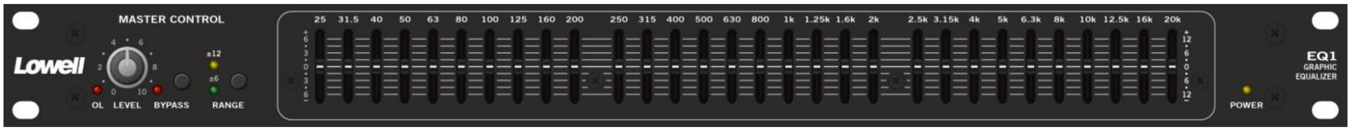
INSTALLATION SHEET AND OPERATORS MANUAL FOR MODEL "EQ1" 1/3 OCTAVE GRAPHIC EQUALIZER



Front Panel

Rear Panel

EQ1 General Description:

The Lowell EQ1 is a single channel 30-band Constant-Q graphic equalizer with thirty 20mm center-detented linear sliders on ISO center frequencies. The front panel controls include a rotary overall level control, a ±12dB or ±6dB range selector switch, an overload clipping light, an EQ bypass switch with LED, and a power LED indicator. The EQ1 is equipped with rear panel balanced/unbalanced XLR and ¼" TRS phone plug inputs and outputs. Hook-up is intuitive. Just follow the connector pin-out instructions printed on the rear of the unit. Polarity convention is per IEC/ANSI/AES standards of pin 2 positive, pin 3 negative and pin 1 shield. The EQ1 does not invert the signal. You may use either the XLR or ¼" TRS phone connectors for input or output. Only connect to one INPUT connector type. The XLR and ¼" TRS phone plug inputs do not sum, so you must use one or the other. The XLR and ¼" TRS phone output connectors are wired in parallel (with no isolation between the two connectors) but you may use both connectors if desired to feed 2 amplifiers or other equipment.

Getting Started:

Please study carefully the "IMPORTANT SAFETY INSTRUCTIONS" that are given on page 2 before applying power to your EQ1. Those experienced with the process of adjusting a graphic equalizer to tune a sound system, will find the EQ1 easy to use thanks to the innovative constant-Q circuitry that is designed to minimize interactions between adjacent bands. For those that have never adjusted a graphic equalizer before, a helpful section is included in this operators manual with basic instructions for tuning a paging/background-music system, sound reinforcement system, and a sound masking system. We strongly suggest that you protect your settings after carefully adjusting the EQ1, by using one of the optional Lowell security covers (sold separately) that are described below.

Optional Security Covers:

Two security covers are sold separately to prevent tampering with the EQ1 controls.
The Lowell SSC-1V vented security cover and Lowell SSC-1P Plexiglass security cover are shown below.
For rack-mount installation, 2 installer provided rack screws hold the security cover over the front of the EQ1.
For shelf-mount installation, the security cover may be attached to the EQ1 with installer provided screws and nuts.

Lowell EQ1 shown with optional Lowell SSC-1V vented security cover

Lowell EQ1 shown with optional Lowell SSC-1P plexiglass security cover

Lowell Manufacturing Company ● 100 Integram Drive ● Pacific, Missouri 63069 U.S.A.
Call: 800-325-9660 Fax: 636-257-6606 Click: www.lowellmfg.com

Instruction Sheet IS-EQ1
Issued: 1-20-14

IMPORTANT SAFETY INSTRUCTIONS

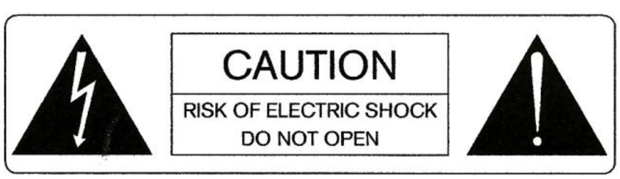
- Read these instructions.
- Keep these instructions.
- Heed all warnings.
- Follow all instructions.
- Do not use this apparatus near water.
- Clean only with a dry cloth.
- Do not block any ventilation openings. Install in accordance with manufacturer's instructions.
- Do not install near any heat sources such as radiators, registers, stoves, or other apparatus (including amplifiers) that produce heat.
- Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding-type plug has two blades and a third grounding prong. The wide blade or third prong is provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
- Protect the power cord and plug from being walked on or pinched particularly at plugs, convenience receptacles, and the point where it exits from the apparatus.
- Only use attachments and accessories specified by the manufacturer.
- Use only with the cart, stand, tripod, bracket, or table specified by the manufacturer, or sold with the apparatus. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.
- Unplug this apparatus during lightning storms or when unused for long periods of time.
- Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.
- The plug on the power cord is the AC mains disconnect device and must remain readily operable. To completely disconnect this apparatus from the AC mains, disconnect the power supply cord plug from the AC receptacle.
- This apparatus shall be connected to a mains socket outlet with a protective earthing connection.
- When permanently connected, an all-pole mains switch with a contact separation of at least 3 mm in each pole shall be incorporated in the electrical installation of the building.
- If rack mounting, provide adequate ventilation. Equipment may be located above or below this apparatus, but some equipment (like large power amplifiers) may cause an unacceptable amount of hum or may generate too much heat and degrade the performance of this apparatus.
- This apparatus may be installed in an industry standard equipment rack. Use screws through all mounting holes to provide the best support.

WARNING: To reduce the risk of fire or electric shock, do not expose this apparatus to rain or moisture. Apparatus shall not be exposed to dripping or splashing and no objects filled with liquids, such as vases, shall be placed on the apparatus. This product may contain chemicals known to the State of California to cause cancer, or birth defects or other reproductive harm.

NOTE: This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: Reorient or relocate the receiving antenna.
Increase the separation between the equipment and receiver.
Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
Consult the dealer or an experienced radio/TV technician for help.

CAUTION: Changes or modifications not expressly approved by Lowell Manufacturing will void the manufacturers warranty.

WARNING



To reduce the risk of electrical shock, do not open the unit. No user serviceable parts inside. Refer servicing to qualified service personnel.

The symbols shown below are internationally accepted symbols that warn of potential hazards with electrical products.

This symbol indicates that a dangerous voltage constituting a risk of electric shock is present within this unit.

This symbol indicates that there are important operating and maintenance instructions in the literature accompanying this unit.

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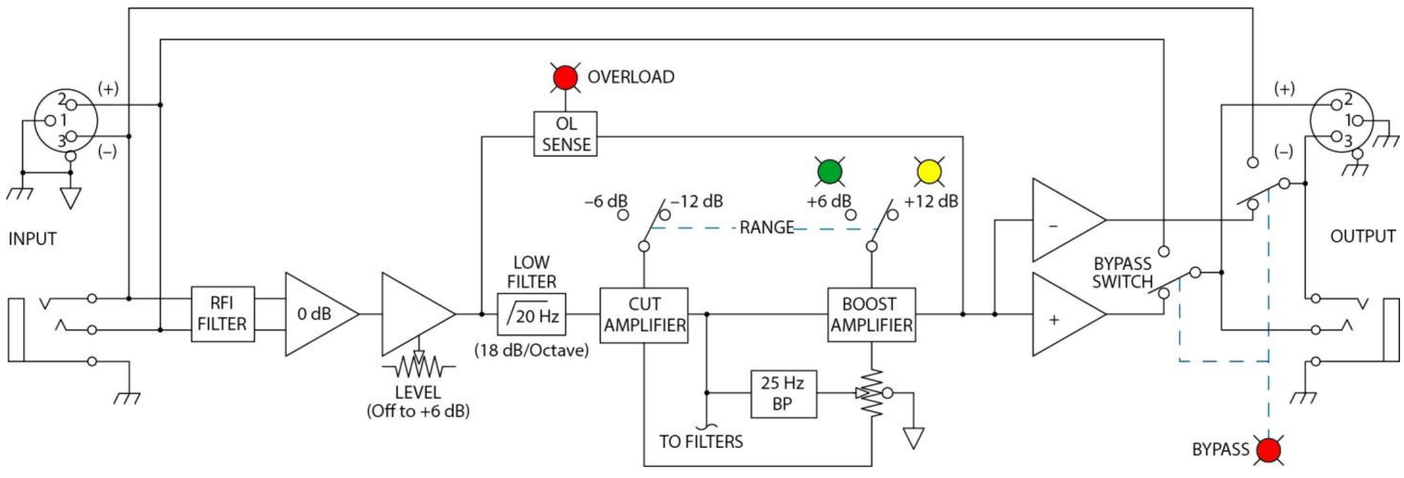
EQ1 Block Diagram



EQ1 Technical Specifications

Note: 0 dBu = 0.775 Vrms (reference) dBu = 20 log (V_1 / 0.775) where V_1 is the rms voltage to be converted to dBu.
Sliders: (30) 20mm-travel center-detent controls, 1/3-Octave at ISO spacing from 25 Hz to 20 kHz
Filters: Constant-Q design to minimize interactions between adjacent bands
Range: ± 12 dB or ± 6 dB depending on the position of the front panel "RANGE" switch
Inputs: XLR and ¼" TRS phone plug, active 20 kΩ balanced or 10 kΩ unbalanced
Maximum Input: 20 dBu. Note: Only one input (XLR or ¼" TRS) may be used at a time. The inputs do not sum.
Outputs: XLR and ¼" TRS phone plug, active 400 Ω balanced or 200 Ω unbalanced Note: The XLR and ¼" TRS output connectors are wired in parallel (with no isolation).
Maximum Output: +20 dBu balanced into 2 kΩ/+19 dBu balanced into 600 Ω +15 dBu unbalanced into 2 kΩ/+13 dBu unbalanced into 600 Ω
Overall Gain with sliders centered: Off to +0 dB (unbalanced output) / Off to +6 dB (balanced output)
Filters: RFI filters included and Infrasonic (subsonic) filter 20 Hz 18 dB/octave Butterworth low-cut filter included.
Overload LED Threshold: 4 dB below clipping
Frequency Response: 20 Hz – 100 kHz, +0 dB/-3 dB
THD and Noise: 0.011% (+4 dBu, 20 Hz - 20 kHz BW) IM Distortion (SMPTE): 0.01% (+4 dBu, 60 Hz - 7 kHz, 4:1)
Signal-to-Noise Ratio (20 kHz noise bandwidth, unity gain, balanced): +20 dBU output: 107 dB with sliders centered, 92 dB with sliders full boost, 104 dB with sliders full cut +4 dBU output: 91 dB with sliders centered, 76 dB with sliders full boost, 88 dB with sliders full cut
Common Mode Rejection: 40 dB @ 1kHz
Universal Line Voltage: 100-240 VAC, 50/60 Hz
Chassis Construction: All steel
Chassis Size: 1.75" H X 19" W X 5.25" D (1U of rack space) Weight: 5 lb. (2.3 kg.)
Shipping Carton Size: 4.25" H X 20.3" W X 13.75" D Shipping Carton Weight: 8 lb. (3.6 kg)

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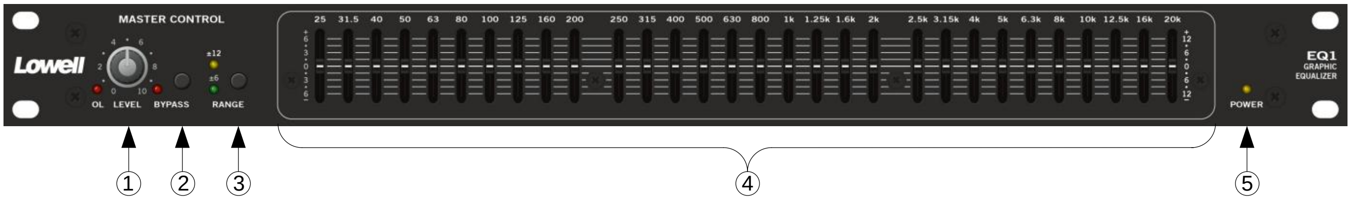
EQ1 Front Panel Description



① **LEVEL control:** Sets the level of signal coming into the EQ1. Turn this control down if the over load **OL** LED lights up steadily (meaning too strong of an input signal). Since actual unity gain depends on varying slider settings (which is why we have not marked a unity gain position on the front panel), use the **BYPASS** switch to determine the exact unity gain position of this **LEVEL** control by comparing equalized and bypassed volumes. The **OL** indicator begins to light at a threshold of 4 dB below clipping and lights fully if any section of the EQ1 is within 3 dB of clipping. Occasional blinking of this LED is acceptable, but if it re-mains on more than intermittently, turn down either the **LEVEL** control on the EQ1 or reduce the output level of the preceding component that feeds the input of the EQ1 to avoid audible distortion.

② **BYPASS switch:** When the switch is pushed in and the red LED is lit, this indicates that the unit is in the BYPASS mode: signal is routed directly from the input to the output without passing through any active circuitry. Use this switch to compare equalized and unequalized (bypassed) program material, or to bypass the EQ section in the event of power loss or unit failure.

③ **Filter RANGE switch:** The gain range of the filter sliders is switchable (as a group) from ±6 dB for high resolution, to ±12 dB for maximum boost/cut capability. Yellow & green LEDs indicate the current range setting.

④ **Filter level slide controls:** Each of these sliders controls the output level of each of the bandpass filters. Center position is grounded for guaranteed flat response.

⑤ **POWER:** When the EQ1 is plugged into 85-240 VAC, this emits yellow light.

EQ1 Rear Panel Description

① **XLR INPUT jack:** Accommodates balanced signals. Lowell adheres to the international and U.S. standard for balanced pin configurations: Pin 1 is chassis ground (neutral), pin 2 is hot (positive), and pin 3 is signal return (negative)**.** *Choose between this XLR and the ¼" TRS Input jack—use only one—they do not sum.*

② **¼" TRS INPUT jack:** This TRS (Tip-Ring-Sleeve) ¼" jack accommodates either balanced or unbalanced signals. For an unbalanced signal, use a mono ¼" plug (single conductor with shield). For a balanced signal, use microphone cable (two conductor with shield) with a TRS ¼" plug. *Choose between this ¼" plug and the XLR Input jack—use only one— they do not sum.*

③ **¼" TRS OUTPUT jack:** This TRS (Tip-Ring-Sleeve) ¼" balanced jack is compatible with either balanced or unbalanced systems. For an unbalanced signal, use a mono ¼" plug (single conductor with shield). For a balanced signal, use microphone cable (two conductor with shield) with a TRS ¼" plug. The XLR and ¼" TRS output jacks are wired in parallel with no isolation. Both jacks may be used at the same time.

④ **XLR OUTPUT jack:** This balanced output is wired per the international and U.S. standard for balanced pin configurations: Pin 1 is chassis ground (neutral), pin 2 is hot (positive), and pin 3 is signal return (negative)**.** Outputs can feed from this XLR jack and from the parallel ¼" output jack at the same time.

⑤ **UNIVERSAL VOLTAGE INPUT:** This miniature IEC 60320 C6 appliance inlet mates with the IEC 60320 C5 line cord provided (USA domestic). Note: Never lift the ground connection on this power cord.

EQ1 Connection

INPUTS
Both the XLR and ¼" TRS inputs are wired in parallel and are actively balanced. Each works equally well. Choose strictly from a required hardware point-of-view, there will be no performance trade-offs. The wiring convention adheres to American, British and International standards of pin 2 or tip being hot, pin 3 or ring being return, and pin 1 or sleeve being shield. Unbalanced operation involves using only pin 2 or tip as signal, and pin 1 or sleeve as shield or ground. It is not necessary to short any inputs to ground for unbalanced operation. It doesn't hurt. It's just not necessary. Use pin 1, or the shell, for shield ground.

OUTPUTS
Balanced output requires using pin 2 or tip, and pin 3 or ring for the signal. It does not require pin 1 or shield. The signal exists differentially between the two balanced leads; ground is not involved. To insure a hum-free system, use the ground pins only for shielding.

EXPANDING
Expanding and/or daisy-chaining the inputs and outputs normally uses the ¼" jacks. The parallel input connectors allow driving a second EQ1 without special cabling. Simply connect the feed for the first EQ1 to the XLR balanced input. Use a ¼" TRS phone plug jumper cord to connect the ¼" TRS input jack on the first EQ1 to the ¼" TRS input jack on the second EQ1 and both units will be fed with the same input signal. A similar thing can be done with the output wiring. The balanced XLR output can feed to one amplifier, and the ¼" TRS phone jack output can feed to a separate amplifier or the input of some other device.

SIGNAL LEVELS
Input signal levels from -10 dBV to +4 dBu are considered normal and within range (at least 20 dB of headroom exists above these levels). Do not connect microphones directly to the input of the EQ1. Microphones require an external mic preamp. The EQ1 requires a line level input signal.

Operating Instructions

Setting Gain Structure

Here is one method of setting your equalizer gain that works well. Begin with the following settings:
1. Engage the **BYPASS** switch. (switch depressed, bypassed and **LED** is *on*.)
2. Put all sliders in their center position (0 dB). Note: All sliders have a detent at the center 0dB position.
3. Position the **LEVEL** control about "6" for unbalanced operation and "7" for balanced operation.
4. Apply a signal to the system.
5. Verify the **OL** LED is not on—occasionally blinking during extreme peaks indicates an optimal setting. But if it lights up a lot or lights steadily, lower the output level of the previous device in the signal chain.
6. Release the **BYPASS** switch and begin adjusting the equalizer filters. Note: For insight into a method of using the equalizer to tune a sound system or a sound masking system, see the following three sections.
7. During filter band adjustments, if the **OL** LED lights more than occasionally, turn down the output of the previous device in the signal chain. Run the EQ1 with an input signal that is as hot as possible without the OL lighting more than occasionally.
8. Insuring the proper level of gain though the EQ1 is just as important as adjusting the equalizer bands. Improper gain distribution is a common cause of loss of system headroom and less than optimum noise performance. The **BYPASS** switch allows comparison of equalized versus un-equalized signal. It is also useful in adjusting the level of the EQ1 for unity gain which results in the best signal-to-noise performance. When the gain is not properly adjusted, the level difference between the equalizer "bypassed" or "in the circuit", can be significant. Once all filter bands are adjusted to your liking, adjust the **LEVEL** control on the EQ1 so there is no difference in overall level with the **BYPASS** switch in the bypassed position (pushed in and LED on) compared to with the **BYPASS** switch in the active position (not pushed in and LED off).
9. The last step is to reconfirm one last time that the **OL** LED lights only when there are large signal spikes in the program material. If the **OL** LED lights up a lot or lights steadily, lower the output level of the previous device in the signal chain.

Tuning a Sound System for "Flat" Response using the EQ1

A commercial sound system is typically installed for one of two purposes: Either a sound exists at one location and needs to be spread throughout a facility where the original sound cannot be heard (as in the case of a voice from a paging microphone, a prerecorded message, or background music being distributed throughout an office complex), or the sound that exists is not loud enough to be heard by all of the listeners (as in the case of a sound reinforcement system with a performer using a live microphone on a stage with listeners throughout the auditorium). In both cases, it is important that the original sound is reproduced or reinforced in such a manor that the sound heard from the speakers has the same frequency content as the original voice or music program. Modern electronic sound equipment that is operating properly amplifies sound system signals without "coloring" or changing the frequency response of the original signal. There are, however, two items that can drastically affect the output of the sound system. The first is the system loudspeakers. There is no perfect loudspeaker transducer that can turn an electrical signal into a sound wave without affecting the frequency response of the signal somewhat. Some speakers are better than others, but none reproduce sound perfectly. The second item is the acoustical space that the speakers are covering. Anyone that has spent time in a reverberant gymnasium or in a building with glass walls, knows how dramatically a sound can be distorted by the acoustical environment. Equalization cannot erase all of these acoustical challenges, but there are certain improvements that can be made by using a graphic equalizer.

When the sound from an electronic sound system is produced by an imperfect loudspeaker transducer into an imperfect acoustical space, the amplitude of the sound at certain frequencies can be either reduced or increased due to mechanical issues in the loudspeaker itself or as a result of acoustical issues in the room. In the early days of sound system use, engineers developed the graphic equalizer to deal with the destructive effects of non-perfect loudspeakers and poor acoustics. The graphic equalizer divides the audio frequency spectrum (the sound that humans can hear) into isolated 1/3 octave bands. That allows the user to adjust selected 1/3 octave bands (slices) of the audio signal that have been artificially boosted or attenuated by the loudspeakers or the acoustics.

Audio Engineers have developed an audio test signal called "Pink Noise" which is a noise that contains equal energy per octave. Most humans (because of the way our ears work) would report that "Pink Noise" sounds "FLAT". In other words, it sounds like it has as much energy in the low frequencies as it does in the high frequencies. A complete discussion of audio theory is beyond the scope of this paper, but suffice it to say that "Pink Noise" has become the standard test signal used to tune a system equalizer. A device called a "Real Time Analyzer" (RTA for short) was developed that is calibrated to Pink Noise and can detect the output that is produced by the sound system and break the signal up into the same standardized ISO 1/3 octave band centers as the sliders control on the graphic equalizer.

The steps to tuning a sound system for "Flat Response" (In other words for equal energy per octave like Pink Noise) are fairly simple. Pink Noise is fed to the input of the sound system with all tone controls (bass, treble, or mids) on the sound system mixer set to flat (no boost or gain). The test microphone for the RTA is placed on axis with one of the loudspeakers at a typical listener's position. If the display on the RTA shows a flat horizontal line, the sound system has produced a pure Pink Noise signal and no tuning of the equalizer is required. In reality, that never happens or there wouldn't be a need for an equalizer. In normal practice the response curve on the RTA will show a mostly flat line but there will be a series of peaks and dips to the line that have been caused by the imperfect response of the loudspeaker or by issues with the acoustics. A peak in the curve can be reduced by slightly lowering the slider on the equalizer that corresponds to the same 1/3 octave frequency band as that of the peak showing on the RTA. A dip in the curve can be corrected by slightly raising the slider that corresponds to the same 1/3 octave frequency band as that of the dip on the RTA.

Repeating this process will eventually "Equalize" the frequency response of the sound system so that a flat pink noise input will result in a flat pink noise output from the sound system. Now that the sound system has been tuned using the equalizer, the output of the sound system should have the same frequency response content as the live or recorded voice or music material that is fed into the sound system. This discussion has been a bit of a simplification. Many good text books have been written on the subject of sound system equalization and a study of those would be a worthwhile endeavor.

It is important for a graphic equalizer user to understand the limitations of this technology. Acoustic problems are generally not consistent across the entire area of the sound system coverage. This is much more of a problem when setting up a sound system for a large venue. In a typical large room or hall, there will be areas that have acoustic reinforcement and resonance problems and other areas where certain frequencies are almost entirely canceled out. It's always a good idea to try to seek an acoustic remedy for acoustic problems whenever possible. When this is not possible or feasible, an equalizer may be used to compensate for an acoustic problem. But the problem is only improved at the point where the measurement is taken and other locations in the room may be adversely affected by the equalizer setting. For this reason, it is a good idea to measure the acoustic response of the system from several locations and average the equalizer's setting. Doing this helps most locations in the venue to receive similar acceptable sound quality from the sound system.

Equalization can be like spice in the hands of a master chef. A little goes a long way in improving sound quality, too much, and the mix is spoiled. If modest amounts of equalization (6-8 dB) do not solve the problem, it is best remedied by other means. Avoid adding large amounts of boost below 63 Hz, especially when using vented bass cabinets. Boosting frequencies below the vented enclosure's low frequency cutoff can easily cause over excursion of the speaker's cone, causing premature failure. In addition, boosting low frequencies can make your power amplifier run hotter, leading to premature amplifier failure. Boosting high frequencies can sometimes emphasize the high frequency noise from the electronic equipment in the sound system signal chain and a "hiss" may be heard coming from the speakers. Be conservative boosting frequency bands when equalizing a sound system. When equalizer adjustment is completed, compare the un-equalized sound with the equalized sound by alternately engaging the BYPASS switch. Use familiar source material and walk around in the sound coverage area to insure that no anomalies have been introduced into the sound in the listening area. If it sounds good, you're done.

Live Microphones and Controlling "Feedback" using the EQ1

We've all heard that annoying squeal when live microphones are used and the sound system goes into "feedback". No matter how perfectly you have set your EQ1 to flatten the frequency response of the sound system, there will still be some peaks at certain frequencies. When a sound system is turned up to the point that the output of the speakers is picked up again by the microphone and re-amplified, the frequencies where there are peaks, will "ring" or "squeal" first. In some cases the sound system's gain before feedback will not let the operator turn up the sound system loud enough for the needs of the performance. When the sound system is turned up with the live microphone turned on until feedback occurs, the frequency that feeds back will show up as a spike on the display of a real time analyzer (RTA). If the feedback is at an isolated frequency, it is possible to slightly lower the gain of the slider on the EQ1 in the 1/3 octave band that contains that frequency. Note that when you tune out that feedback, you are also reducing the level of all of the frequencies in that third octave band, so notch for feedback sparingly. Notching too many sliders to reduce feedback can make the sound system sound terrible. It's best to listen to the system after each adjustment to make sure you haven't overdone it. When 3 or 4 frequencies are feeding back at the same time, that means the output of the system is fairly flat so you should stop. You've now gotten as much volume out of the sound system as possible unless you change the location of the microphone, or change the aiming of the speakers to keep the sound from the speaker from being picked up by the microphone. If the sound system can now be operated at a louder level because you have reduced the feedback and the system still sounds good, you're done tuning for feedback.

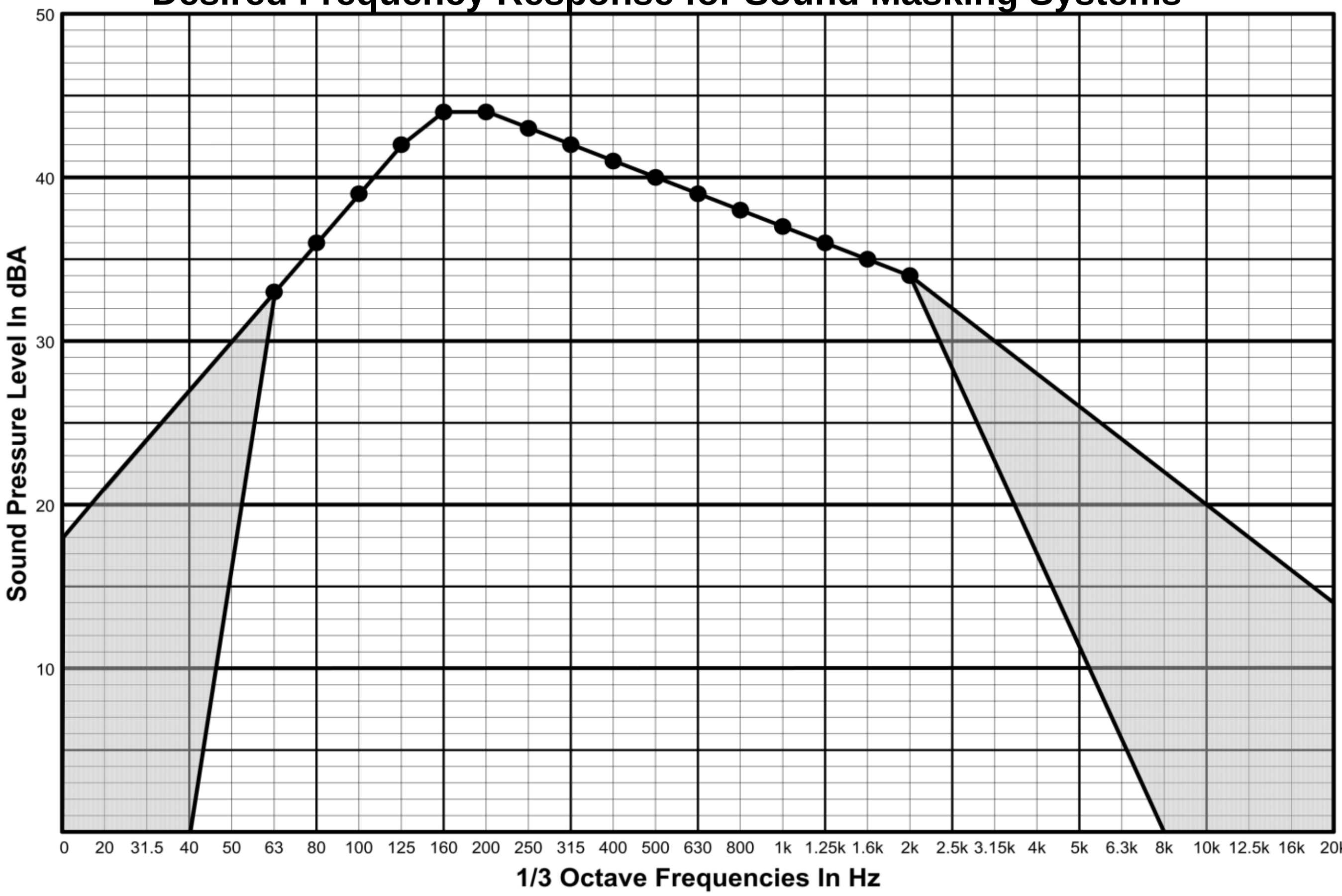
Tone Contouring (Also called "Voicing") using the EQ1

An EQ1 can be used for tone contouring by ear which is basically adjusting the tone of the system. Be careful about adding upper bass (63 Hz to 200 Hz) as this can cause "muddiness" or loss of definition. Also see the previous warning about boosting frequencies below 63 Hz. Middle frequency problems usually express themselves by vocals having a nasal quality (too much mid band boost) or vocals not being easily understandable (usually caused by mid band frequencies being under represented in the overall sound). It's good for a sound system to have a crisp sound in the high frequency bands, but too much high band energy can cause vocal speech or singing to sound too "spitty" or "essy". Boosted highs can cause too much "sizzle" in music which can be most obvious if the music includes cymbals and hi-hats. Be careful voicing a system by ear. This takes a lot of experience and poor choices can result in feedback and in an unnatural sounding system.

Tuning a Sound Masking System using the EQ1

Sound masking systems are installed to provide speech privacy in modern open-office plans with low partitions that make up cubicles for the office workers. The concept is that by raising the ambient noise in the open-office area, workers find it harder to hear and understand what their neighbor in the adjacent cubical is talking about. Productivity can be increased by reducing distractions. Sound masking speakers are typically installed above the finished ceiling aiming upward. The masking noise bounces off of the structural ceiling that is above the lay-in tile finished ceiling and then filters down through the tile to the office area below. The masking sound is colored by both the material that it bounces off of above the ceiling and by the ceiling tile that it passes through. It is important to use a 1/3 octave graphic equalizer like the EQ1 to restore the frequency content of the sound masking noise to a spectrum that has been determined to optimize the speech privacy effect. The curve below shows the ideal sound masking noise curve to achieve at the listeners position (this is called the NC40 curve).

Desired Frequency Response for Sound Masking Systems



Sound masking system graphic equalizer adjustment is a fairly simple process. Once the speakers are installed and all ceiling tiles are put in place so the finished ceiling is completely closed, pink noise (un-equalized) is fed through the system (usually the pink noise is generated by a “Masking Noise Generator” that is designed specifically for sound masking systems). The RTA microphone is placed in a typical cubical at 4' from the finished floor (the average listeners ear position). The masking sound is turned up until the energy at 160Hz is roughly 44 dBA. Adjust the sensitivity of the RTA so the 160 Hz band is reading +4dB. Adjust the 63Hz-2kHz band sliders to achieve the ideal curve shown above.

Desired Results on the RTA Display (NC40 Curve):

63Hz = -7dB, 80Hz = -4dB, 100Hz = -1dB, 125Hz = +2dB, 160Hz = +4dB, 200Hz = +4dB, 250Hz = +3dB, 315Hz = +2dB, 400Hz = +1dB, 500Hz = 0dB, 630Hz = -1dB, 800Hz = -2dB, 1kHz = -3dB, 1.25kHz = -4dB, 1.6kHz = -5dB, 2kHz = -6dB,

The masking noise above 2kHz and below 160Hz should be allowed to roll off smoothly and naturally. The acceptable levels above 2kHz and below 160Hz can be anywhere in the shaded area of the graph above. The goal is to make the masking noise sound similar to air handling noise. Any adjustments made above 2kHz and below 160Hz should be made in an attempt to make the noise more soothing and more like air handling noise.