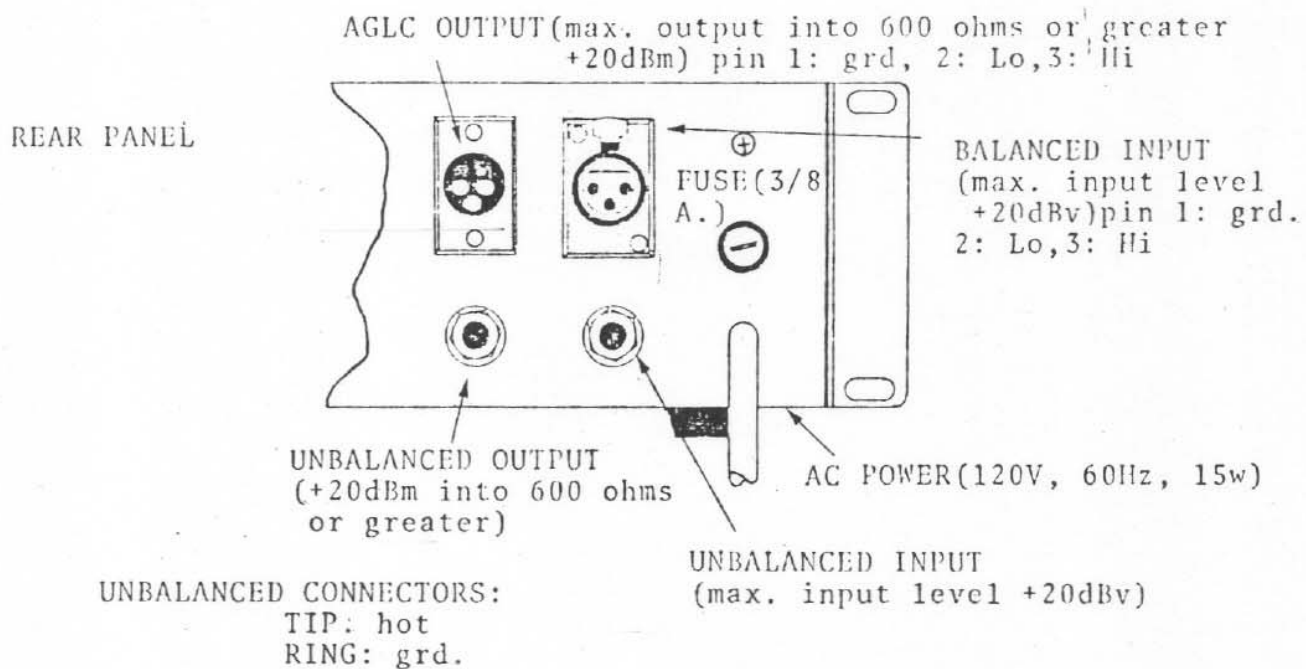
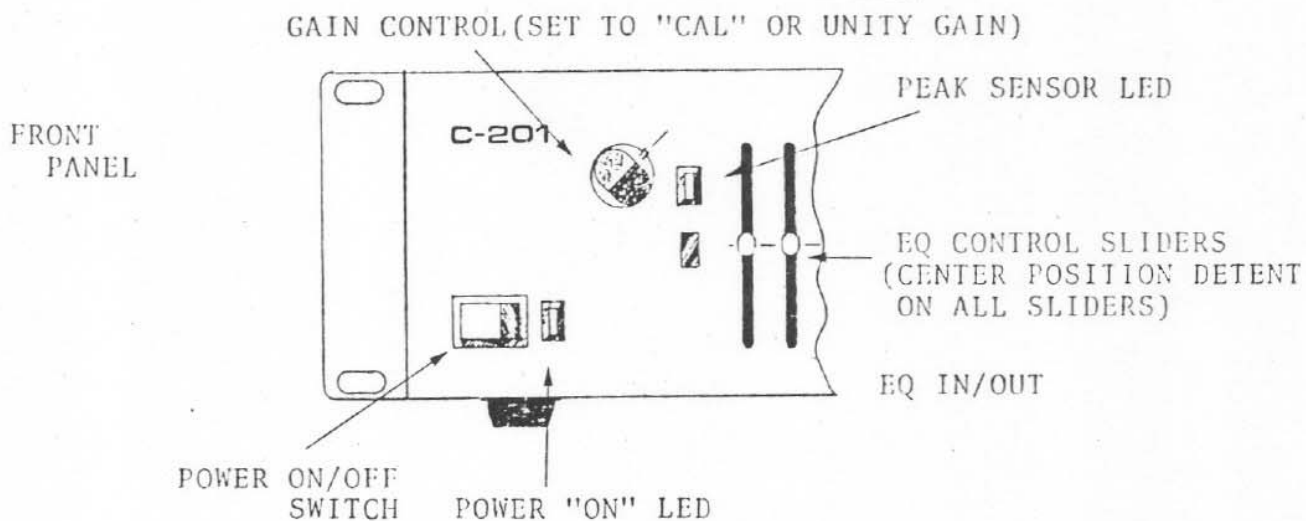


C-201

CAUTION

To prevent electrical shock, do not disassemble. No user-serviceable parts inside; refer servicing to qualified service personnel. Serviceman must disconnect line cord before disassembling.

C-201 CONTROLS AND CONNECTORS



C-201 CONTROL FUNCTIONS

POWER ON/OFF AND POWER "ON" LED

The Power On/Off switch on the front panel simply turns the C-201 "on" or "off". The green LED is lit when there's a power on condition with the C-201. That's important. What you don't want to do is make any connection to the C-201 with the power on!!

But the C-201 has a special feature that deserves mention and another caution, at this point. The C-201 has an internal relay that protects your loudspeakers from a hi-level turn-on crack or thump. This turn-on thump is a potential killer of loudspeakers, particularly HF drivers. To prevent that, the C-201's outputs aren't connected to the rest of the equalizer's circuitry until the power supply of the equalizer's at "full charge". This can and will save your expensive drivers from taking a ride to recone land, but here's the caution.

Even though the C-201 protects your loudspeakers from turn-on transients or turn-off transients, a lot of other people's gear isn't. Observe the following power "turn-on" procedure for maximum loudspeaker protection in a PA system: power-on mixers, equalizers and any other equipment "at the board" on then power amps! When powering your PA down, amps FIRST then mixers, equalizers etc.!

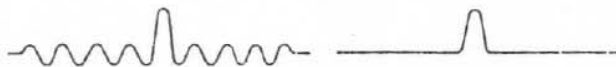
DO NOT MAKE ANY CONNECTIONS, OR CHANGE USER-SERVICABLE FUSE WITH THE POWER "ON"!!

EQ CONTROLS

Each of the 10 slide controls in the equalizer section governs the relative loudness of one octave of the audio spectrum (20Hz to 20KHz). The frequency affected most by each slider is marked on the front panel of C-201. The bands are broader when smaller amounts of the control range are used, and become narrower as the boost or cut is increased. This gives you control over somewhat more general bands when you need it, and more specific control when you need the greater selectivity. The "Q" (selectivity) of the C-201 EQ bands has been selected very carefully to give the best sounding results. The center detent on all EQ control sliders make it easy to return all or any to "flat" or center.

Each slider has a 30dB overall range, +15dB (boost) to -15dB (cut). But remember: FOR BEST RESULTS THE EQUALIZATION CONTROLS SHOULD BE KEPT AS CLOSE TO CENTER AS POSSIBLE. There are two reasons for this: 1) The overall sound you get with all controls cut 15dB (except one, which is at 0) is much the same as the sound you get with all controls at 0 (except one, which is at +15dB).

Even though these two control settings may sound very similar, they are actually quite different. When all the EQ sliders are cut 15dB a great deal of "ripple" becomes evident in the frequency response. If the response of the two EQ settings shown above were graphically plotted, they would look like this:



2) The other reason the controls should be run as close to 0 as possible will become evident as you begin to hear the subtleties of equalization: A little EQ goes a long way. There are extreme cases of course, But generally speaking,

any component in your system that raises the need for a full 15dB of equalization probably ought to be replaced!

GAIN

The gain controls adjust the level of the equalized signals on the C-201. Another important feature about the gain controls is that they are AutoPad® gain controls.

TAPCO-pioneered AutoPad® is a system allowing you to control distortion by simply turning down the gain till the distortion disappears. The distortion may or may not be audible. The peak sensor LEDs may briefly flash indicating an overload at one of three major points in the C-201's signal path, or the distortion may be prolonged and very audible. Whatever the case, simply turn down the gain till the distortion disappears. Simple enough? That's the beauty of AutoPad® !

The center detent on the gain control is for unity gain. Generally, that is the real function of the gain controls. The convenience of the center detent is obvious. If you boosted frequencies in the EQ control section, the gain will probably have to be turned down some. Use the EQ in/out switches to match the levels of the original signal to the output levels of the C-201.

PEAK SENSOR LEDs

When the Peak Sensor LEDs are lit, even for a brief flash, they indicate a clipping, hence distortion situation, in progress. This can occur at a point just past the input, at the Gain control, and post EQ control section. If you are in a clipping situation, adjust by first turning down the gain a bit and/or perhaps adjust an EQ slider. If the problem still persists, turn down the preamped source (mixer, instrument preamp, whatever) that goes into the C-201.

EQ IN/OUT

The EQ In/Out switches take the EQ control section out of the signal path. A switch is provided for each channel allowing the C-201 to be used "single channel" (Ch-1 for the house mains, Ch-2 for monitor EQ, as an example) or in a stereo pair.

C-201 INPUT AND OUTPUT CONNECTIONS

The C-201 Graphic Equalizer is designed to be used in systems where any combination of signal processing equipment might be necessary at any time-- situations that usually require jungles of wire and extra adapters of every description. This is why the C-201 has both balanced and unbalanced inputs and outputs, and why they are made to be used in any combination. As an example, the unbalanced input could be used while both the balanced and the unbalanced outputs are used, each driving a separate piece of equipment.

The C-201 is designed for use with line level signals. This means it should always be put into the sound chain after the preamp or mixer. The C-201 can be used to boost weak preamp or mixer signals but it is not intended to be used as the preamp in a system.

"space"

This is the basic set-up that will most always be used with the C-201. No matter how you hook up this equalizer the output impedances will always be matched, because the line drivers remain in the circuit path even when the equalizing part of the circuitry is switched "out". These line drivers are like little power amps, and like most power amps, they're short circuit proof. The best way to find out how the C-201 works with another piece of equipment is to plug it in and try it! Even if the two devices turn out to be grossly mismatched, you won't damage the C-201. CAUTION: ALWAYS CONNECT OUTPUTS TO INPUTS, AND INPUTS TO OUTPUTS. The C-201 circuits are fully protected against damage from abnormal signal levels, but the other gear you have may not be. So be careful!

UNBALANCED CONNECTIONS

The unbalanced connections are used for all the usual hi-fi and semi-pro kinds of equipment. Among this group are preamps, mixers, reverb units, reel to reel and cassette recorders. Always use the "High Level" or "Line" inputs and outputs on associated equipment when making connections to the C-201. And, always use shielded cables. The input cable to the equalizer should be kept as short as practical, but the output cable can be as long as you like (even a mile!). Again, if you want to know if it'll work, try it.

BALANCED INPUTS AND AGLC OUTPUTS

The Balanced Inputs and AGLC Outputs are designed to be used with any professional equipment that has balanced circuitry. This includes a wide variety of mixers, tape recorders, digital delays and other equipment. This includes many types of broadcast related equipment as well.

Whatever the equipment, all connections should be to line level inputs or outputs. In the case of outputs, the C-201 employs TAPCO's AGLC or Automatic Ground Loop Compensation. This clever circuit design references the signal to the signal ground of the next piece of gear in the system: power amp,

crossover, etc. This allows the C-201's circuitry to reject up to 40dB of ground potential (Hummmmmmm) difference. If the AGLC Output is accidentally terminated in an unbalanced input you don't have to worry about ground loops or damage to the power drivers in the C-201. If the situation is such that ground loops, or termination problems become too much for the AGLC to handle, another solution like insuring proper termination or powering the C-201 and next piece of gear from the same point (outlet group, power bar, etc.) should be found.

Maximum output from the AGLC Outputs, like the Unbalanced Outputs, is +20dBm(7.75V RMS) into 600 ohms. Plenty of output for virtually any use situation including long runs of snake cable.

Unbalanced Inputs, Balanced Inputs maximum input level is +20dBv.

FUSE

If the power fuse, located on the rear panel, should blow; turn the power "OFF" before changing it. For added safety we recommend unplugging the unit. Replace with 3/8 A. AGC fuse ONLY.

CAUTION

To prevent electrical shock, do not disassemble. No user-serviceable parts inside; refer servicing to qualified service personnel. Serviceman must disconnect line cord before disassembling.

HOW TO USE THE C-201

When you install an equalizer in your sound system, you are giving yourself complete control capability. Equalization is really where art and science come together -- the realization of creative technology. With a graphic equalizer you can actually create the sound you want. You can make sounds that would never be heard without the equalizer. A perfect example of this kind of sound enhancement can be heard on nearly any recording. The multi-track recording process has allowed recording engineers to completely separate and analyze each of the many sounds that make up a complete musical ensemble. This closer examination made it apparent to the engineers that something had to be done to make the composite sound seem more real. This is how equalization came to be used so heavily in recording. At this point, creative equalization of nearly every microphone channel used in a recording is quite commonplace. The original intent was to make recordings sound more real, and in fact recordings do sound more real these days. Beyond absolute realism, of course, lies sound enhancement. Because equalizers are able to completely reshape the frequency response of any sound source, they can also reshape the reproduced harmonic structure of musical instruments and voices. This ability to exercise complete artistic license with sound has given recording engineers the ultimate choice, and has given listeners recordings that (in many cases) actually sound better than the real thing.

WHAT IS FLAT ANYWAY?

The recording process is probably the most extreme example of the creative potential of the graphic equalizer. But, this process is very representative of the one most basic use of equalization -- that is, to perfectly tailor the quality of any sound to any situation. In most sound reproducing (as opposed to recording) systems, you will get the best quality sound when the system is providing flat response. Of course, flat frequency response is the elusive butterfly of the sound business, and in reality is not attainable. This is because even the finest individual system components cannot, by themselves, overcome the irregularities of the listening environment. Reasonable flat response, $\pm 3\text{dB}$ for instance, can be obtained only in very well designed acoustical environments using graphic equalizers guided by highly sophisticated instrumentation. But anyone can make a very good approximation of flat frequency response with a little ear training and an octave band equalizer like the C201. And ultimately, it is your ears that will be the judge anyway.

Why all this business about flat response? Only because "flat" is the starting point. Only when a system is reasonably flat can we begin to make qualitative judgements based upon some standard. The mere ownership of a graphic equalizer forces you to make these qualitative judgements, and to tune your system accordingly. It may well be that you will end up with a frequency response that is far from this so-called flat, but it will suit your own taste, and you will know how it got that way.

GENERAL PLAYBACK EQUALIZATION (HOW TO GET THERE FROM HERE)

Use the hook-up diagrams in the next section of this manual to make the

initial connection of your C-201 to the rest of your system. In lieu of high cost spectrum analyzers, calibrated microphones and pink noise generators, our only required piece of "test gear" is an FM radio -- any old radio will do, as long as you can connect it into the system easily. Be sure everything is hooked-up properly, and turn the system on. Set the FM tuner between stations, where you get nothing but that rushing river sound. (Switch the muting circuit off, if there is one. And, be sure bass and treble controls are set "flat".) Set all the EQ controls on the C-201 at "Q", and turn the volume of the noise up to the same level you will use when listening to music. Now, listen very carefully to the relative balance of the whole range of noise that you hear. If your system is perfectly flat, you will hear every portion at exactly the same volume as every other. If it is not, certain segments of the spectrum will seem to be missing, while others are exaggerated.

Perhaps you will not hear some of the extreme high and low frequencies very well at all. By trial and error you can locate the EQ slider on the C-201 that corresponds to the parts of the spectrum that are in need of adjustment. Move the EQ controls very carefully -- you will probably be surprised at how much real control is available from each slider. By a selective process of balancing the different EQ bands, you can smooth out the sound of the noise 'till no segment seems to be missing, and no segment seems to be exaggerated. REMEMBER: THE FREQUENCY RESPONSE OF THE HUMAN EAR IS DEPENDENT UPON LOUDNESS. You must be sure that the equalized signal is heard at the same overall volume as the non-equalized signal to make a fair comparison between the two.

Also bear in mind that no one EQ band is completely independent. The bands are purposely designed to overlap so the final equalized response will not have any great peaks or dips. Every time you adjust one band, you may also have to adjust the adjacent bands to keep the response characteristic you originally aimed for. The process is simply one of adjustment, comparison, adjustment, and so on. Again, remember to set the Output Level controls for unity gain (no change) while making these comparisons. (You can use the C-201 as a booster amplifier later on if you need to.) Once you have arrived at the settings that seem to give you uniform response, put on your favorite record (hopefully one that's well engineered!). It will probably sound very different from the way you're used to hearing it, but leave the EQ controls this way until your ears have had a chance to thoroughly adjust to this new sounds. If your system is in fact equalized for a more uniform total response, you will be hearing that record the way it was intended to be heard for the first time. Every record has a different "sound", and that sound didn't just get there by accident. It may well be that the particular quality of every record in the world is not exactly to your taste, but you can be sure that the sound of the record is intentional. You may want to adjust your equalizer to improve the sound of a particular recording, now that you've heard it flat. If you do, make a note of the settings of the EQ controls as they are in the flat position, so they can be easily re-set.

This general equalization technique can be applied to any sound system to get an approximation of flat response. It should be stressed, however, that no matter how flat your system is -- if it doesn't sound good, it doesn't sound good. The whole idea is to improve the sound, and that's what the C-201 is for.

SOUND RE-ENFORCEMENT

For general program equalization the C-201 can be connected between the mixer and the power amplifier(s). Use whatever combination of inputs and outputs are necessary to properly terminate the mixer and feed the power amp. Remember that both outputs on the C-201 can be used at the same time. This allows you to drive a power amp with the unbalanced output, and a tape recorder, phone line, etc. with the balanced output. When you adjust the EQ for the best sound, just be sure that no one segment of the audio spectrum is exaggerated and that no one segment is missing. When you can hear everything clearly, you've got the right EQ. If you are adjusting the system response for a situation that is likely to reoccur, make a note of the EQ settings so you can generate the same performance levels more quickly the next time around.

To help eliminate feedback in a PA system, the C-201 is installed between the mixer and power amp, as usual. Make the sound check with all the EQ controls set flat. After you have a good mix, slowly increase the system gain until feedback begins to develop. The frequency at which the system is ringing, or beginning to feed back, may be reduced by lowering the corresponding slider on the C-201. Which slider? You'll just have to fish around 'till you find the right one. The ringing will diminish when you adjust its corresponding frequency band -- you'll know when you find it. Once you've performed this operation a few times, you'll be able to tell pretty quickly which slider will control the offending frequency. A word of caution: Octave equalizers have rather generalized EQ bands (compared to a third octave equalizer, for instance). This means that every time you decrease the level of one of the EQ bands, you may be impairing the overall quality of the program material. The C-201 can be used to suppress feedback, but moderation is in order.

For stage monitor equalization, the C-201 should be connected between the mixer's monitor mix output and the power amp that drives the monitor speakers. When equalizing stage monitors you may want either maximum quality, or maximum intelligibility. If the vocalists are real nervous about how they sound out front, you will probably have to make the monitors sound as good as possible to allay their fears. But sometimes you can't get the best sound without feedback problems, so you have to sacrifice some overall quality for greater intelligibility. You can use the same techniques here as in eliminating feedback from the main speakers. Equalize the system under the same conditions you would ordinarily encounter during a performance. Have the musicians play one of their usual tunes, then adjust the EQ so the monitors "cut through" clearly. In the absence of the music the monitors probably won't sound so hot, but they will do the job of keeping the band together during a performance.

BROADCASTING

The C-201 Graphic Equalizer is ideally suited for use as a combination telephone line and transmitter equalizer. Telephone lines used for remote broadcasts very frequently are not of the highest quality. Even Class A lines have been known to suffer from frequency response deviations. One C-201 installed in the main control room can take care of the phone line, and equalize the transmitter's signal too.

Transmitters (especially older models) are often plagued by strange modulation noises and poor high end frequency response. With an equalizer in the line between the studio and the transmitter those frequencies causing modulation problems can be gently reduced, while the high end is slightly increased. The result is a cleaner signal, lower listener fatigue, better ratings and increased billing!

This entire situation is easily handled by one C-201. Each channel is completely independent, so it can be used for two completely different signals.

In addition to phone line and transmitter EQ, the C-201 is often used to create a "sound" for a particular announcer. It has been common for some announcers to have their own microphone, and thereby their own sound. But with the C-201, everyone can use the same mike, with the "sound" generated by the equalizer. This lets all the announcers be happy with the same mike, saving the expense and headaches caused by having to use many different mikes to please all the announcers. Of course, spot production can be greatly improved as well!

Balanced circuitry makes the C-201 compatible with all professional studio gear.

SPECIAL EFFECTS

Perhaps the simplest and most noticeable effect that can be created with the graphic equalizer is the telephone (or filter mike) effect. Just remove most of the high and low end response from the signal by putting all but the middle two or three EQ sliders all the way down. The effect is further increased by putting the 960Hz band all the way up.

Mono recordings can be made to sound more like stereo with a graphic. The mono signal is fed to both channels of the equalizer simultaneously. Each channel is equalized differently, then fed to a stereo system. This effectively "spreads out" the sound, and can enhance the perceived quality of a mono recording when it is played or recorded in stereo.

INDIVIDUAL CHANNEL EQ

The C-201 can be used for individual channel EQ with any mixer that has channel patching, or accessory send/receive jacks. Just put the C-201 in the loop created by the patching output/input, and adjust the EQ controls for the particular quality you want. The output level controls should be adjusted for unity gain, so the mixer is allowed to operate at the levels for which it is designed.

RECORDING

The C-201 may be put into the recording chain between the mixer and the tape

machine. If a professional recorder is being used, the connections should be made to the C-201's balanced outputs. Remember that you can use the balanced and unbalanced inputs and outputs in any combination -- even both outputs at once.

CAUTION

To prevent electrical shock, do not disassemble. No user-serviceable parts inside; refer servicing to qualified service personnel. Serviceman must disconnect line cord before disassembling.

C-201 SPECIFICATIONS

Frequency response	20 Hz to 20 kHz \pm 1 dB	Rise time	2.4 microseconds (100 kHz, 10V p-p)
Signal to Noise ratio (20 kHz NBW, 600 Ohms in/out)	90 dB (below 1V output) 110 dB (below maximum output)	Input impedance	22 k Ohms unbalanced 33 k Ohms bridging balanced
T.H.D. (20Hz to 20kHz maximum output, 600 Ohms)	<.05%	Output impedance	51 Ohms, all outputs
SMPTE IM Distortion (maximum output, 600 Ohms)	<.05%	Input CMRR	greater than 60 dB
CCIF IM Distortion (19 & 20 kHz mixed 1:1, maximum output)	<.05%	AGLC attenuation (10K Ohm load)	typically, 40 dB
Maximum input level	+ 20 dBV	Gain	adjustable, off to + 12dB
Maximum output level (into 600 Ohms or greater)	+ 20 dBm	EQ control range	\pm 12 dB
Slew rate	11 volts per microsecond	Size (W-H-D)	19" X 3½" X 8"
		Weight	10 lbs.
		Power requirements	120 volts, 60 Hz, 15 watts

All product specifications subject to change without notice.