

Film-Tech

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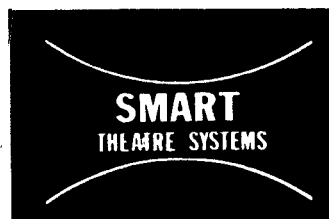
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INSTALLATION AND OPERATION MANUAL

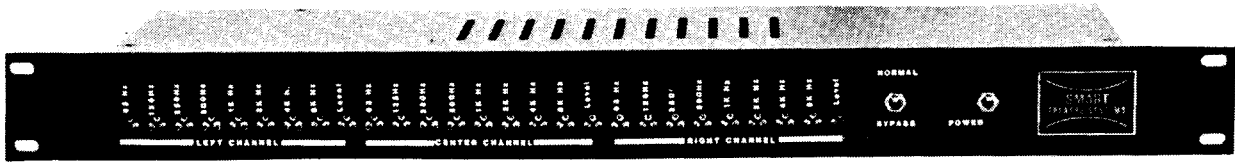
EQ600 THEATRE EQUALIZER



SMART THEATRE SYSTEMS

P.O. BOX 80381, ATLANTA, GEORGIA 30341

EQ600 EQUALIZER



MADE IN U.S.A.

FEATURES

Three Channel EQ
Hidden Controls
Emergency-Bypass
Special Filters
Small Size
Minimum Phase Shift
Quality Engineered
Designed for Theatres
Fully Regulated
Adjustable Gain
Premium Low Noise IC's

Maximum Output:	+20 dBm unterminated +17 dBm into 600 ohms
Signal-to-Noise Ratio:	110 dB
Equivalent Noise Input:	-90 dB
Frequency Response:	20 Hz to 16KHz (-3dB)
Boost and Cut Range:	12 dB
Gain Adjustment Range:	7 dB per channel
Line Operation:	115 or 230 VAC 50/60 Hz

The EQ600 Equalizer is a unique product designed expressly for motion picture theatre playback use. Unlike general purpose equalizers that serve a broad consumer market in Hi-Fi, musical instrument, home recording, and general sound applications, the EQ600 contains special features that motion picture theatres need for their sophisticated stereo sound systems.

The small size saves rackspace. Exclusive use of integrated circuits and dense packaging now make small size desirable and practical. The unit is only 1 $\frac{3}{4}$ " in height and occupies 1 rack unit of space.

Three full channels of treatment are contained in the EQ600 package. Because equalization is not recommended on the surround channel, the product contains the Left, Center, and Right channels in one chassis. A removable security panel hides all controls and markings from the user. The operator is not likely to "fiddle" with the settings because they are not visible. A special tuning tool is shipped with each unit for set-up use. Also a hex wrench is provided to remove the special button screws on the security cover.

Special filter characteristics are designed into the EQ600. A combining filter, minimum phase shift circuit design produces far superior results over simple band pass designs used in consumer products. This more elaborate scheme accounts for the colorless transparency of sound that the EQ600 produces. Full **one octave** equalization was selected so that larger portions of the audio spectrum could be easily moved. Phase shift problems are minimized using larger bands, and "cut only" filters in the sensitive mid-band frequencies. This method is ideal for almost all theatres, except those that have poor acoustic environments, or inadequate speaker systems. A built in low pass filter (-3 dB at 16KHz) removes noise above the film recording limit and minimizes oscillation and RF pickup hazards.

An EMERGENCY-NORMAL switch on the front panel permits the operator to quickly go around the active circuitry on the important center channel. The switch is clearly labeled and readily accessible. The EQ600 Equalizer fully regulated and is capable of either 115 or 230 volt AC 50/60 Hz operation.

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EQ600 THREE CHANNEL ROOM TUNING EQUALIZER

INSTALLATION MANUAL

The **EQ600 EQUALIZER** is a unique specialty product designed expressly for motion picture playback use. It is radically different than any other filter set on the market. Unlike general purpose graphic equalizers that serve a broad market in Hi-Fi, musical instrument, home recording and studio applications, the EQ600 contains special features that motion picture theater sound systems need. Here are some of the main differences:

LOW PROFILE saves rackspace. The EQ600 is only 1 3/4" in height and occupies 1 rack unit.

THREE FULL CHANNELS OF ROOM TUNING. Complete **one octave** Left, Center, and Right filter sets are contained in the EQ600 package. Because equalization on the surround channel is not recommended, no filter set is required.

ALL ADJUSTMENTS ARE MADE FROM THE FRONT. The chassis does not have to be removed from the rack to accomplish a full tuning of each channel.

HIDDEN CONTROLS. A Removable security panel hides all controls and markings from the user. The operator is not likely to "fiddle" with the settings because they are not as accessible. A *special tuning tool* is shipped with each unit for set-up use. The nine controls for each channel are clearly marked.

EMERGENCY-BYPASS SWITCH on the front panel permits the operator to quickly go around the active circuitry on the important center channel. This switch is clearly labeled and readily accessible.

The **SPECIAL FILTER CHARACTERISTICS** are especially suited to motion picture theater use. Full octave band equalization was selected so that *larger portions of the spectrum* could be easily moved. Phase shift problems are no problem because of minimum phase filters using large bands, and "cut only" filters in the sensitive mid band frequencies. This method is ideal for almost all theaters, except those that have extremely poor acoustic environments, or inadequate speaker systems.

THE CONTROLS AND THEIR ACTION

63 Hz is a *boost only* control. This section will assist stage speakers to increase bass reproduction. Most front-loaded horn theatre speakers roll off in response around 80 Hz. 12dB of boost is available in this band. The fully counterclockwise position of the pot is *flat*, and clockwise rotation increases the boost.

125 Hz is a *boost and cut filter*. This band may be used to remove the bump in the response of many front-loaded reflex enclosures. This control can also "sweeten" the top end of the bass portion of the audio spectrum. The control for this filter is normally set in the mid position for flat response. Clockwise rotation will *boost* the band to a maximum of 12 dB, and a counterclockwise rotation of the pot will *cut* the band by 12 dB.

250 Hz is 12 dB of *cut only*. The clockwise position of the control is flat, while counterclockwise rotation *introduces attenuation* in this band.

500 Hz. This control will *CUT the band ONLY*. The fully clockwise position is *FLAT*, and counter-clockwise rotation of the pot will *attenuate* the band to a maximum of 12 dB.

1000 Hz(1KHz). Same action as above.

2000 Hz(2KHz). Same action as above.

4000 Hz(4KHz). Same action as above.

8000 Hz(8KHz). Same action as above.

All of the filters above 250 Hz are designed for *cut only* to avoid phase shifts that are obvious and audible in filter sets that boost and cut each band. This potential problem is more severe in 1/3 octave filter sets.

A built-in low pass filter in each channel is set at 15 Khz to reduce high frequency noise in the region above the usable soundtrack bandwidth.

A fully regulated bi-polar supply gives a high headroom capability, and low noise performance.

Adjustable LEVEL CONTROLS on each channel can be used as a *final trim adjustment* to balance and match levels the equipment that precedes the EQ600. Also these controls are useful in making up gain when heavy “cutting” of the various audio bands is employed.

The low impedance outputs of the EQ600 are capable of matching to the input requirements of almost any brand of power amplifier. The +20 dBm output level (7.75 volts RMS) has the drive necessary for even the lowest sensitivity amplifiers.

The EQ600 has excellent combining action. When two or more adjacent bands are attenuated, a very *smooth combining of the filter skirts* occurs. Many filter sets on the market have filter bands that act individually, rather than combining. The result is deep “spears” that occur in the response curve when large amounts of attenuation is used in any filter section.

WARNING

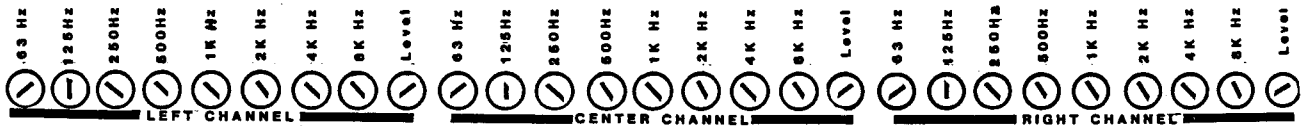
A LARGE AMOUNT OF BOOST IN THE BASS FREQUENCIES WILL CAUSE THE POWER AMPLIFIER TO DELIVER A GREAT DEAL OF POWER TO THE STAGE SPEAKERS IN THE BASS REGION. MAKE SURE THE AMPLIFIERS AND SPEAKERS ARE CAPABLE OF HANDLING THIS INCREASE.

LINE VOLTAGE OPERATION. The EQ600 is shipped with internal line voltage settings of 115 volts AC. The fully regulated supply will accommodate line variations from 110 VAC to 130 VAC. If 230 volt operation is desired, the installer *must change the jumpers* at the line input. Remove the two 115 volt jumpers and install one jumper between the solder pads labeled 230. This operation can be performed from the top of the PC board by removing the top chassis cover. Make sure that the new jumper leads are *not too long* or they may extend down to the bottom chassis cover and short to ground. The EQ600 is designed to operate properly on either 50 or 60 Hz current.

GAIN ADJUSTMENT. Before any room equalization adjustments are made, set the LEVEL controls of each channel to their *fully counter-clockwise position*. An extra 7 dB of gain in each channel is provided so that gain can be made up, if many filters are in the extreme cut position. This feature can also be used to add additional system gain if the preceding device has a low output, or the power amplifiers need more audio drive.

SOUND SYSTEM EQUALIZATION

STARTING POSITION OF POTS. Each of the three channels contains the an *identical set of controls*. Make sure the NORMAL-BYPASS (EMERGENCY) switch on the center channel is in the NORMAL position. All pots should be at their *fully counter-clockwise rotation*, except for the 125 Hz control. Set this control to it's mid-position.



Operation of filter controls

HOUSE EQUALIZATION.

(1) Connect the pink noise generator output (from the real time analyzer) to the input of one channel of the EQ600 and view one of the stage channel speaker systems on the real time analyzer to determine what shaping is necessary to achieve the desired playback response.

(2) You may have to temporarily disconnect the normal input source in order to insert your pink noise test signal.

(3) Set the sound level in the auditorium to level *above the ambient noise level* of the room.

If the response curve is very "lumpy" and appears to need severe correction, *abandon your attempt to equalize* for the moment and concentrate on correcting the problems the speaker might be creating. NEVER USE AN EQUALIZER TO FIX SPEAKER SYSTEM PROBLEMS. Check the horn phasing and network balance. Check the components in the speaker system to see if they are producing a full range response. Replace the diaphragm or woofer cone if these components are fatigued.

(4) Move your sensing mike to another point in the auditorium to observe standing waves in the auditorium.

(5) When you are convinced that the speakers are operating correctly, begin equalization by adjusting the pots *above 250 Hz*. Obtain the "ideal house curve" by shaping frequencies above 1 kHz for a total 3 dB per octave rolloff.

(6) Now treat the frequencies *below 250 Hz* for the most desirable playback curve. Some equalizers on the market have a separate bass control. The filters in the EQ600 are *boost at 63 Hz* and *boost-cut at 250 Hz*. This will allow the same effect as separate controls. Many installers like to add boost at the extreme low end as a "crowd pleaser". Perform the same procedure on the two remaining stage speaker channels.

(7) Check to see that all stage speakers are *in-phase* with each other.


(8) Move your sensing mike to various parts of the auditorium to see that your settings are consistent and correct.

(9) Remember that additional bass boost will consume *more amplifier power in the bass region* of the audio spectrum which could result in system overload during loud soundtrack passages.

WORDS OF ADVICE. Some of the worst systems in the country are *equalized* systems. An equalizer *cannot correct* for bad system or speaker phasing, improper system alignment, or poor speakers. Often the controls are set to such extremes that filter phase shift adds coloration to the sound. This is particularly evident in filter sets that boost and cut in the midrange. Equalizers are intended to help correct for various *acoustic environments*, not for problems created by the sound system. There are several books on the market that may aid in understanding the principles of room equalization.

FINAL SETUP. After you have finished tuning the stage speakers to the house, set each level control for equal sound pressure output while monitoring an SPL meter, or level scale on your real time analyzer. Move the NORMAL-BYPASS switch to the BYPASS position to see that the *center channel level* is close to the level of the equalized center channel output. Now, set the house power amplifiers for the desired playback level. Replace the security cover that hides the controls from the operator.

EQ600
THEATRE EQUALIZER

L IN G C IN G R IN G G L OUT G C OUT G R OUT


BARRIER STRIP TERMINALS

SERVICE

Every component of the EQ600 is field repairable mostly with commonly available parts including the integrated circuits. The only proprietary part is the power transformer. The unit has been carefully designed to work with 10% tolerance capacitors and resistors, even though we manufacture the product with closer tolerance components. IC sockets are used to facilitate easy "chip" removal and replacement, should this ever become necessary.

Each unit is burned in for a minimum of 160 hours at the factory before testing and packaging. A failure of one or more functions of the EQ600 will lead to a service call from the owner. Always check the *obvious causes* of the symptoms before opening the unit.

- 1. Is the unit receiving AC power? (power LED on)
- 2. Is the fuse blown? The EQ600 has one ½ Amp fuse.
- 3. Is the NORMAL-BYPASS switch in the NORMAL mode.
- 4. Is the equipment preceding or following the unit operating properly? Check signals arriving at the inputs.

When all symptoms point to an internal problem your only choice is to substitute the unit, bypass it, repair it in the booth or shop.

A quick check at the + 15 and -15 volt regulator outputs will indicate if the problem is in the power supply section. Place your service meter negative probe on a convenient chassis ground, and the positive probe on pin 3 of the 7815 regulator. It should show 15 volts DC. If not, check pin one of the regulator. You should be able to read 22 to 30 volts DC input to the regulator. If you cannot obtain a reading *at least 3 volts higher* than the 15 volt regulated output, you may have a shorted diode, filter capacitor, or bad power transformer. Perform the same procedure on the negative regulator. This time place the negative probe on pin 3 of the 7915 regulator, and the positive probe on chassis ground. **BE SURE NOT TO SHORT THE PINS OF THE REGULATORS WHEN MAKING TESTS. A MOMENTARY SHORT MAY DESTROY THEM.**

Since each of the equalizer channels is independent to each other, a problem with all channels is likely to be in the power supply which is common to all channels.

When you are satisfied that voltages are correct, go to the section that appears to be giving trouble. The most practical way to troubleshoot audio circuits *is through signal tracing* with a scope. Put an audio signal into the channel input and follow it through the circuit. This method will allow you to locate a defective component. All of the IC's are quad BI-FET op amps. They may be removed from their sockets and substituted for a suspected bad chip. Moving a similar IC from one socket to another (in the suspected circuit) may reveal a problem if the symptom moves. Be sure to observe the proper pin orientation when replacing an IC.

MANY IC DEVICES CAN BE DESTROYED BY HANDLING. CMOS logic devices and BI-FET Op Amps are very static sensitive. They are safe when plugged in their sockets, but removal can expose the inputs to large doses of static electricity from tools, your hands, or other static generating components. **USE PROPER HANDLING PROCEDURES** when removing IC's from their sockets.

It is very rare to have to replace an entire P.C. card. Suspect active components first, then capacitors, and finally resistors, in that order.

An important part of any pre-service call is to make sure the operator or other theatre personnel is *fully familiar* with the operation of this equipment. Often, service calls are made un-necessarily because the operator was not trained with the correct procedures.

SMART THEATRE SYSTEMS maintains a factory service department and can provide quick handling of replacement parts, or telephone advice in the event of a problem. The Technical Support Department may be reached at (404) 452-1820 during normal business hours (EST) Monday through Friday.

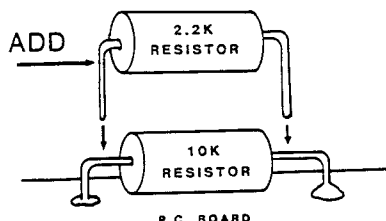
We reserve the right to *make improvements* to our products without notice. If you have questions regarding updates that do not agree with the schematics in this manual, please contact us for additional information regarding circuit changes.

Refer to the schematic diagram at the end of this manual for component values and circuit wiring.

MODIFYING THE EQ600 FOR SPECIAL APPLICATIONS.

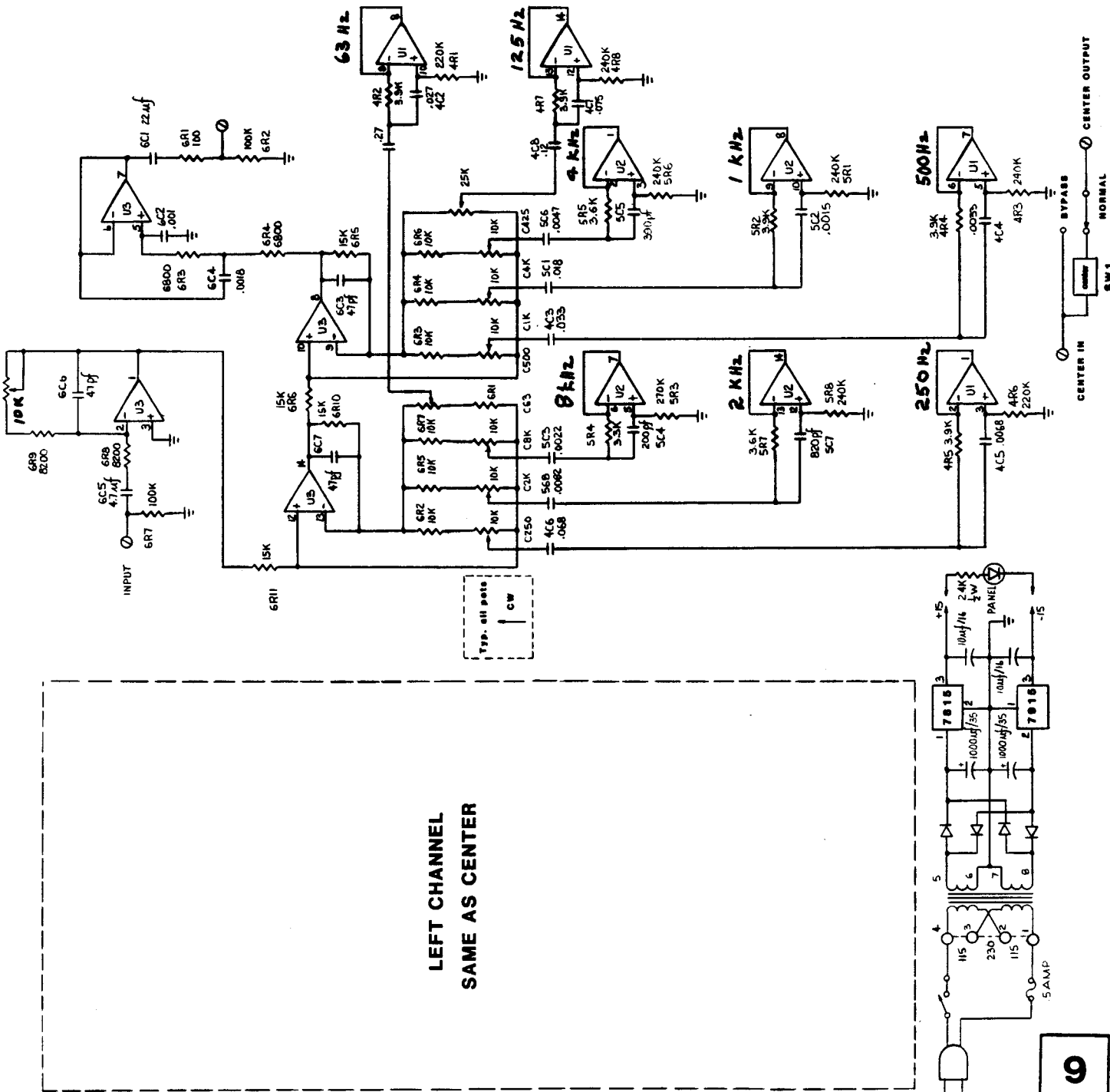
There have been some occasions where a Sound Engineer has inquired about adding a slight boost to the frequency bands that are designed as CUT-ONLY filters. One application is to raise the high frequency response of stage speaker systems that employ a constant directivity type high frequency horn. These devices have a very smooth response, but appear to be rolling off in response at the high end of the spectrum when viewed on a Real-Time analyzer. This is because the pattern is held to a wider dispersion angle than earlier horn designs that "beam" on axis and concentrate all their energy in the center of the horn. Another reason to want to boost the HF region is to offset screen transmission losses with certain brands of movie screens.

The CUT-ONLY filters can easily be modified to give a 4 dB boost, without affecting the cut range, by adding a 2200 Ω resistor across the 10K Ω resistor that is in series with the range control for the filter you are interested in modifying. The additional resistor can be "tack soldered" to the existing resistor, from the top of the P.C. board. Refer to the schematic and parts layout diagram for the location of the circuit you wish to modify.



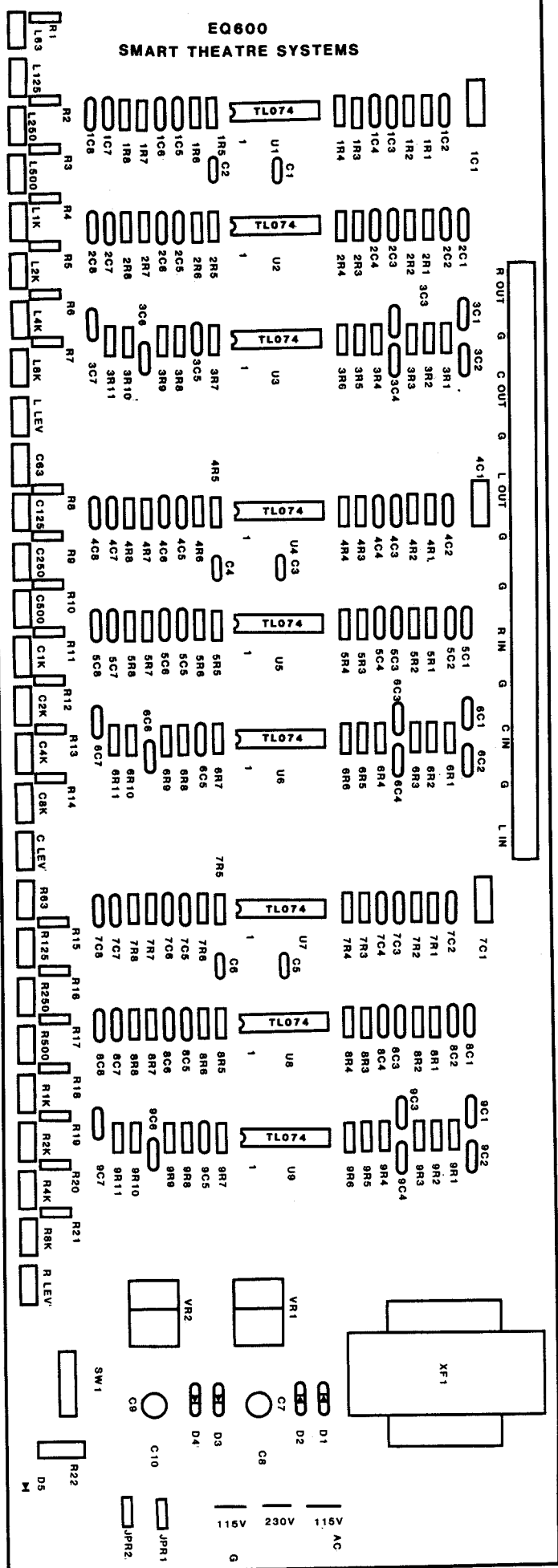
RIGHT CHANNEL
SAME AS CENTER

LEFT CHANNEL
SAME AS CENTER



SMART THEATRE SYSTEMS			
TOLERANCES UNLESS NOTED	SCHEMATIC	SCALE	DRAWN BY TONY THOMAS
DECIMAL			APPROVED BY
FRACTIONAL			TITLE
2			EQ6000 THEATRE EQUALIZER
ANGULAR			DATE
3			7-16-83
			DRAWING NUMBER
			0600A200

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PARTS LAYOUT FOR EQ600 EQUALIZER