TAPCO®

TECHNICAL AUDIO PRODUCTS CORPORATION

2230

OWNER'S MANUAL

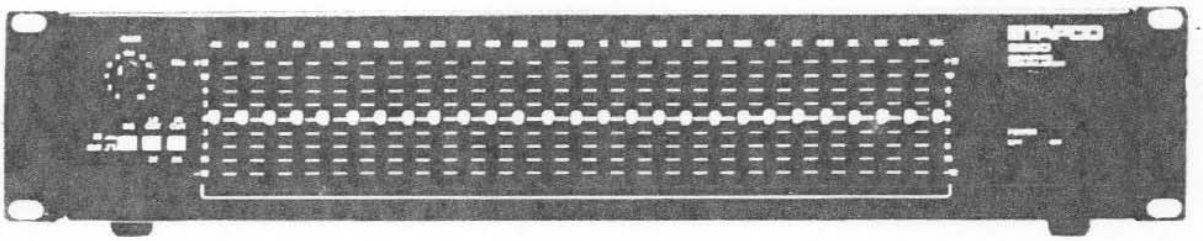
EV/TAPCO 2230 1/3 OCTAVE GRAPHIC EQUALIZER

The TAPCO 2230 is a single channel combining filter one-third octave graphic equalizer. 27 bands of equalization and a host of other professional features make the 2230 at home in sound reinforcement, recording and broadcasting environments.

*** FEATURES ***

* 27 BANDS OF EQUALIZATION FROM 40HZ TO 16KHZ
* ± 12dB BOOST AND CUT
* COMBINING FILTER ACTION
* ISO CENTER FREQUENCIES
* CENTER DETENTED EQ CONTROLS
* EXTREMELY LOW NOISE
* OVERALL GAIN CONTROL (DETENT AT 'CAL' POSITION)
* 32HZ 18dB/OCTAVE SWITCHABLE HIGH PASS FILTER
* 8KHZ 6dB/OCTAVE SWITCHABLE LOW PASS FILTER
* BALANCED INPUTS
* FLOATING BALANCED OUTPUTS
* PEAK STRETCHED LED CLIPPING INDICATOR
* EQ IN/OUT SWITCH
* ALL STEEL CHASSIS
* RECESSED CONTROLS
* SECURITY COVER

DWG 30-700043-A



1. FRONT PANEL CONTROLS

A. GAIN CONTROL

The rotary gain control sets the overall gain or amplification of the equalizer. It is effective only in the 'IN' position of the EQ IN/OUT swtich. It should be set so there is no audible level change when switching from EQ IN to EQ OUT.

B. EQ IN/OUT SWITCH

Bypasses the equalizer and filter portions of the 2230. It allows instant comparisons between equalized and unequalized settings. In the 'OUT' position the signal bypasses the major portion of the 2230's circuitry. All that is left in-circuit is the input amplifier and output line driver amplifers.

C. HIGH PASS FILTER SWITCH

Switches in a 32hz 18dB/octave high pass (low cut) filter into the signal path. This can be extremely useful in eliminating unwanted low frequency information (like room rumble, stage noise, etc.) from the signal. It is also useful for protecting low frequency loudspeakers in vented (ported) enclosures from damage due to subsonic energy causing excessive excursion (cone travel). This is caused by applying drive signals below the frequency where the box can load the speaker cone properly. These unwanted very low frequencies waste amplifier power and contribute little to the overall sound quality, especially when they are below the low frequency cutoff of the loudspeaker system.

D. LOW PASS FILTER SWITCH

Switches in an 8kHz 6dB/octave low pass (high cut) filter. Use it to eliminate excessive high end in bright reverberant rooms. When the 2230 is used as a sophisticated tone control, the low pass filter can be used to remove unwanted high frequency information like hiss from an input signal.

E. EQUALIZATION CONTROLS

Each of the 27 slide controls sets the level of its own frequency band. The 27 bands cover the 40 to 16KHz range at ISO (International Standards Organization) specified center frequencies with an overall range of 12dB boost or cut.

Because of the nature of the filters in this and all other equalizers, each control predominantly affects the level of its own frequency band and to a lesser degree, adjacent bands. This interaction is desirable and is enhanced by the circuit configuration used in the 2230. The combining action used in the 2230 results in smoother phase and frequency response, especially between bands.

When equalizing, it is generally best to try to keep the overall curve (an imaginary line drawn through all of the EQ controls) centered around the centerline of the equalizer slide controls. This avoids excessive boosts and cuts, which cut down on the available headroom.

F. OVERLOAD LED

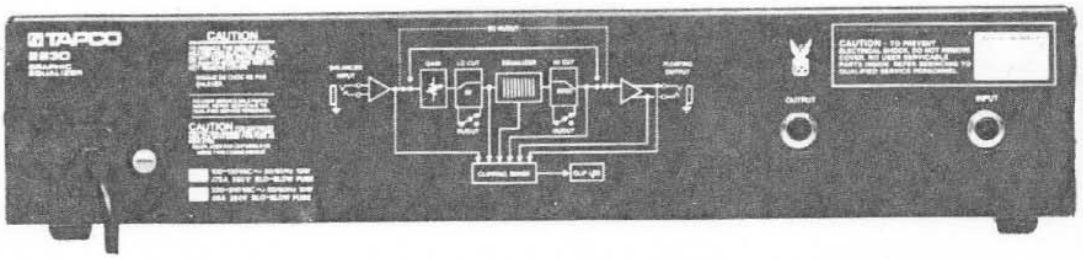
Monitors all critical points within the equalizer for overload. The threshold of the clipping indicator is approximately 2dB below clipping. For enhanced visibility, the LED is 'peak stretched' so that even the briefest clipping can be seen.

G. POWER SWITCH AND LED

The power switch turns the unit on and the LED indicates the presence of power within the unit. If it does not illuminate when the power switch is set to 'ON' check the AC power connections and fuse.

H. SECURITY COVER

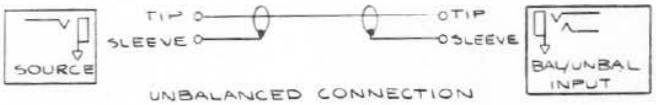
A security cover is provided to prevent unauthorized tampering with control settings. It is installed by removing the two upper screws (one top left, one top right) that hold the equalizer into the rack, overlaying the security cover, and replacing the two screws.



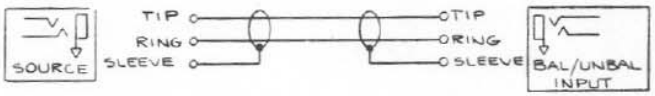
2. REAR PANEL CONNECTIONS

A. INPUT JACK

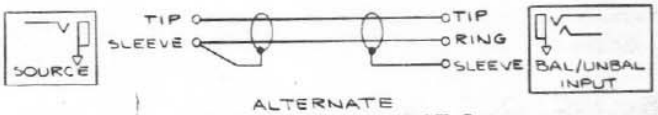
A 1/4" tip-ring-sleeve phone jack. The input will accept balanced or unbalanced input signals at line (power amp input or approx 0dBu) levels. Input impedance is 15K unbalanced and 30K balanced. Balanced connections must utilize a tip-ring-sleeve (3 circuit or stereo) 1/4 inch phone plug. Unbalanced connections must utilize a tip-sleeve or 2 circuit (standard) 1/4 inch phone plug. See figures 1A and 1B for these hookups. Some unbalanced setups may be quieter (less hum) using an alternate input hookup. See figure 1C.



UNBALANCED CONNECTION
FIG. 1A



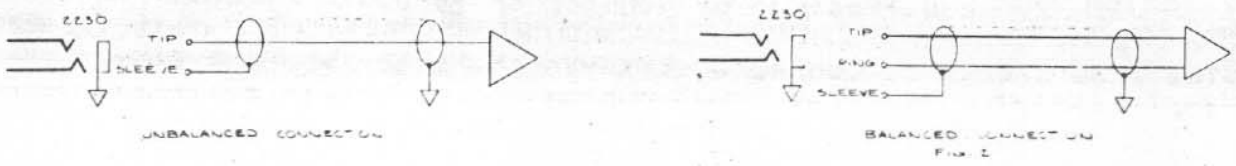
BALANCED CONNECTION
FIG. 1B



ALTERNATE
UNBALANCED CONNECTION
FIG. 1C

B. OUTPUT JACK

The 2230 has a floating differential(balanced) output utilizing a tip-ring-sleeve jack. It may drive balanced or unbalanced loads. Unbalanced loads must use a tip-sleeve plug at the equalizer end. A unique floating differential line driver allows compatibility with either balanced or unbalanced loads with no change in gain or performance. The actual source impedance is 110 ohms, balanced or unbalanced. The load impedance should be no lower than 600 ohms balanced or unbalanced. See figure 2 for hookup.



UNBALANCED CONNECTION

BALANCED CONNECTION
FIG. 2

C. POWER CORD AND LINE FUSE

Connect the 2230 to an AC power source of 110-130VAC, 50-60 Hz, 10 W. In countries other than the USA or Canada, observe the line voltage label on the rear panel.

Replace the fuse with a 175ma (.175amp) slo-blo type (120V version only). Bussman type MDL 175/1000 250V or Littlefuse 313.175. Repeated fuse blowing is a sign of component failure. Refer the unit to qualified service personnel. Export models: see rear panel for fuse information.

CAUTION: NO USER SERVICEABLE PARTS INSIDE. REFER ALL SERVICING TO QUALIFIED SERVICE PERSONNEL. HIGH VOLTAGE PRESENT INSIDE CASE.

3. SOUND REINFORCEMENT APPLICATIONS

The most common sound reinforcement uses for the 2230 are:

1. equalization of house or frontal system
2. equalization of monitor or foldback system.

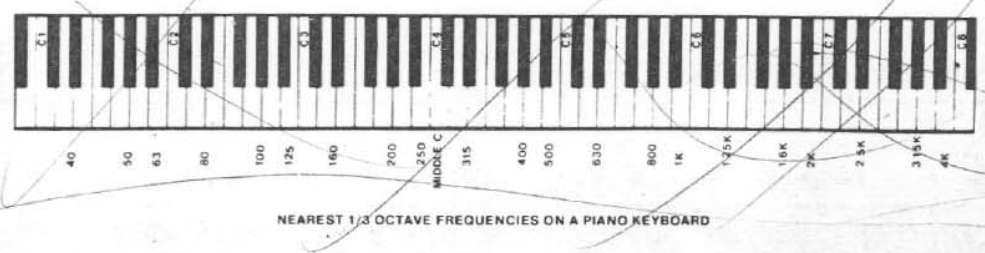
The 2230 should be connected between the mixer and the power amplifier(s). If there is a compressor, it should be connected after the equalizer. Effects devices can be connected before or after the equalizer.

Detailed equalization of any system without instrumentation (test equipment) is difficult if not impossible. It is possible to achieve approximate results without the use of instruments. The use of a real time analyzer is strongly recommended for best results with this equalizer.

An alternate method is known as feedback or regenerative tuning. Basically, the sound system is brought to the threshold of feedback and held there. All normally used microphones should be in place and on. The frequency (pitch) of the feedback is noted and the corresponding slider on the equalizer adjusted to attenuate at the feedback frequency. Move the control just enough to cause the feedback to go away. Now increase the gain and repeat the process. The trick is in knowing when to stop. Generally, when you can get two frequencies to feedback simultaneously, you're there. A smooth looking curve on the equalizer controls may not necessarily be the best curve. Remember, LESS EQUALIZATION IS BETTER.

A simple method for converting pitch to frequency is via a piano. All you have to do is remember that A above middle C is 440 hz (that's why they call it A-440). Moving up an octave doubles the frequency and moving down halves it. Now locate the feedback pitch on the piano and make a rough guess as to its frequency.

there will be some sort of piano keyboard vs frequency chart here



NEAREST 1/3 OCTAVE FREQUENCIES ON A PIANO KEYBOARD

If you really want to be scientific about it, charts or tables relating musical pitch to frequency are easily found in most audio reference books.

Keep in?

When using a real time analyzer, you have the choice of using pink noise and a calibrated microphone to adjust the equalizer for smoothest overall response or to simply use the analyzer to tell you which slider to move when doing a feedback tuning. The best method is to use the calibrated microphone and pink noise first, then do a feedback tuning to get out the last small peaks. Having the analyzer connected to the system during performance may help you to spot feedback more exactly when it happens, as it will usually be the slowest to decay on the analyzer display.

If you use the pink noise method, remember that ruler flat frequency response from 20 to 20KHz is not necessarily what you really want. Most loudspeaker systems sound best when a 'house curve' or controlled high frequency rolloff is introduced. This should consist of a gentle (approx 3dB/oct) rolloff starting somewhere between 5 and 10khz (sometimes known as the Boner Preference Curve)

It is generally preferred to ~~go after~~ try to smooth out the major peaks and leave the dips alone. Large amounts of boost should be avoided. Dips in the response may be caused by absorption within the room and will soak up incredible amounts of power. Fortunately, dips are much less audible than peaks. A good job of system/room equalization will probably require less than 6dB of equalization at any single frequency if done properly.

4. RECORDING APPLICATIONS

The usual uses for the 2230 in the studio are:

1. control room monitor equalization
2. sophisticated tone shaping.

Connect the 2230 between the mixing console outputs and the power amplifier(s). When using the 2230 for tone control, connect it in the channel or submaster patching loop of the console or between the console and tape machine. It is not recommended to be connected between an instrument and the mixer, unless the instrument can produce line level signals (0dBv or approx .7 V). It won't hurt anything to do this, but it may be noisy.

When used for control room monitor equalization, use of a real time analyzer is recommended. Equalization by ear or other method does not produce optimum or even near optimum results. The sonic quality of the finished product is inversely linked to the sound or tonal balance of the monitors. Too much bass on the monitors will produce thin sounding mixes. Excessive high end will cause dull sounding mixes. Peaks and dips will result in dips and peaks in the mixes and so on. Again, as in sound reinforcement overall flat equalization will not produce optimum results and the use of a controlled high frequency rolloff (3-9dB/oct @8khz) will generally produce the best results. When your monitors are equalized correctly, your mixes will sound good on almost anything.

5. IN CASE OF DIFFICULTY

A. Is the unit turned on? Is the fuse good?
B. Check control settings. Is the gain control turned up?
C. Check all cables. 95% of all problems are caused by bad cables. Make sure you have inputs and outputs straight.
D. Bypass the unit by plugging the input and output cables together. If you now get sound, the equalizer is defective.
E. When all else fails, take the 2230 to an authorized TAPCO service center or contact the factory. Be prepared to supply the serial number of your unit and proof of purchase.

*** CAUTION ***

NO USER SERVICEABLE PARTS INSIDE. CAUTION--HIGH VOLTAGE PRESENT INSIDE CASE. REFER ALL SERVICING TO QUALIFIED PERSONNEL, AUTHORIZED WARRANTY CENTER OR TO THE FACTORY.

F. For further applications assistance, write or call the factory. If you write, include your phone number and a time when you can be reached at that number.

6. SPECIFICATIONS

TYPE:	1/3 OCTAVE COMBINING FILTER GRAPHIC EQUALIZER
FREQUENCY RANGE:	40Hz TO 16Khz
EQ CENTER FREQUENCIES: (HZ)	40, 50, 63, 80, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1K, 1.25K, 1.6K, 2K, 2.5K, 3.15K, 4K, 5K, 6.3K, 8K, 10K, 12.5K, 16K (27 BANDS ON ISO CENTERS)
RANGE:	12dB BOOST OR CUT
HIGH PASS FILTER:	-3dB AT 32 HZ, 18dB/OCTAVE
LOW PASS FILTER:	-3dB AT 8KHZ, 6dB/OCTAVE
OVERALL GAIN:	+15dB MAX, UNITY WITH GAIN CONTROL AT 'CAL'
FREQUENCY RESPONSE:	20 Hz TO 20 KHz, ±1dB WITH ALL SLIDERS CENTERED
DISTORTION:	LESS THAN 0.05% THD+NOISE, 20-20,000 Hz AT 1 VOLT RMS OUTPUT WITH ALL SLIDERS CENTERED LESS THAN 0.05% SMPTE IM DISTORTION AT 1 VOLT RMS OUTPUT WITH ALL SLIDERS CENTERED
NOISE (TYPICAL):	GREATER THAN -90dBV (20KHz NBW, 600 OHM SOURCE)
CONNECTORS:	1/4" TIP-RING-SLEEVE PHONE JACK
INPUT IMPEDANCE:	15K UNBALANCED, 30K BALANCED
OUTPUT IMPEDANCE:	110 OHMS, BALANCED OR UNBALANCED
OUTPUT TYPE:	FLOATING DIFFERENTIAL. WILL DRIVE BALANCED OR UNBALANCED LOADS
OUTPUT LOAD:	600 OHMS MINIMUM
CLIPPING LEVEL:	+18dBm INTO 600 ohms, +20dBV INTO 5000 OHMS OR GREATER
SIZE:	3.5" x 19" x 7"
NET WEIGHT:	8 Lb 12 Oz.
POWER REQUIREMENTS:	110-130 VAC, 50-60HZ, 10W.
ACCESSORIES:	SECURITY COVER (SUPPLIED)

7. TAPCO BIBLIOGRAPHY

BOOKS

1. THE PA BIBLE available from Electro Voice, 600 Cecil St., Buchanan MI 49107. ATTN: PA BIBLE. $2 gets you Vol 1 and all subsequent chapters.

2. THE AUDIO CYCLOPEDIA Howard Tremaine c1969 Howard W. Sams Co. Indianapolis IN.

3. ACOUSTIC TECHNIQUES FOR HOME AND STUDIO F. Alton Everest c1973 Tab Books #646, Blue Ridge Summit PA 17214

4. SOUND REINFORCEMENT an anthology of articles from the Journal of the Audio Engineering society. c1978 Audio Engineering Society Inc.

5. SOUND SYSTEM DESIGN Don and Carolyn Davis c1975 Howard W. Sams Co. Indianapolis IN.

MAGAZINES

1. RECORDING ENGINEER/PRODUCER published bi-monthly (6 iss/yr) by Gallay Communications Inc. POB 2449 Hollywood CA 90028. $10/yr.

2. STUDIO SOUND monthly, subscription department, Link House, 25 West St., Poole, Dorset BH15 1LL, Great Britain. Sent free to qualified readers.

3. MODERN RECORDING AND MUSIC monthly, Cowan Publishing, 14 Vanderventer Ave, Port Washington NY 11050. $12/yr

4. SOUND ARTS Sound Arts Merchandising Inc, 220 Westbury Ave. Carle Place, NY 11514.

5. JOURNAL OF THE AUDIO ENGINEERING SOCIETY (JAES) monthly except Jan/Feb and Jul/Aug. Free to members of any grade, $45 to nonmembers.
State of the Art papers on all phases of audio engineering. Papers are written by professionals in audio engineering and are usually presented at one of the society's yearly conventions (Europe and the US). Highly technical, written at engineering level (don't spare the math).

Membership in the society is open to anyone with an interest in audio engineering. There are 3 membership grades: Member, Associate and Student. Dues vary with membership grade. A subscription to the Journal is part of the yearly dues. Contact: Audio Engineering Society, Lincoln Building, 60 E 42nd St. New York NY 10165. (212) 661 2355

6. dB the SOUND ENGINEERING MAGAZINE monthly, $9/yr. Sagamore Publishing Co.

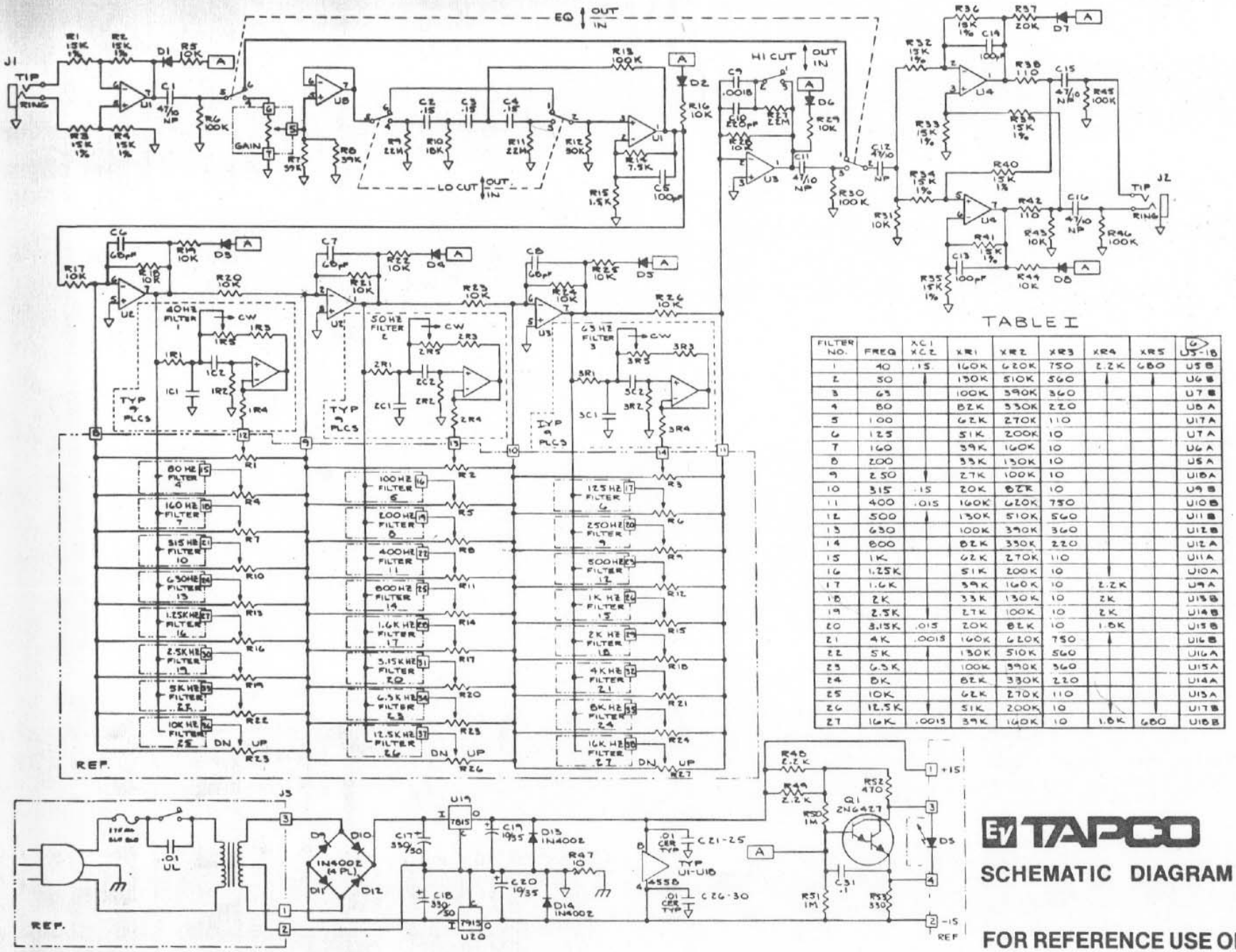


TABLE I

FILTER NO.	FREQ	XC1 XC2	XR1	XR2	XR3	XR4	XR5	IC U5-18
1	40	.15	160K	620K	750	2.2K	680	U5B
2	50		130K	510K	560			U6B
3	63		100K	390K	360			U7B
4	80		82K	330K	220			U8A
5	100		62K	270K	110			U17A
6	125		51K	200K	10			U7A
7	160		39K	160K	10			U6A
8	200		33K	130K	10			U5A
9	250		27K	100K	10			U18A
10	315	.15	20K	82K	10			U9B
11	400	.015	160K	620K	750			U10B
12	500		130K	510K	560			U11B
13	630		100K	390K	360			U12B
14	800		82K	330K	220			U12A
15	1K		62K	270K	110			U11A
16	1.25K		51K	200K	10			U10A
17	1.6K		39K	160K	10	2.2K		U9A
18	2K		33K	130K	10	2K		U15B
19	2.5K		27K	100K	10	2K		U14B
20	3.15K	.015	20K	82K	10	1.8K		U13B
21	4K	.0015	160K	620K	750			U16B
22	5K		130K	510K	560			U16A
23	6.3K		100K	390K	360			U15A
24	8K		82K	330K	220			U14A
25	10K		62K	270K	110			U13A
26	12.5K		51K	200K	10			U17B
27	16K	.0015	39K	160K	10	1.8K	680	U18B

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SCHEMATIC DIAGRAM 2230

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