NEXT soft-button.

```
NEXT  *DISCRETE SAMPLES
EXIT   CONTINUOUS SAMPLES
```

(e) Press the NEXT soft-button again.

```
START DISCRETE SAMPLE 001
EXIT
```

(f) Press the START soft-button. The display will show the equalizer taking the first sample. When that is finished, you will see:

```
START DISCRETE SAMPLE 002
EXIT
```

(g) Place the microphone at location 2, then press the START button again.

(h) When that sample is finished, place the microphone at location 3 and press the START button again.

(i) Optionally, take additional samples. Always take samples in the seating area.

(j) When all samples have been completed, press the EQ button, and notice the equalizer curve that has been set up.

(k) For frequencies <80 Hz and >10 kHz, lower the gain to -12 dB. Use the left/right buttons to select frequencies and the down button to lower the gain.

(l) Press the STORE button.

```
STORE      PROGRAM *001
EXIT       Antioch
```

(m) Now press the up/down buttons to select a slot in which to store the generated curve. It is recommended that you use one of the TEST slots initally, and then later store the curve to the appropriately named slot if it works well through several meetings. After selecting, press the STORE soft-button (the one near the display) to save the curve.

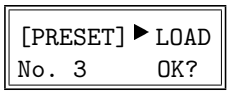
(n) Press the EQ button to return to the normal curve display.

6. Return the microphone and cable to their respective places.

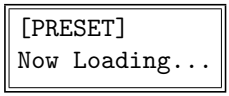
1.1.5 Feedback Suppression

You can read more about feedback suppression in the Appendix (3.2.2).

1. Turn on the platform microphone.
2. [D-901 mixer] Load the `Setup2` preset:
   (a) Press button `3` (`Setup2`) in the `PRESET` section.

   (b) Press `ENTER` (push the `CHANGE PARAMETER` knob).

3. [D-901 mixer] Perform automatic feedback suppression setup:
   (a) Press the `SEL` button in the `MIC BUS` section.

   (b) Push the right arrow in the `ENTRY SECTION`.

   (c) Push `ENTER`; the D-901 will automatically find frequencies that are likely to cause feedback and add appropriate filters.

There are now 9 filters set in the MIC BUS of the D-901. Note that they have not yet been saved to a preset; you will do this when you set up the "Normal" presets in the next section.

1.1.6 Normal/Local Preset

Now the 9 feedback filters need to be saved to the Normal preset.

1. [D-901 mixer] Outputs 3 and 4 were disabled for feedback filter detection; now enable both:
   (a) In the `OUTPUT` section, press `3` and `ON`.

(b) Do the same for output 4.

2. [D-901 mixer] Save the customized `Setup2` preset to the `Normal` preset:

   (a) Press button `4` (`Normal`) in the `PRESET` section.

   ```
   [PRESET] ▶ LOAD
   No. 4      OK?
   ```

   (b) Press the `PRESET` button.

   ```
   [PRESET] ▶ SAVE
   No. 4      OK?
   ```

   (c) Press `ENTER`.

   ```
   [PRESET]
   Now Saving...
   ```

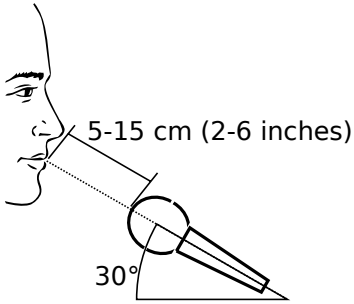
1.1.7 Final Preparation

- Test each of the 4 microphones. You may want to disable output 4 while doing so. If you are using the SoundMate transmitter, check that the meter responds.
- Test the microphone stand with several full up/down cycles to ascertain that the collar is loose enough.
- **After all testing is complete**, put 8 new AA lithium batteries in the microphones. **Attempting to use a pair of lithium AA batteries in a microphone for more than a single convention is not recommended** (considering available Lithium batteries as of year 2012).
- Put batteries in the SoundMate receivers (used Lithium batteries work nicely).

Setup is complete! The system should be ready now for normal use.

1.2 Normal Usage

- Before an event
  - Power up the system with the upper button on the CyberPower power supply.
  - Turn on the microphones:
    - not more than 15 minutes before meeting, and
    - the microphones can be left on for the duration of the meeting.
  - Place them in their proper locations:
    - **black** goes at the platform,
    - **red** is used by the lead singer (provide grace card if applicable),
    - **yellow** is used by a microphone carrier during prayer and testimony times, and
    - **blue** remains at the system as a backup for black and is also used by a microphone carrier during prayer and testimony times.
- Microphone stand
  - Use the toggle switch on the control mounted on the left above the storage drawer to remotely control the microphone stand. Speed can be adjusted using the dial to the right of the switch (speeds less than about 50% might have trouble raising the microphone).
  - Because the microphone stand is noisy, you may want to disable input 1 or reduce the gain while adjusting the stand.
  - If the stand is being manipulated manually (for example, the gooseneck is being adjusted), avoid adjusting the stand or use a low speed (50%).
  - Generally the microphone should be pointed directly at the speaker's mouth, but you also need to consider the preferences of the speaker, how much the speaker moves around (for more movement, further away is better), and trouble with feedback or noise (closer is better). Moving the microphone further away can also reduce essing problems slightly. The best distance from mouth to microphone capsule ranges from 5 to 15 cm (2 to 6 inches).



- AS-QUAD receivers
  - The 4 microphone receivers from left to right correspond to inputs 1 through 4. The `RX` light indicates that the receiver detects a microphone transmitting on the particular channel (the microphone is on).
- General
  - A fader controls the gain for each input and output channel. As well as adjusting the volume, you may disable the channel.
    1. Select the channel using the corresponding selector key, then
    2. adjust the gain using the knob or press the `ON` key to enable/disable the channel.
  - A **mixer firmware bug** occasionally causes the display to show `ASSIGN` and the input channel selector keys to be ignored. If this happens, just press the left arrow key to return to the standard display.
  - Remember that any active input is a possible path for feedback. It is quite possible for feedback to occur on a different input from the one currently in use, though input gates reduce this possibility somewhat.
  - When someone is speaking and also using a SoundMate or other receiver, it may be necessary to disable output `3` if feedback occurs through the receiver.
  - During a power outage, hold the lower button on the CyberPower power supply (for 3 seconds) to silence the outage alarm. The power supply will run the system for approximately 30 minutes. The display will show the approximate remaining time: press the lower button to turn on the display and cycle through information.

- After an event
  - Collect the microphones.
    - It is important to collect them as soon as possible to reduce the total amount of time that the lithium batteries are used. Carelessness in this regard increases the likelihood of microphones failing during the last meetings.
    - Check the battery status. For lithium batteries: replace if the display shows less than 3/3. For alkaline batteries: replace if the display shows less than 2/3.
    - Turn off and store the microphones on top of the storage drawer.
  - Power off the system with the upper button on the CyberPower power supply.
  - Put on the front case door (it is not necessary to tighten the screws).

1.3 Manual Usage

The `Manual` mixer configuration disables many automatic features and bypasses the CEQ280A. Expect lower sound quality.

1. [D-901 mixer] Load the `Manual` preset:
   (a) Press button `1` (`Manual`) in the `PRESET` section.

   ```
   [PRESET] ▶ LOAD
   No. 1      OK?
   ```

   (b) Press `ENTER` (push the `CHANGE PARAMETER` knob).

   ```
   [PRESET]
   Now Loading...
   ```

Now use the mixer like normal, but remember that feedback is more likely: be sure to disable/mute inputs whenever they are not in use.

1.4 Emergency Usage

If nothing seems to be working and you need sound as soon as possible, you can use the included backup equipment. This method depends on only these devices:

- the TOA DA-250F channel 4 (each channel is self-contained, including power supply), as well as
- the CyberPower power supply (unless power is re-routed inside the case).

Expect significantly lower sound quality, including disruptive feedback.

1. Power off all devices using front panel controls (excluding the CyberPower power supply, the CEQ280A, and the microphone stand remote).
2. Get the ElectroVoice dynamic microphone from the storage drawer and the grey XLR cable from the storage area at the bottom of the case.
3. Connect the cable to the microphone and the XLR input at the front lower left of the rack case.
4. Disconnect the 2 SoundSphere cables from the outputs at the rear of the case; connect them to the TRS 1/4-inch jack outputs at the front lower left of the rack case.
5. Place the microphone at the platform.
6. Make sure the channel 4 sensitivity is set to -∞ dB (fully counterclockwise).
7. Power on the DA-250F amplifier.
8. Use the `CHANNEL 4` sensitivity to adjust volume.
9. **Be careful!** There is now no automatic feedback suppression in place.

It would also be possible to use the `MIX` port of the Galaxy AS-QUAD wireless microphones receiver in order to use the wireless microphones (the rear case door must be removed for access the `MIX` port).

1.5 Packing Up

1.5.1 Tear-down Notes

- Fully lower the microphone stand.
- Make sure the system is powered off. Otherwise, the power supply battery will be drained and damaged.
- Remove the 2 AS-QUAD antennas and store them in the drawer.
- Collapse the microphone stand and boom for travel; tighten the collar.
- In the area at the bottom of the case, store:
  - the microphone stand cable,
  - the XLR cable used with the SoundMate transmitter, and
  - the AC power cord, as well as
  - the long grey XLR backup/RTA cable.
- If the system will be going into storage for more than a month, remove the batteries from the microphones.
- Retrieve all 8 SoundMate receivers.
- Store the microphones in the storage drawer. Use the foam strip to secure the microphones.

1.5.2 Transportation Notes

- Only use the caster wheels on smooth, paved areas: be careful to avoid shaking the contents of the case. Because the front is heavier, **push the system from the front** (the large case fan is opposite you as you push) so it does not tip over.
- **Always transport the case on a side, not the front or back.** In a bench seat, the front of the case should face the back of the seat (because the front is heavier).

1.5.3 Storage Notes

- Store as you would any other sensitive and expensive electronics. Protect from extreme temperatures.
- To maximize the battery lifetime of the CyberPower power supply, it should be connected to AC power overnight at least once every 3 months. It is not necessary to power up the system for the battery to charge.

Chapter 2

Hardware

2.1 Equipment

This section is intended to serve as a "parts list" as well as a quick reference for each major device in the system. Read the individual device manuals for more information.

2.1.1 Samson SRK-16 case

Website: http://www.samsontech.com/samson/products/accessories/racks/srk8/

The shell of the system is a 16U rack case with custom front and rear doors and rear port bank for easy connectivity.

2.1.2 Galaxy AS-QUAD and microphones

Website: http://www.galaxyaudio.com/AS-QUAD.jsp

- AS-QUAD chassis
- 4 AS-TVREC receivers
- 2 antennas
- 4 AS-TVHH wireless dynamic microphones

- AS-TV8DCC charger
- power adapter with attached cable

The AS-QUAD equipment provides the system's only inputs; 4 inputs for the D-901 mixer. The microphones transmit on frequencies in the range 640.1 to 663.9 MHz.

To set the channel for the receivers and microphones, just hold the `SET` button (near the display on the microphones) until the channel blinks, adjust the channel with the arrow buttons, then press the `SET` button again to apply. Otherwise, the receiver/microphone will display the channel frequency when the down arrow is pressed.

Each of the 4 microphones requires 2 AA batteries and has a battery charge indicator. The microphones are powered on and off by holding the button on the bottom end until the display shows either `On` or `OFF`. The `Hi/Low/Mute` switch should probably be covered with black electrical tape.

If you use rechargeable batteries (and the Galaxy charger), the batteries must be 1.2V NiMH with a maximum capacity of 2100 mAh. The charger connector is available at the left just above the drawer, notice the small white plastic strap.

The AS-TVHH dynamic microphones can be calibrated somewhat by using 2 equalizer adjustments:

Frequency (Hz)	Gain (dB)	Q factor
150	-1	1.752
4.5k	-2.5	1.752

2.1.3 TOA D-901

Website: http://www.toaelectronics.com/d-901.asp

- D-901 mixer
- 4 D-922E mic/line input modules (8 inputs)
- 1 D-936R stereo input module (1 input, unused)
- 2 D-971E line output modules (8 outputs)
- power cable

All signals arriving to the system come to this mixer, and all signals leaving the system via an output come from this mixer (through respective amplifiers). When using the system, nearly all of the manual adjustments you make will be at this mixer.

Slots are numbered from right to left. Inputs and outputs are numbered from top to bottom on each slot.

Slot	Inputs/Outputs	Module
1	Inputs 1-2	D-922E
2	Inputs 3-4	D-922E
3	Inputs 5-6	(empty)
4	Inputs 7-8	D-936R
5	Inputs 9-10 or Outputs 1-4	D-922E
6	Inputs 11-12 or Outputs 5-8	D-922E
7	Outputs 1-4	D-971E
8	Outputs 5-8	D-971E
9	Remote control	D-981

Note that slots 5-8 accommodate only two D-971M and/or D-971E Line Output Modules total.

All mixer settings can be modified both at the front panel and with a computer through the RS-232/serial port. There are 16 available presets for saving individual configurations. When the mixer starts, it loads the preset that was last loaded; settings are not saved through a power cycle unless they have been saved to a preset.

Optimal input trim settings based on maximum likely signal level for AS-QUAD microphones (versus “normally approximately 0db” use):

Input type	Gain (dB)
Speech	-4
Singing	-6.5

2.1.4 Peavey CEQ 280a and Samson MM01

Website: not available

- CEQ 280A equalizer
- power cable
- calibrated condenser microphone (SAMSON MM01)

This devices does room equalization, using 3 basic functions:

- pink noise generator,
- equalizer, and
- realtime analyzer.

An *Auto EQ* function combines these functions to automatically balance the output with the room response.

The following microphone curve for the SAMSON MM01 RTA microphone is stored under `CURVE1`:

Frequency (Hz)	Gain (dB)
32-2.5k	0
3.15k	+1
4k	+0.5
5k	+1
6.3k	+1
8k	+1.5
10k	+1
12.5k	+1
16k	+1.5

Look in the Room Equalization section on page 28 for more information about using this device.

2.1.5 TOA DA-250F

Website: http://www.toaelectronics.com/amp0012.asp

- 8 ohm amplifier for each of 4 channels
- power cable
- tamper-proof cap for each channel

This 4-channel amplifier accepts 3 D-901 mixer outputs; it powers the 2 main SOUNDSPHERE outputs plus the 70V output. Channel 4 is reserved for emergency usage (Section 1.4): the DA-250F contains a separate power supply for each channel.

There is 1 jumper inside for each channel to select between "+4 dB" and "-10 dB"; all 4 jumpers are set to "+4 dB".

2.1.6 CyberPower OR700LCDRM1U

Website: http://www.cyberpowersystems.com/products/ups-systems/smart-app-ups/rackmount-lcd/OR700LCDRM1U.html

- OR700LCDRM1U power supply
- power cable

This device supplies power to the system, including during an outage. The display provides information about load and remaining run-time. In the case of a power outage, the unit will beep; to disable the alarm, hold the lower button until the mute indicator appears on the display (about 3 seconds).

2.1.7 Remote Control Microphone Stand & Remote

- microphone stand
- controller
- remote cable
- power cable

This microphone stand is homemade. It might be a bit noisy, but it has been reliable and has a larger vertical range than the single commercially available alternative that has been found online.

The controller has been upgraded to include a speed controller and rack-mount capability.

With the stand at its lowest point, the microphone capsule/head should be about 1.2 meters (4 feet) from the platform floor to accommodate a broad range of heights.

2.1.8 Telex SoundMate devices

Website: unavailable

- ST-200 transmitter, with configurable channel
- 8 large SR-50 receivers, channel J

- 1 G-Blaster battery-powered amplifier
- earphones and ear-buds
- 1/8 inch plug audio cables

The SoundMate devices provide assistive listening inside the meeting room.

Note that anyone using a SoundMate receiver will hear noise if the transmitter is powered off. This could be especially annoying if the volume is up for use during a meeting and then the transmitter is powered off before the receiver has been powered off. Therefore it is suggested to power the transmitter separately from the system and leave it on indefinitely.

2.1.9 Miscellaneous

- XLR cables
- remote microphone stand and cable
- batteries
  - Lithium non-rechargeable AA for wireless microphones
  - AA for SoundMate SR-50 receivers
- U-style microphone holder
- clip-style (extra) microphone holder
- etcetera

2.2 Rear Settings

Here is a list of switch settings at the rear of the devices.

- Galaxy AS-QUAD
  - MIXER: *HI*[1]
- TOA D-901

[1]The AS-QUAD mixed output is not normally used.

  - All GND switches: *LIFT (right)*
  - Slots 1,2,6 PHANTOM switches: *OFF (right)*
  - Slots 1-2 MIC/LINE switches: *MIC (left)*
  - Slots 1-2 level switches: *-36dB (right)*
  - Slot 5, input 1 PHANTOM switch: *OFF (right)*
  - Slot 5, input 1 MIC/LINE switch: *LINE (left)*
  - Slot 5, input 1 level switch: *-10dB (left)*
  - Slot 5, input 2 PHANTOM switch: *ON (left)*
  - Slot 5, input 2 MIC/LINE switch: *MIC (left)*
  - Slot 5, input 2 level switch: *-50dB (left)*
  - Slot 6 MIC/LINE switches: *LINE (right)*
  - Slot 6 level switches: *+4dB (right)*

- TOA DA-250F
  - BRIDGE 1: *OFF (out)*
  - CH1 TO ALL: *OFF (out)*
  - BRIDGE 2: *OFF (out)*

- Telex SoundMate ST-200
  - Balanced Input: *600Ω Line Level*
  - RF Power: *Hi*

2.3 Connectivity

2.3.1 External

The following connections are made externally:

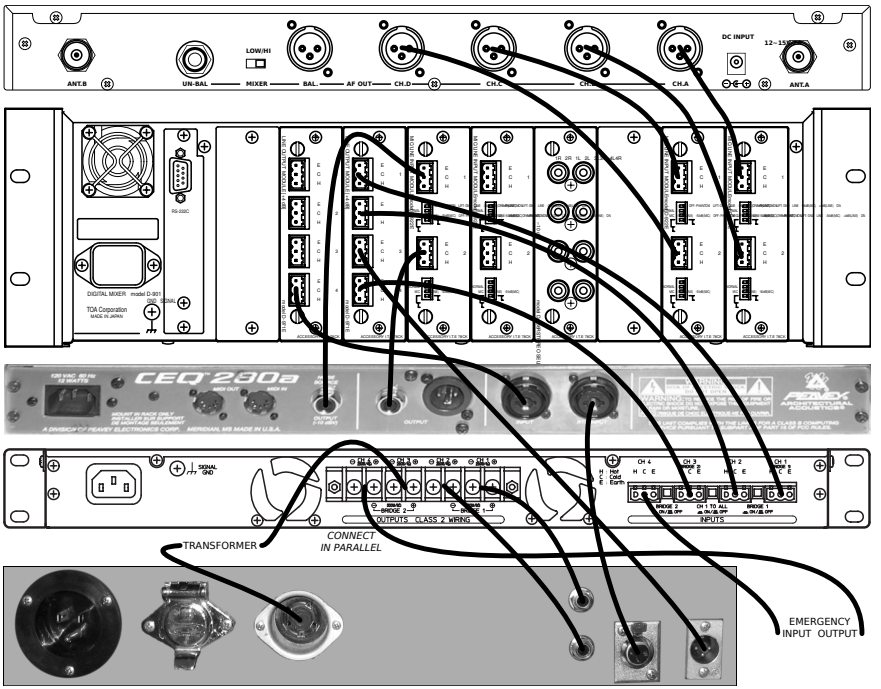
- AC power,
- 2 SoundSpheres,
- 70V output,
- remote microphone stand,

- SoundMate transmitter (with shelf or ledge),
- RTA microphone (temporary) (currently disconnected; connect to rear of CEQ280a inside), and
- emergency microphone and SoundSphere (used only if necessary).

2.3.2 Internal

- Speaker wire: stripe is positive
- Audio cables: white is positive, black is negative

Here is a crude schematic showing the connections between the devices in the system.



Chapter 3

Appendix

3.1 Radio Theory

- A fundamental frequency is the lowest in a harmonic series; each harmonic frequency is a multiple of the fundamental frequency.

- The transmit frequency equals the fundamental frequency. For example, if device A is transmitting at 100 MHz and device B is receiving at 300 MHz, then device B might receive interference from device A because 300 is a multiple of 100. Think of a transmitter as transmitting primarily on its fundamental "set" frequency and also on multiples of that frequency.

3.1.1 Frequency Blacklist

The following radio frequencies have been associated with problems; that is, they may have experienced interference at some point. You may want to avoid using these frequencies with wireless devices.

- 640.1 MHz (AS-QUAD channel 1)

- 641.6 MHz (AS-QUAD channel 2)

- 655.2 MHz (AS-QUAD channel 11)

3.2 Audio Theory

- A medium (usually air) attenuates (reduces the power of) high frequencies more than low frequencies.
- A fundamental frequency is the lowest in a harmonic series; each harmonic frequency is a multiple of the fundamental frequency.
- Voice frequencies information:
  - Range:
    - Telephony: 300 to 3.4k Hz
    - Speech critical: 170 to 8.3k Hz
  - The voiced speech of a typical adult male will have a fundamental frequency from 85 to 180 Hz, and that of a typical adult female from 165 to 255 Hz.
  - Sibilants, or essing, is the high frequency noise associated with the letter *s*. Sibilants range from 2 kHz to 10kHz, depending on the individual's speech characteristics.
  - Speech critical frequency bands (Hz); first, the centers and widths, then the calculated frequency ranges, and last the resulting important bands when using a 29 band equalizer (other bands may be reduced significantly):

Center	Width	→	Range	→	Critical bands
					160
200	60		170-230		200
300	60		270-330		250
500	60		470-530		315
800	70		765-835		500
1k	80		960-1040		800
1.5k	100		1450-1550		1k
2k	130		1935-2065		1.6k
3k	200		2900-3100		2k
5k	300		4850-5150		3.15k
8k	600		7700-8300		5k
					8k

3.2.1 Room Equalization

The *frequency response* of a room refers to the way sounds of different frequencies behave in the room. In every room, some frequencies ranges

will be reflected more than others. To compensate for this, we need 4 things:

- a source of sound that is equal across all frequencies (pink noise generator),
- a RTA microphone to accurately "hear" the pink noise in the room,
- a real-time analyzer to show us what the microphone is "hearing", and
- an equalizer to change the frequency levels.

The equalizer will use a resulting "curve" to make the pink noise (as "heard" by the microphone) match the "target curve" which would be flat with roll-off on both low and high ends.

The Peavey CEQ 280a provides all of these, with automatic room equalization.

Here are 2 possible target curves for equalization (stored in CEQ 280a memory); `CURVE1` is a standard speech response target curve, and `CURVE2` is the same with the speech critical frequency band concept applied (-2 dB).

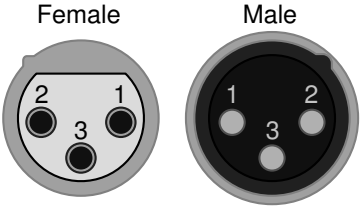
Frequency (Hz)	Gain (dB): `CURVE1`	Gain (dB): `CURVE2`
32-63	-12	-12
80	-4	-6
100	-2	-4
125	0	-2
160-315	0	0
400	0	-2
500	0	0
630	0	-2
800-1k	0	0
1.25k	0	-2
1.6k-2k	0	0
2.5k	-1	-3
3.15k	-3	-3
4k	-4	-6
5k	-4	-4
6.3k	-5	-7
8k	-6	-6
10k	-7	-9
12.5k-16k	-12	-12

3.2.2 Feedback Suppression

Some frequencies are more likely to be detected by an input and re-amplified in a loop continuously, causing disrupting noise. Automatic feedback suppression (with both fixed and dynamic filters) is provided by the D-901 mixer.

3.3 Connector Specifications

3.3.1 XLR (microphone)

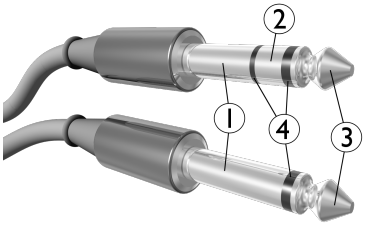


Pin	Function
1	Ground (cable shield)
2	Positive polarity terminal (“hot”)
3	Return terminal (“cold”)

3.3.2 Euroblock/Phoenix

Euroblock wiring varies by device. Refer to device documentation or rear panel.

3.3.3 TS/TRS (1/4-inch audio jack)



Some of the audio plugs and jacks in this system do not need a signal ring (2) and so will correspond to the lower graphic.

Note that TS/TRS plugs and jacks are used with various wiring configurations. The table shows how they are used for this system.

	Part	Function
1	Sleeve	Ground (cable shield)
2	Ring	Signal negative (for balanced connections)
3	Tip	Signal positive
4	Insulator	

3.3.4 Amphenol UY5 tube socket

This 5-pin connector has been traditionally used for 70V audio. Connector specifications are unknown.

3.3.5 Speaker wire

The white band is positive. Always verify polarity when making connections.

3.4 System Design Concepts

This system was designed with the following things in mind.

1. Separation/clarity of functionality

   Each device should have a clear and evident use. Avoid purchasing devices that have unnecessary functionality. This is especially applicable when the system is expected to be used by individuals who are unfamiliar with it.

2. Size and form (19 inch rack mount)

   The 19 inch rack mount specification provides for variable sized devices in a rectangular rack cabinet without wasting space.

3. Clear signal path

   The mixer mixes. Inputs go to the mixer from a receiver and outputs go from the mixer to an amplifier. There certainly can be reasons to deviate from this, but it helps keep the complication centered on the mixer and the cables neat behind the rack, and helps the users understand the signal path.

4. Cooling

   Make sure the system as adequately cooled. Overheating can cause thermal protection shutdowns and damage to devices.

5. Electromagnetic interference

   Although sound equipment is becoming increasingly digital (like the mixer) there unfortunately are still many analog signals in use, especially in cables. If power cables or transformers are in close proximity to those cables, there is the possibility of interference, causing a hum in that part of the signal path. Avoid this by:

   - using shielded cables (proper braided shielding),
   - using balanced (versus unbalanced) connectors, cables, and device ports,
   - physically separating power lines from signal lines in the case (cross at right angles), and
   - placing transmitters and their antennas at least 2 meters from the system.

   Note that speaker wire (which connects amplifier outputs) should be neither shielded nor balanced.

6. Ground loops

   Consider disconnecting power grounds and/or using signal ground lifts to prevent ground loops.

3.5 Disclaimer and warnings

Remember to take advantage of available resources, including:

- this manual,
- device-specific manuals in the yellow envelope,
- the internet,
- other people, and
- your own “sound” judgment.

This manual and the system as a whole imply no warranty or guarantee; the entire risk regarding quality and performance is the responsibility of the reader and user.