

FM PRESELECTORS
MODELS 764A AND 765A

TFT

***TIME AND FREQUENCY
TECHNOLOGY, INC.***

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FM PRESELECTORS
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SECTION 1
GENERAL INFORMATION

1.1 General Description

The TFT Models 764A and 765A FM Preselectors, when used with the Model 763 FM Modulation Monitor, allow off-the-air measurement of the modulation percentage of a selected transmitter carrier in the frequency range of 88 to 108 MHz.

The Model 764A also provides a carrier frequency error measurement capability, and a means of presetting two frequencies for monitoring, so that a competitive comparison can be made of the performance of any two broadcast transmitters within a receiving range by merely selecting each frequency in turn with pushbutton switches.

Two options are available for the Model 764A:

a. Carrier Frequency Alarm. Actuates an external alarm when the carrier being monitored departs more than a specified amount from its assigned frequency.

b. BCD Frequency Output. Makes a BCD readout of frequency error available at a rear-panel connector for operation of external logging or other equipment.

1.2 Specifications.

1.2.1 Models 764A and 765A.

Frequency Range	88 to 108 MHz
RF Sensitivity	100 uV for 56 dB SNR, 1 mV for 66 dB SNR.
Input Impedance	75 ohms (nominal)
Tuning	4-digit thumbwheel switches, 100-kHz resolution.
IF Selectivity	375 kHz (nominal) for 3-dB bandwidth; 800 kHz (maximum) for 40-dB bandwidth.
Audio Frequency Response	Flat within 0.5 dB from 50 Hz to 75 kHz.
AGC Range	40 dB (+ 30 dB manual attenuation)

1.2.2 Model 764A Only.

Frequency Readout	6 digits
Range	0 to 199.999 kHz
Resolution	1 Hz
Stability	100 Hz/year
Stereo Pilot Frequency	19.000 kHz
Resolution	0.1 Hz
Stability	0.1 Hz in 5 years
SCA Subcarrier Frequency	
Range	23 to 100 kHz
Resolution	1 Hz
Accuracy	1 Hz/year

1.3 Warranty.

TIME & FREQUENCY TECHNOLOGY, INC., warrants each of the instruments of its manufacture to be produced to meet the specifications delivered to the BUYER; and to be free from defects in material and workmanship and will repair or replace, at its expense, for a period of one year from the date of delivery of equipment, any parts which are defective from faulty material or poor workmanship.

Instruments found to be defective during the warranty period shall be returned to the factory with transportation charges prepaid by BUYER. It is expressly agreed that replacement and repair shall be the sole remedy of BUYER with respect to any nonconforming equipment and parts thereof and shall be in lieu of any other remedy available by applicable law. All returns to the factory must be authorized by the SELLER, prior to such returns. Upon examination by the factory, if the instrument is found to be defective, the unit will be repaired and returned to the BUYER, with transportation charges prepaid by SELLER.

Transportation charges for instruments found to be defective within the first thirty (30) days of the warranty period will be paid both ways by the SELLER.

Transportation charges for warranty returns, wherein failure is found not to be the fault of the SELLER, shall be paid both ways by the BUYER.

This warranty does not apply to instruments which, in the opinion of the SELLER, have been altered or misused.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. TFT IS NOT LIABLE FOR CONSEQUENTIAL DAMAGES.

1.4 Claim for Damage in Shipment.

Your instrument should be inspected and tested as soon as it is received. The instrument is insured for safe delivery. If the instrument is damaged in any way or fails to operate properly, file a claim with the carrier, or if insured separately, with the insurance company.

WE SINCERELY PLEDGE OUR IMMEDIATE AND FULLEST COOPERATION TO ALL USERS OF OUR PRECISION ELECTRONIC INSTRUMENTS.

PLEASE ADVISE US IF WE CAN ASSIST YOU IN ANY MANNER

Time & Frequency Technology, Inc.
3090 Oakmead Village Dr.
Santa Clara, CA 95051
(408) 727-7272

SECTION 2

INSTALLATION

2.1 Unpacking and Inspection.

Upon receiving the instrument, inspect the packing box and instrument for signs of possible shipping damage. After installing the instrument as described in this section, operate it in accordance with the procedure of Section 3. If the instrument is damaged or fails to operate properly, file a claim with the transportation company, or with the insurance company if insured separately.

2.2 Power Requirements.

Both FM Preselectors derive their power from a 117-volt AC source, 50 to 400 hertz, and require 35 watts. The Preselectors can also be wired for 230-volt operation on special order.

2.3 Installation and Connections.

The connection instructions in this section refer only to the Models 764A and 765A. For information on connecting the Model 763 Monitor, refer to the Model 763 instruction manual.

When either the Model 764A or Model 765A is ordered with the Model 763 Monitor, the Preselector is factory installed in the same chassis as the Monitor. The following external connections are required:

a. Connect the PRESELECTOR OUTPUT connector at the rear of the Preselector to the INPUT FROM PRESELECTOR connector at the rear of the Monitor using the short coax cable provided.

b. Connect FM antenna to the RF input marked 10 MV MAX at the rear of the Preselector. If the AGC meter indicates a higher than normal reading, connect the antenna to the input marked 300 MV MAX. Set the ANT INPUT switch handle to point toward the connector being used.

Two additional connections are required for the Model 764A if the frequency of a stereo pilot carrier and/or an SCA subcarrier are to be measured:

c. For stereo pilot carrier frequency measurements, connect a coax cable between 19 KHZ PILOT CARRIER INPUT connector on the Model 764A rear panel to the STEREO PILOT (19 KHZ) connector on the Model 724A Stereo Monitor.

d. For SCA subcarrier frequency measurements, connect a coax cable between SCA CARRIER INPUT connector on the Model 764A rear panel to the SCA SUBCARRIER connector on the Model 730A SCA Monitor.

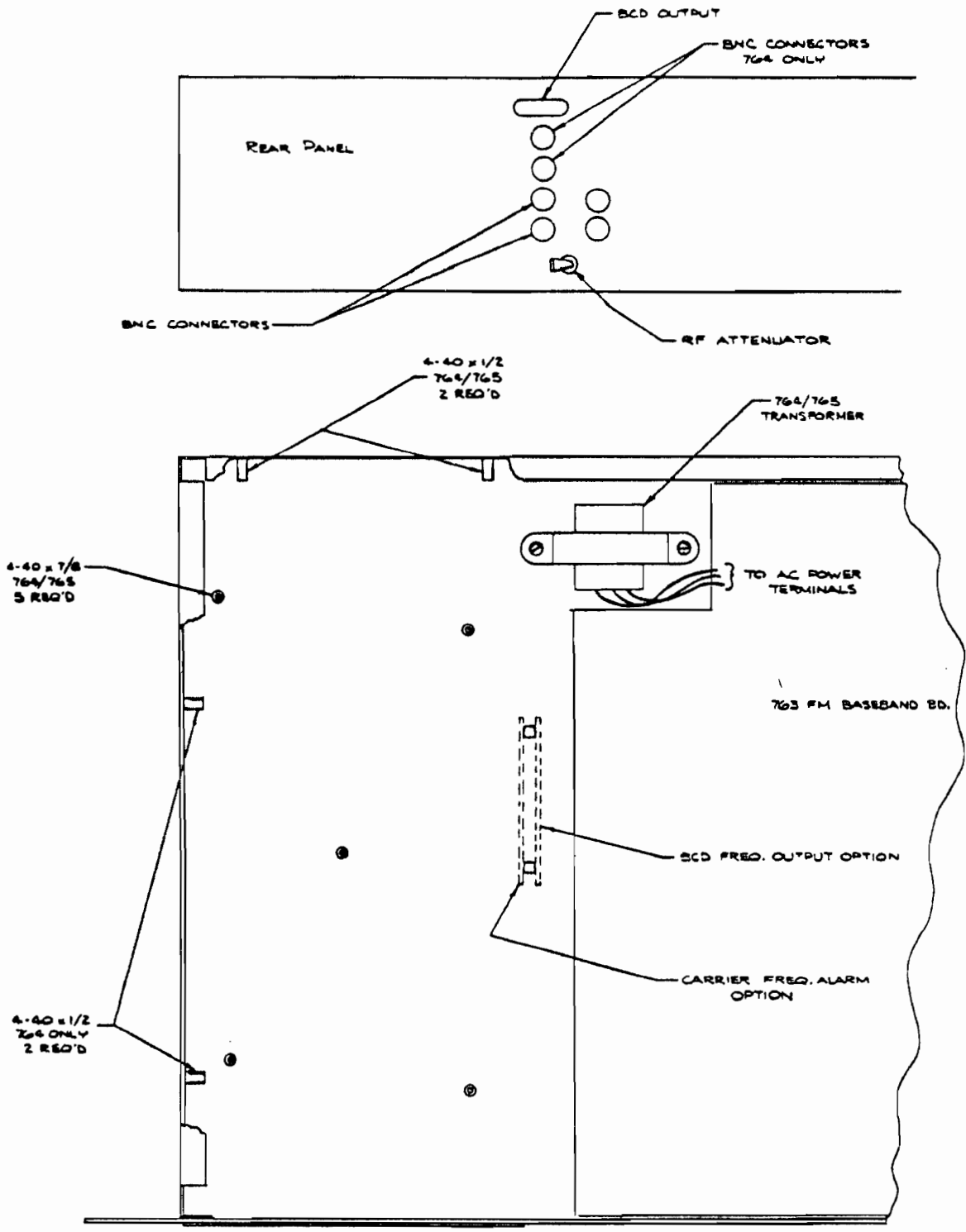


FIGURE 2-1

SECTION 3

OPERATION

3.1 General.

The Models 764A and 765A Preselectors allow off-the-air operation of the Model 763 FM Modulation Monitor. In addition, the Model 764A enables measurement of carrier frequency error. It should be noted that when either Preselector is used, AM measurements cannot be made on the Model 763, and the RF LEVEL pushbutton switch and SET control on the Model 763 front panel are inoperative. The Carrier Power Alarm option cannot be used when the Preselector is installed.

3.2 Turn-On and Warm-Up.

The Preselectors contain no on-off switch. They derive their power (117 VAC, 35W) from the Model 763 power line cord, and so are on whenever the Model 763 is plugged into an appropriate power source. Either Preselector can be used for monitoring after a 1-minute warm-up.

3.3 Controls, Connectors, and Indicators.

3.3.1 Model 764A Front Panel.

Fig. 3-1
Ref. No.

<u>Ref. No.</u>	<u>Name</u>	<u>Function</u>
1	GATE lamp	In normal operation, flashes for 1/2 second every 4 seconds to indicate proper counter operation.
2	FREQUENCY -Hz indicator	Indicates difference between frequency of monitored carrier and the frequency set up on the selected thumbwheel switches. The + or - at the left of the display indicates that the error is above or below nominal frequency, respectively.
3	AGC METER	When needle is in white range, indicates sufficient RF level for accurate monitor operation.
4	COUNTER switch	Enables selection of stereo pilot frequency, main carrier frequency error, or SCA subcarrier frequency for display on the FREQUENCY -Hz indicator.

Fig. 3-1
Ref. No.

	<u>Name</u>	<u>Function</u>
5	FREQUENCY-MHz thumbwheel switches	The two rows of thumbwheel switches allow presetting four carrier frequencies.
6	Station selector lamp	The lighted lamp indicates which frequency has been selected.
7	Station selector switches	Depressing one of these switches selects the frequency set up on the thumbwheel switches on the same row.

3.3.2 Model 764A Rear Panel.

Fig. 3-2
Ref. No.

	<u>Name</u>	<u>Function</u>
1	300 MV MAX connector	Used to connect an antenna input with signal level between 10 mV and 300 mV.
2	ANT INPUT switch	Selects either the 10 mV maximum RF input or the 300 mV maximum RF input.
3	10 MV MAX connector	Used to connect an antenna input with signal level of 10 mV or less.
4	PRESELECTOR OUTPUT connector	Used to connect the Preselector output to the Model 763 INPUT FROM PRESELECTOR connector.
5	SCA CARRIER INPUT connector	Used to connect the SCA subcarrier output of a Model 730A SCA Monitor into the Preselector for frequency measurement
6	5 MHz TIME BASE OUTPUT connector	Provides a 5-MHz output from the TCXO or standard 5-MHz oscillator for oscillator calibration purposes.

REV.	DATE	BY	DESCRIPTION
1	10-4-76	WCA	INITIAL ISSUE
2	10-4-76	WCA	REVISED TO ADD PINS
3	10-4-76	WCA	REVISED TO ADD PINS
4	10-4-76	WCA	REVISED TO ADD PINS

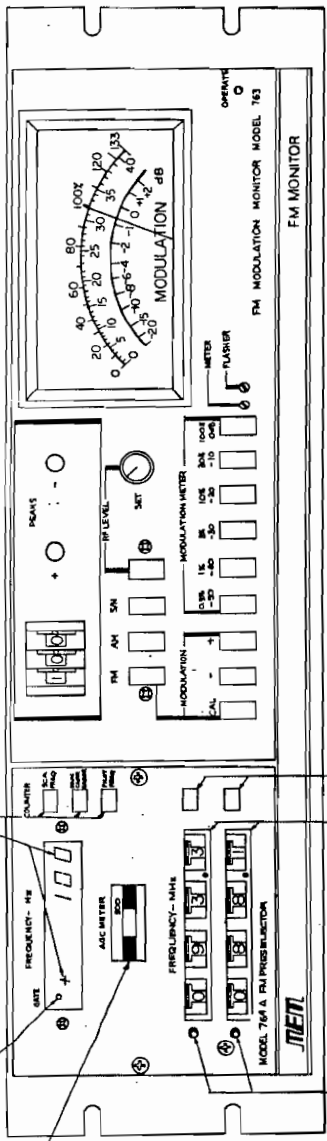


FIGURE 3-1

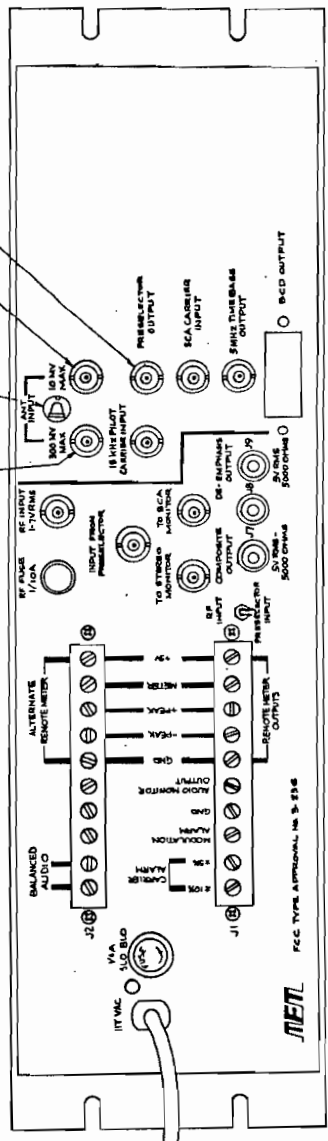
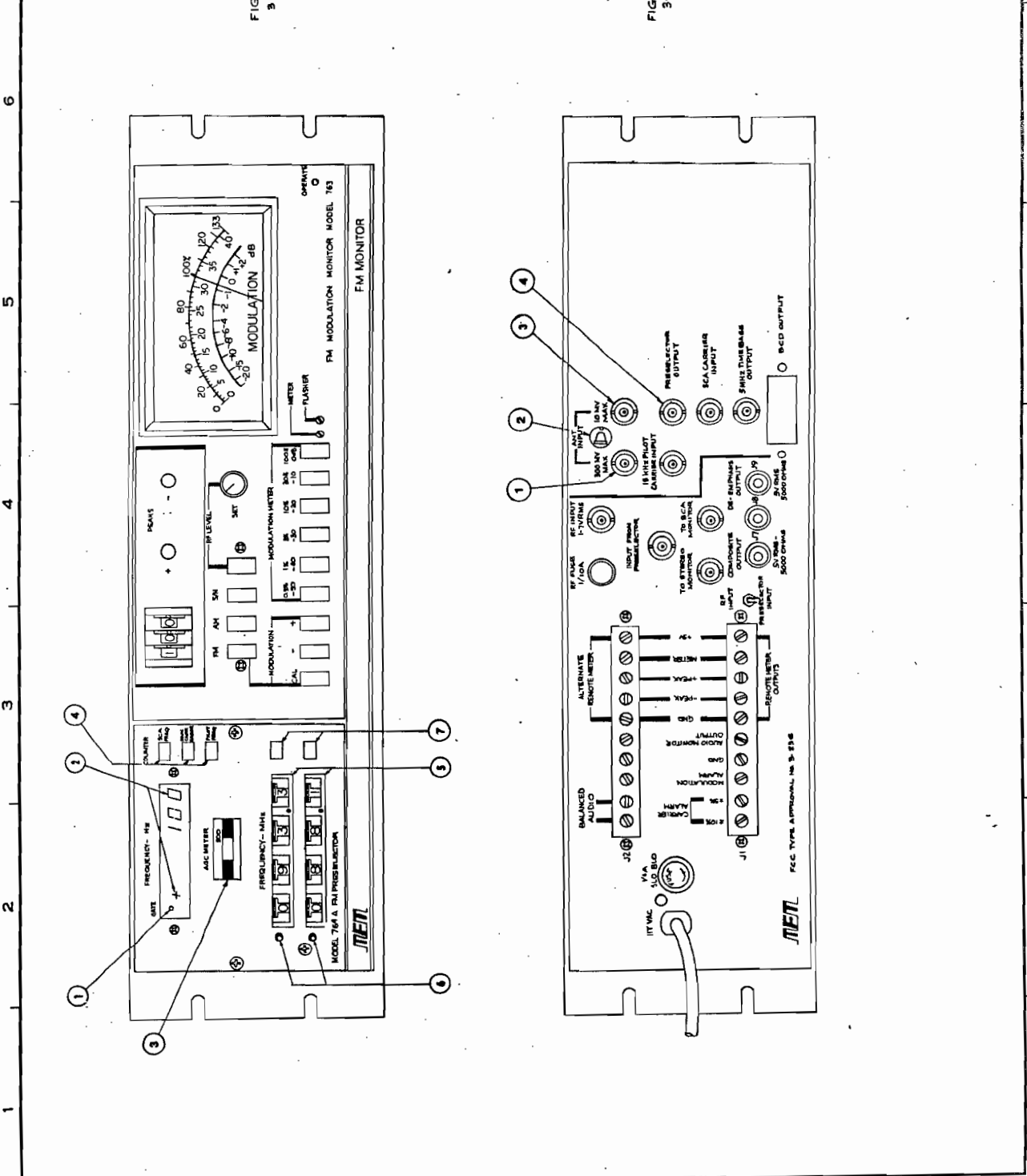


FIGURE 3-2

REV.	DATE	BY	DESCRIPTION
1	10-4-76	WCA	INITIAL ISSUE
2	10-4-76	WCA	REVISED TO ADD PINS
3	10-4-76	WCA	REVISED TO ADD PINS
4	10-4-76	WCA	REVISED TO ADD PINS



REV. NO.	DATE	BY	REVISIONS
765A	10/15/54	WJ	REV. FOR 765A PER
765B	11/15/54	WJ	REV. FOR 765A PER
765C	12/15/54	WJ	REV. FOR 765A PER

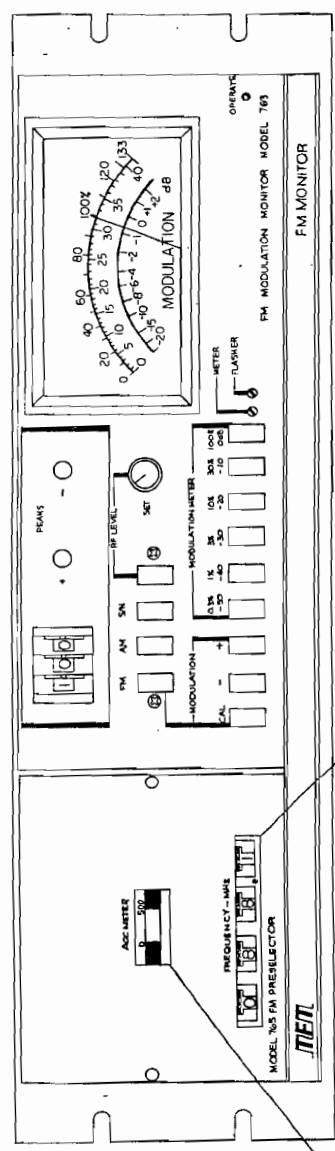


FIGURE 3-3

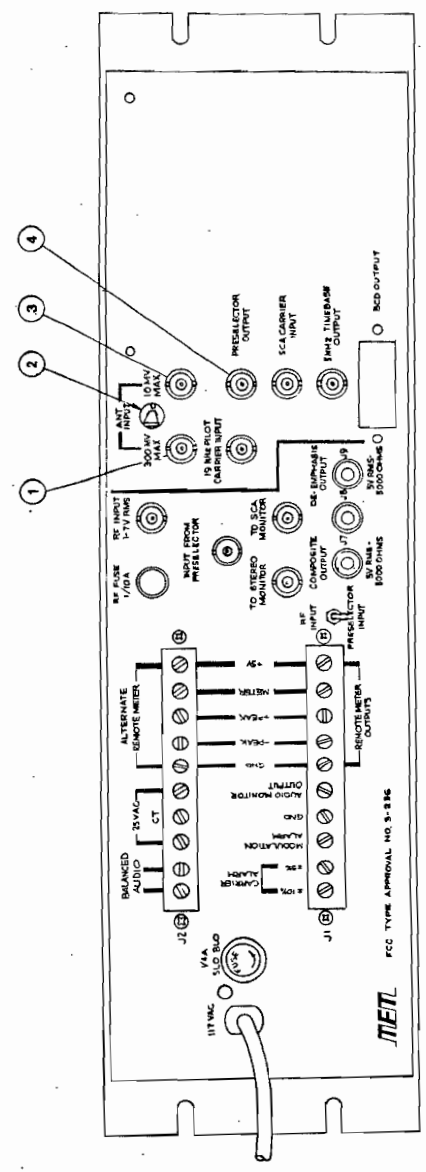


FIGURE 3-4

DATE	REV. NO.	ISS. NO.	ISS. DATE	REVISIONS
				REMOVE ALL BURS AND SHARP EDGES
				TOLERANCE UNLESS OTHERWISE SPECIFIED
				100% INSPECTION
				DO NOT SCALE THIS PRINT

DATE	REV. NO.	ISS. NO.	ISS. DATE	REVISIONS
				REMOVE ALL BURS AND SHARP EDGES
				TOLERANCE UNLESS OTHERWISE SPECIFIED
				100% INSPECTION
				DO NOT SCALE THIS PRINT

Fig. 3.2
Ref. No.

	<u>Name</u>	<u>Function</u>
7	BCD OUTPUT connector	Provides a BCD output of the frequency error for logging or other equipment when the BCD Frequency Output option is installed. Also provides an alarm signal when the Carrier Frequency Alarm option is installed.
8	19 KHz PILOT CARRIER INPUT connector	Used to connect the 19-kHz output of a Model 724A Stereo Monitor into the Preselector for frequency measurement.

3.3.3 Model 765A Front Panel.

Fig. 3-3
Ref. No.

	<u>Name</u>	<u>Function</u>
1	FREQUENCY-MHz thumbwheel switches	Used to tune the Preselector to the frequency to be monitored.
2	AGC METER	When needle is in the white range, indicates sufficient RF level for accurate monitor operation.

3.3.4. Model 765A Rear Panel

Fig. 3-4
Ref. No.

	<u>Name</u>	<u>Function</u>
1	300 MV MAX connector	Used to connect an antenna input with signal level between 10 mV and 300 mV.
2	ANT INPUT switch	Selects either the 10 mV maximum RF input or the 300 mV maximum RF input.
3	10 MV MAX connector	Used to connect an antenna input with signal level of 10 mV or less.
4	PRESELECTOR OUTPUT connector	Used to connect the Preselector output to the Model 763 INPUT FROM PRESELECTOR connector.

3.4 Preselector Operating Procedures.

3.4.1 Model 764A.

- a. Make sure the rear panel RF INPUT/PRESELECTOR INPUT switch on the Model 763 rear panel switch is in the PRESELECTOR INPUT position.
- b. Set each row of thumbwheel switches to a carrier frequency to be monitored.
- c. Press the front-panel COUNTER MAIN CARRIER ERROR switch.
- d. Select one of the carrier frequencies by depressing the associated pushbutton, and read the frequency error of this carrier on the FREQUENCY -Hz display.
- e. If overloading or interference is present, set the ANT INPUT switch toward the connector marked 300 MV MAX and move the antenna cable to that connector.
- f. If a Model 724A Stereo Monitor has been connected to the Model 763/764A as described in Section 2.3, the pilot carrier frequency can be read on the FREQUENCY -Hz display by pressing the COUNTER pilot frequency switch. Note that the reading is actual frequency, and not frequency error.
- g. If a Model 730A SCA Monitor has been connected to the Model 763/764A as described in Section 2.3, the SCA subcarrier frequency can be read on the FREQUENCY -Hz display by pressing the COUNTER SCA frequency switch. Note that the reading is actual frequency, and not frequency error.

3.4.2 Model 765A.

- a. Make sure the rear-panel RF INPUT/PRESELECTOR INPUT switch on the Model 763 rear panel is in the PRESELECTOR INPUT position.
- b. Set the thumbwheel switches for the carrier frequency to be monitored.
- c. If overloading or interference is present, set the ANT INPUT switch toward the connector marked 300 MV MAX and move the antenna cable to that connector.

3.5 Use of the Preselectors With the Model 763.

FM modulation measurements can be made with the Model 763 as described in its instruction manual. AM and carrier level measurements CANNOT be made when using a preselector.

3.6 Carrier Frequency Alarm (Optional).

This option is available for the Model 764A only. It actuates an alarm connected to the rear-panel BCD OUTPUT connector when the carrier being monitored departs by more than a specified amount from its assigned frequency. The frequency error to trigger the alarm is factory set, and is specified when the option is ordered. No operating controls are involved.

3.7 BCD Frequency Output (Optional).

This option, available for the Model 764A only, provides a BCD readout of frequency error to external equipment connected to the rear panel BCD OUTPUT connector. No operating controls are involved. The frequency range of the BCD OUTPUT is ± 199.999 kHz from the dialed-in center frequency.

SECTION 4

THEORY OF OPERATION

4.1 Block Diagram Discussion (Figure 6-1).

The RF input from the antenna is amplified in a tuned amplifier and applied to the first mixer. The LO input for the first mixer, which is 10.7 MHz above the desired received signal, comes from a voltage-controlled oscillator (VCO) in a phase-locked loop. Also in the loop is a synthesized LO consisting of a divide-by-N counter (programmable divider) and a phase detector. A 12.5-kHz signal obtained by dividing the output of a precision 5-MHz oscillator is also applied to the phase detector. The divide-by-N counter is adjusted by front-panel thumbwheel switches so that a 12.5-kHz phase detector input is produced when the VCO frequency is correct for the received frequency indicated by the thumbwheel switches. The output of the phase detector is a DC voltage which varies with the phase difference between the two inputs to the synthesized LO; this DC voltage is used to tune the VCO to maintain a zero phase difference. The DC voltage also tunes the input RF amplifier.

After amplification in a linear phase IF amplifier, the 10.7-MHz is applied to a second mixer. The 10-MHz LO input for the second mixer is also derived from the precision 5-MHz oscillator. The resulting 700-kHz IF signal is amplified and delivered to the rear-panel PRESELECTOR OUTPUT connector for feeding the Model 763 FM Modulation Monitor.

The Model 764A Preselector also contains a frequency error display. The circuitry for driving this display is shown within dashed lines in Figure 6-1. The time base for the error counter is obtained by dividing the precision 10-kHz frequency derived from a temperature-controlled crystal oscillator. The Preselector output, nominally 700 kHz, is stripped of any amplitude modulation in a limiting amplifier, and the carrier frequency is counted in the error counter. Any difference from 700 kHz is displayed. Since a given error in the carrier RF produces the same error in the IF, the displayed error is also that of the carrier RF.

The counter can also be used to measure the frequency of the 19-kHz pilot carrier from a Model 724A Stereo Monitor and the frequency of the SCA subcarrier from a Model 730A SCA Monitor. The 19-kHz pilot carrier frequency is multiplied by 10 to provide a 0.1-Hz resolution rather than the normal 1.0-Hz resolution.

4.2 RF Tuner (Figures 6-4 and 6-8) and Prescaler (Figure 6-3).

4.2 RF Tuner (Figures 6-4 and 6-8 and Prescaler (Figure 6-3) (Continued)

The RF tuner is a shielded assembly containing an RF amplifier, a mixer, a VCO and a buffer amplifier. The input and output circuits of the RF amplifier, the input of the mixer, and the VCO are all varactor tuned by means of a DC voltage from the phase detector in the LO synthesizer circuitry. The VCO is tuned to a frequency 10.7 MHz higher than the RF amplifier and mixer. The buffered VCO output drives ECL dividers U2 and U3 on the Tuner/Switch Board. This divided-by-eight signal is translated to TTL levels by transistors Q1 and Q10, and delivered to the programmable divider on the Preselector Board.

The VCO also provides an output for the phase-locked loop, which controls the VCO frequency. This output is buffered by Q1 on the Main Board and applied to a divide-by-eight prescaler consisting of dual J-K flip-flops U1 and U2. The VCO output is divided by four in U1 and again by two in U2. Q2 amplifies the divided VCO output to drive the divide-by-N counter.

4.3 Timebase (Figures 6-5 and 6-6) and Dividers (Figure 6-3).

The timebase for the Model 764 Preselector is shown in Figure 6-6. It consists of a 10-MHz temperature-controlled crystal oscillator followed by a divide-by-two flip-flop to give a highly stable 5-MHz output. The Model 765A timebase consists of a 5-MHz crystal oscillator, as shown in Figure 6-5.

The 5-MHz timebase output enters the Preselector Board through pin 2 of J5 (Figure 6-3). It is divided by 10 in U13, by 10 in U14, and by 4 in U15 to provide a 12.5-kHz pulse train to the phase detector. The 50-kHz output of U14 (pin 8) is divided by 5 in U17 to provide a 10-kHz timebase for the counter circuits in the Model 764A (pin 1 of J7).

4.4 Divide-by-N Divider, Phase Detector, and Loop Amplifier (Figure 6-3).

The output of the divide-by-eight prescaler at pin 1 of J1 is applied to the divide-by-N counter consisting of decade counters U7 through U10, J-K flip-flop U19, and associated gates and inverters. The purpose of the divide-by-N counter is to divide the incoming RF by a factor (N) that will produce a 12.5-kHz output when the VCO output is exactly 10.7 MHz above the frequency dialed in on the thumbwheel switches. To accomplish this, the circuit consisting of U2, U3, U4, and U5 presets the divide-by-N counter to the nine's complement of ten times the dialed-in frequency. The counter then counts up from the preset count to 9999, resets to 0, counts up to a fixed count of 10 times the IF offset, and produces an output pulse. The total count is the required value of N, and the output pulses will occur at a PRF of 12.5 kHz if the VCO is exactly 10.7 MHz above the dialed-in frequency.

4.4 Divide-by-N Divider, Phase Detector, and Loop Amplifier (Figure 6-3) (Continued)

For example, if a frequency of 106.2 MHz is dialed in, the thumbwheel switches would preset the divide-by-N counter to $9999 - 1062 = 8937$. The VCO frequency ($106.2 + 10.7 = 116.9$ MHz) is divided by 8 in the prescaler to give 14.6125 MHz. When the divide-by-N counter is clocked, it will count up to 9999, reset to 0, and count up to 107, for a total count of $1062 + 107 = 1169$, at which time an output pulse is produced. Thus the divide-by-N counter divides the output of the prescaler by 1169 to give the required 12.5 kHz. Any error in the VCO frequency will be reflected in the output frequency of the divide-by-N counter.

The phase detector consists of Q9 through Q13 and associated components. Capacitor C48 charges at a linear rate through constant-current source Q10. When the 12.5-kHz pulsed input from the timebase dividers is high, switch Q13 is turned on and discharges C48. When the 12.5-kHz input is low, switch Q13 opens and allows C48 to charge and thus produce a ramp waveform. At some time during the charging of C48, a short pulse is received from the divide-by-N counter through transformer T1, which turns on sampling gates Q11 and Q12. These gates pass the ramp voltage existing at the time of the sampling pulse to holding capacitor C49. Thus the value of the voltage on C49 will depend on the time at which the sample pulse from the divide-by-N counter arrives with respect to the timing of the ramp.

The DC voltage on C49 is applied through the loop amplifier consisting of buffer U16, active low-pass filter U20 and U21, and amplifier U22 to tuner Z1 on the Tuner/Switch Board to tune the VCO and RF amplifiers. The filter eliminates spikes and other transients in the DC voltage. When a preset voltage (approximately 4.3V) is reached on the tuning ramp, diode CR20 changes the feedback ratio of operational amplifier U22 to increase its gain and thus compensate for the reduction in tuner control sensitivity at the higher frequencies.

The Model 764A requires a Thumbwheel Switch Board (Figure 6-7) to accommodate the second set of thumbwheel switches. Thumbwheel Switch Board connector P8A plugs into J8A on the Counter Board, which in turn plugs into J8 on the Preselector Board. The tuning frequency is selected by closing either the channel 1 or channel 2 pushbutton switch (S1 in Figure 6-8). When one of these switches is closed, all others are mechanically opened. Closing a switch applies -0.6 volts to the common bus of the selected row of thumbwheel switches, allowing the required input lines to the nine's complement circuit to be set low, corresponding to the thumbwheel switches that are closed. The common bus for the thumbwheel switches is held at -0.6V instead of 0V because, if 0V were used, the isolation diodes associated with the thumbwheel switches would hold the selected input lines to the divide-by-N counter at +0.6 V instead of 0V. For good noise immunity the divide-by-N lines must be at 0V. The -0.6V level is furnished by Q2 and associated components (Figure 6-3). This voltage also lights the LED CR16 on the Preselector Board, CR1 on the plug-in mounted alongside the selected row of thumbwheel switches.

4.4 Divide-by-N Divider, Phase Detector, and Loop Amplifier (Figure 6-3) Continued

In the Model 765A, a jumper is connect as shown by Note 4 of Figure 6-8, thus applying -0.6 volts to the thumbwheel switch common bus on the Preselector Board.

4.5 IF Amplifier, Second Mixer, and Limiting Amplifier (Figure 6-3).

The 10.7-MHz IF from the first mixer in tuner Z1 on the Tuner/Switch Board enters the Preselector Board at J4 and is amplified by tuned cascade amplifier Q3/Q4, filtered to reject adjacent-channel interference, amplified by Q5, and applied to second mixer U6. The IF output of Q5 is also rectified by CR3 and the resulting DC voltage amplified by U1 to furnish AGC voltage to the first RF amplifier (see Figure 6-4). AGC range is from +5V with no signal to -5V for an overscale AGC METER reading. The AGC output of U1 is also applied to Q1. When the AGC voltage reaches +5V, it turns off Q1, thus connecting the cathode of CR17 to -12V and squelching off the 700-kHz IF at the input to limiting amplifier U18. The AGC is also used to drive the front-panel AGC METER and to turn off the counter when the RF input is insufficient for accurate counting (see paragraph 4.7). The AGC output at J10-1 is not used in this equipment.

The input at J5-2 is 5 MHz from either the standard 5-MHz crystal oscillator in the case of the Model 765A Preselector, or from the temperature-controlled crystal oscillator for the Model 764A. The output of amplifier Q8 is tuned to 10 MHz, so that Q8 acts as a doubler. The tuned circuit of Q8 provides a clean 10-MHz sinewave, which is used as the LO input to second mixer U6. The 700-kHz output at pin 6 of U6 is low-pass filtered to remove the 10-MHz and other mixer products, and applied to limiting amplifier U18. The output of U18 is delivered to the rear-panel PRESELECTOR OUTPUT connector via J4-2 of the Tuner/Switch Board. It is fed to the counter (Model 764A only) for measuring carrier frequency error via switch S2 on the Tuner/Switch Board.

4.6 Power Supplies (Figure 6-13).

The Power Supply Board furnishes regulated +5V, +12V, -12V, and +27V for operation of all Preselector circuits except those on the Counter Board of the Model 764A. It also furnishes unregulated +12V and +18V to the Counter Board, and unregulated +30V to the Tuner/Switch Board to be regulated to +15V for the tuner. AC input to the Power Supply Board is from a transformer mounted in the cabinet.

One transformer secondary, with grounded center tap, is connected across pins 1 and 2 of J1. Full-wave rectifier CR1/CR2 delivers +12V unregulated to P1-10, and regulator U1 furnishes +5V regulated to P1-3.

4.6 Power Supplies (Figure 6-13). (Continued)

Another transformer secondary, with grounder center tap, is connected across pins 4 and 5 of J1. Bridge rectifier CR3 through CR6 develops +18V at the junction of CR5 and CR6 and P1-9; this voltage is regulated by U2 to +12V at P1-5. The -18V at the junction of CR3 and CR4 is regulated by U3 to furnish -12V at P1-7.

The AC voltage between J1-5 and ground is applied to the cascade voltage doubler consisting of C4, C5, CR7, and CR8 to develop +35V across C5, which is regulated by U4 to furnish +27V at P1-1.

4.7 Counter Circuits and Display (Model 764A Only) (Figures 6-8, 6-9, and 6-10)

The frequency to be counted enters the Counter Board at pin 5 of P7. This input comes from one of the front-panel COUNTER switches. When the MAIN CARR ERROR switch is closed, the input is the 700-kHz IF at J1-10 of the Preselector Board. When the PILOT FREQ or SCA FREQ switch is closed, the input is 190 kHz from the Tuner/Switch Board or 67 kHz from the rear-panel SCA CARRIER INPUT connector, respectively.

On the Counter Board, limiting amplifier Z15 strips off any amplitude modulation to ensure an accurate count of the carrier frequency. The IF signal is then fed through Schmitt trigger Z24 to dual flip-flop Z11, where it is divided by 4. This is necessary because some of the comparison and transfer functions in counter module Z12 cannot be done when the counter is operating at a 700-kHz counting rate. The time base applied to the counter is 4 seconds rather than 1 second, so that if the IF is precisely 700 kHz, the counter will have counted 700,000 counts in the 4-second period. The divided-down signal is applied through gate Z10-4 to the count input (pin 36) of counter Z12.

The counter time base comes from the timebase divider on the Preselector Board through P7-1. This 10-kHz input is divided by decade dividers Z1 through Z4 to obtain 1 Hz, and then further divided by 4 in dual flip-flop Z5 to produce a 1/4-Hz (4 second period) time base.

The 4-second waveform at pin 11 of Z5 is processed by Z6-3, Z6-6, Z8-11, Z16-6, and Z10-10 to produce a preset pulse at the counter load input (pin 31) of counter Z12; this allows presetting the counter to a count of 700,000. The same 4-second waveform is also processed by Z6-3, Z6-6, Z8-11, Z16-8, Q3, and Z10-13 to produce a store pulse which is applied to pin 15 of counter Z12 to store the count at the end of the 4-second counting period into the register of Z12.

Module Z12 is a six-decade, up-down, presettable counter. At the start of each 4-second counting period, the counter is preset to 700,000 (when the front-panel MAIN CARR ERROR switch is closed). It then starts counting down toward zero. If there is no error in the IF signal, the count at the end of 4 seconds will be zero. If the IF is less than 700 kHz, an error count will remain at the end of 4 seconds.

4.7 Counter Circuits and Display (Model 764A Only.) Figures 6-8, 6-9, and 6-10. (Continued)

If the IF is greater than 700 kHz, the counter will count through 0; when it does, an output is produced at pin 39 of Z12, which sets flip-flop Z9-15 high and send a logic 1 to the counter's up/down control (pin 40) to cause the counter to start counting up from 0. In this case the counter will again end the 4-second period with an error count. When Z9-15 is set high, it also applies the appropriate levels to J and K of Z9-11 so that when the store pulse is received at the end of the 4-second period, pin 10 of Z9 goes low to turn off Q4 and turn off the vertical segments of the + display, thus indicating a frequency higher than the nominal IF. Because of the LO frequencies used, an increase in RF carrier frequency causes a decrease in the IF frequency. (In the SCA and Pilot modes of frequency measurement, the + sign is turned off.

At the end of the 4-second period, the store pulse applied to pin 15 of Z12 causes the count present in the counter at that time to be entered into the display register, which is a part of Z12. Z12 then strobes the display digits by producing an output at pin 24 (LSD) through pin 29 (MSD) in sequence, to turn on power to each of the digits through transistors Q12 through Q23. As each digit is switched on, the BCD count for that digit is taken from the display register and decoded to light the display segments which will produce the required numeral. These segment outputs appear at pins 4 through 10 of Z12, and are delivered to the displays through drivers Q5 through Q11, which ground the appropriate segments.

When counter Z12 is being preset to 700,000, the sixth digit must be the binary equivalent of 7 (111). Diodes CR7 and CR8, and resistors R30, R31 and R32 furnish these three positive voltages to the counter binary input (pins 17 through 19 of Z12) from the sixth digit strobe line (J1-3). All other digits for the preset are zeros.

When the COUNTER PILOT FREQ switch is closed, it applies +5V to the base of Q5 on the Tuner/Switch Board to turn it on and light the decimal point on the display. Q7 and Q6 are also on, placing a logic 0 on pins 1 and 2 of J9 on the Counter Board. This causes the counter to count up.

When the MAIN CARR ERROR switch is closed, it grounds the bases of Q7 and Q6; Q7 removes the ground from J9-1 on the Counter Board to allow normal presetting of counter Z12, and Q6 removes the ground from J9-2 to allow the sign on the display to indicate either + or - and to allow the counter to count up or down. Q5 on the Tuner/Switch Board is also turned off, turning off the decimal point.

When the SCA FREQ switch is closed, Q6 and Q7 are on and Q5 is off, applying a ground to both J9-1 and J9-2 to preset counter Z12 to zero and allow it to count up in normal fashion.

4.7 Counter Circuits and Display (Model 764A Only. Figures 6-8, 6-9 and 6-10. (Continued))

The AGC voltage at P1-6 of the Tuner/Switch Board is applied to Q2 on that board. When the AGC reaches +5V, indicating insufficient signal strength, Q2 is turned off. The resulting low collector voltage is delivered through P2-6 to pin 2 of counter Z12 on the Counter Board to prevent the counter from counting and thus avoid erroneous counts. When the AGC voltage drops below +5V, indicating adequate signal strength, Q2 is turned on and delivers a high to the counter to turn it on.

The SCA and pilot signals from the rear-panel connectors are applied to the circuit consisting of Q9, Q4, Q3 and associated components on the Tuner/Switch Board. This circuit acts as a level detector in the same way as Q2 to turn the counter off in case the selected signal is too low in amplitude for dependable frequency measurement.

The front-panel GATE lamp, located on the Display Board, is driven by the store pulse through one-shot Z17, which stretches the store pulse to approximately 500 milliseconds. Thus the GATE lamp will flash every 4 seconds to indicate normal counter operation.

The Counter Board contains two voltage regulators, Z13 and Z14, to furnish regulated DC voltage for the counter circuits. They operate on unregulated power supplied from the Power Supply Board.

The Display Board (Figure 6-10) contains the six LED displays which can indicate a frequency error from -199999 Hz to +199999 Hz. DS1 displays the + or - and the most significant digit, which can be only 1 or blank. DS2 through DS6 display the other five digits of the frequency error. R1 through R8 are current-limiting resistors for the LEDs. CR1 is the GATE LED.

4.8 19-kHz Multiplier (Figure 6-8).

The 19-kHz multiplier on the Tuner/Switch Board multiplies the pilot frequency by 10 to give a 0.1-Hz resolution of pilot frequency error with the same time base used to achieve 1-Hz resolution on Main Carrier and SCA frequency measurements.

U5 contains a VCO which is tuned to 190 kHz by C13, R30, and R31. The VCO output at pin 4 is buffered by Q8 and sent to the PILOT FREQ switch. This output is also divided by 10 in U6 and applied through pin 5 of U5 to a phase detector in U5, where it is compared with the incoming pilot frequency at pin 2 of U5. Any phase difference between the two inputs tunes the VCO to reduce the phase difference to zero. The output at the PILOT FREQ switch is thus exactly 10 times the pilot frequency.

4.9 Carrier Frequency Alarm (Optional) (Figure 6-11).

When this option is selected, the customer specifies the frequency error (within the range of 0 to +2 kHz) which is to trigger the alarm. This error is factory-preset in BCD form into the counter register (pins 32 through 35 of Z12, Figure 6-9). The counter will then deliver an EQUAL pulse to pin 23 of Z12 whenever the count is equal to the preset count.

There are three possible situations for the Carrier Frequency Alarm:

- a. If the IF being measured is lower than 700 kHz by more than the preset error, counter Z12 on the Counter Board, which starts counting down from 700,000 at the start of each timebase cycle, will never reach the preset count, and no EQUAL pulse will be generated.
- b. If the IF is within tolerance (i.e., between the - preset error and the + preset error), one EQUAL pulse will be generated as the counter goes through the - preset error.
- c. If the IF is higher than 700 kHz by more than the preset error, two EQUAL pulses will be generated as the counter counts down through 0 and back up again past the + preset error.

The Carrier Frequency Alarm Board plugs into J1 on the Counter Board. Pins 13 through 16 of J1 are the BCD lines into the register, while pins 1, 4, 5, and 6 are the digit strobes. The diodes are factory-installed to furnish the required BCD count for each digit. The EQUAL pulse at pin 12 of J1 clocks flip-flop Z1-15 so that, in combination with a SET pulse at the start of each timebase, the output at pin 11 of Z1 is high if no or two EQUAL pulses are received during a timebase period, but low if one EQUAL pulse is received. This allows Q3 to ground an external circuit when the IF is lower or higher than the preset tolerance. Q3 is capable of sinking a maximum of 50 mA at 30 V.

4.10 BCD Frequency Output (Optional) (Figure 6-12).

When the BCD Frequency Output option is selected, the BCD and digit strobe outputs of counter Z12 on the Counter Board are furnished to the BCD Output Board through J2 of the Counter Board. As each strobe line is enabled in turn, from the least significant digit (LSD) (Z12-24) to the most significant digit (MSD) (Z12-29), the corresponding BCD readout for that digit appears at pins 11 through 14 of Z12 (pin 11 is the least significant bit), and is loaded into the register (Z2, Z3, or Z4) on the BCD Output Board that receives a LOAD pulse from the strobe. The content of each register is buffered by Z6 and Z7, and delivered to the rear-panel BCD OUTPUT connector through J2 of the BCD Output Board.

SECTION 5
MAINTENANCE

5.1 General.

Since the Models 764A and 765A Preselectors are solid-state instruments and their power requirements are low, no maintenance problems due to high temperature should be encountered, provided the instrument is installed well away from vacuum-tube and other heat-generating equipment. Likewise, because the operating voltages are low, excessive dust accumulation associated with high-voltage devices should not occur.

Access to components is covered in Section 5.2, and periodic maintenance in Section 5.3. Three methods of calibrating the TCXO are described in Section 5.4, and the AGC METER calibration is given in Section 5.5. Receiver performance checks are covered in Section 5.6, and troubleshooting procedures are given in Section 5.7.

Refer to the Model 763 instruction manual for maintenance procedures pertaining to the FM Modulation Monitor.

5.2 Access.

To gain access to the Preselector components, remove six screws from the top cover and then remove the cover.

To remove PC boards and other assemblies from the chassis, proceed as follows:

- a. Remove the two screws holding the front panel to the chassis.
- b. Remove the screws that hold the PC board to the standoffs mounted on the chassis. See Figure 2-1 for location of screws.
- c. Unplug the cables attached to the PC board.
- d. Pull out the PC board.

5.3 Periodic Maintenance.

Except for the Model 764A TCXO calibration described in Section 5.4, the only periodic maintenance required is cleaning. Once a year, or more often in dusty locations, remove the printed-circuit boards and blow off the dust with compressed air.

5.4 TCXO Timebase Calibration (Model 764A Only).

The 10-MHz TCXO should be calibrated periodically. The aging rate of the oscillator is typically 1 ppm per year. For a monitored frequency of 108 MHz, the local oscillator frequency is 118.7 MHz, and the typical error would be 119 Hz per year. Thus, calibration once a year should ensure keeping the monitor's error well within the FCC allowable transmitter frequency error of ± 2 kHz, even at the high-frequency end of the FM band.

Three calibration methods are described in Sections 5.4.1, 5.4.2, and 5.4.3. For all methods, to adjust the TCXO frequency remove the top cover, as described in Section 5.2. The frequency adjustment screw is located on the side of the TCXO nearest the center of the Preselector, and can be turned with a small screwdriver.

5.4.1 Calibration Using a Secondary Standard.

A secondary standard such as the HP Model 5245 counter or the HP 105A quartz oscillator can be used to calibrate the TCXO.

- a. Remove the instrument from the rack and remove the top cover.
- b. Connect the 5-MHz output of the secondary standard to the external sync input of a 10-MHz oscilloscope. Adjust the oscilloscope for external sync.

Connect the 5-MHz TIMEBASE OUTPUT connector on the rear panel of the Model 764A to the vertical input of the oscilloscope.

- d. Adjust the oscilloscope vertical gain for full-scale deflection and adjust the horizontal sweep speed to 0.1 microsecond per centimeter.
- e. Adjust the Model 764A TCXO frequency for the least movement of the oscilloscope display.

5.4.2 Calibration Using a WWVB Receiver.

- a. Connect the rear-panel 5-MHz TIMEBASE OUTPUT connector to the WWVB receiver.
- b. Refer to the WWVB receiver instructions for the proper setup and method of calibrating the TCXO.

5.4.3 Calibration Using a Highly Accurate Standard.

The 5-MHz output of the TCXO can be compared with the 5-MHz output of a rubidium or other highly accurate standard. This is the most accurate way to calibrate the TCXO.

5.4.3 Calibration Using a Highly Accurate Standard. (Continued)

The TCXO and standard frequencies can be compared in an oscilloscope in any of three ways:

a. Apply the TCXO output at the Model 764A rear-panel 5-MHz TIMEBASE OUTPUT connector to the vertical input of the oscilloscope and apply the 5-MHz output of the standard to the horizontal input of the oscilloscope. Adjust the TCXO frequency for a steady Lissajous pattern.

b. Using a dual-trace oscilloscope, apply the TCXO output from the rear-panel 5-MHz TIMEBASE OUTPUT connector to one oscilloscope channel, and apply the 5-MHz output of the standard to the other channel, triggering the oscilloscope sweep from the standard frequency. Adjust the TCXO frequency until the TCXO waveform is steady or moves very slowly with respect to the standard waveform.

c. Using the output from the frequency standard as the oscilloscope trigger, apply the TCXO output from the rear-panel 5-MHz TIMEBASE OUTPUT connector to the vertical input of the oscilloscope. Adjust the TCXO frequency for a steady pattern.

5.5 AGC Meter Calibration.

a. Connect the output of an appropriate RF signal generator to the rear-panel 10 MV MAX ANT INPUT connector and set the ANT INPUT switch to the 10 MV MAX position.

b. Set the signal generator to some frequency in the band from 88 to 108 MHz, and adjust the signal generator output to 100 UV.

c. Set the thumbwheel switches on the Preselector front panel to the signal generator frequency.

d. Mechanically adjust the needle on the AGC METER so that it is just inside the lower edge of the white zone.

e. Increase the signal generator output by 40 dB.

f. Using variable resistor R11 on the Tuner/Switch Board, set the AGC METER needle just inside the top of the white zone.

5.6 Receiver Performance Checks.

To determine whether the receiver circuits of the Preselector are operating satisfactorily, proceed as follows:

a. With a signal generator connected as in Section 5.5, and with the Preselector tuned to the signal generator frequency, adjust the signal generator output up from zero until the AGC METER indicates just into the white range. The signal generator output for this reading should be 100 UV or less.

5.6 Receiver Performance Checks. (Continued)

b. With no modulation on the signal from the signal generator, and with the DE-EMPH switch on the Model 763 front panel depressed, the residual noise measured by the Model 763 should be less than 56 dB. (Refer to the Model 763 instruction manual for the method of measuring residual noise.)

c. Increase the signal generator output to 1 millivolt. The residual noise should drop to less than 66 dB.

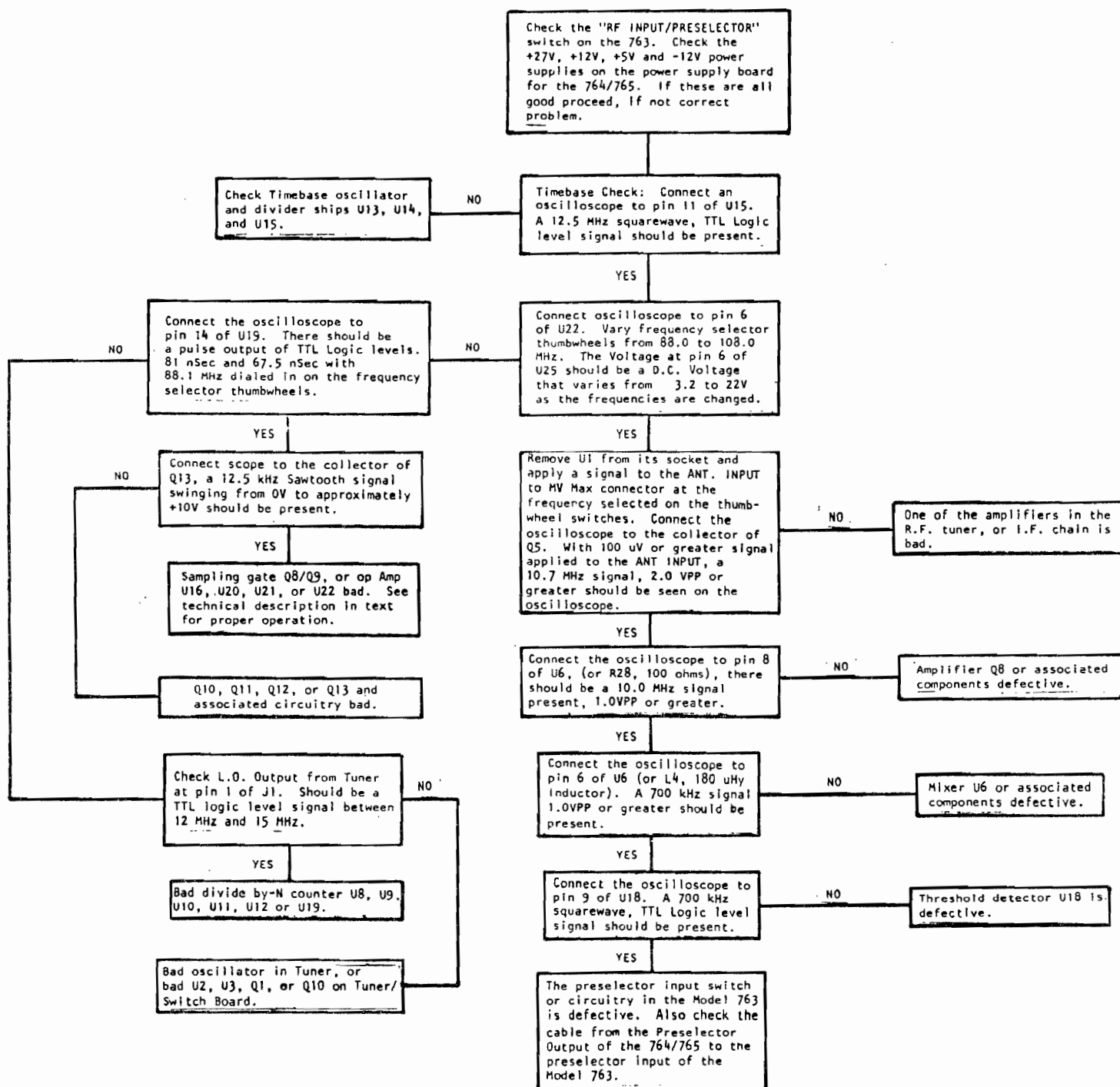
If the Model 765A receiver circuits pass these tests, the Preselector is operating satisfactorily. If the Model 764A receiver circuits pass these tests and if the counter indicates the correct frequency of the signal generator output, the Model 764A is operating satisfactorily.

5.7 Troubleshooting Guides.

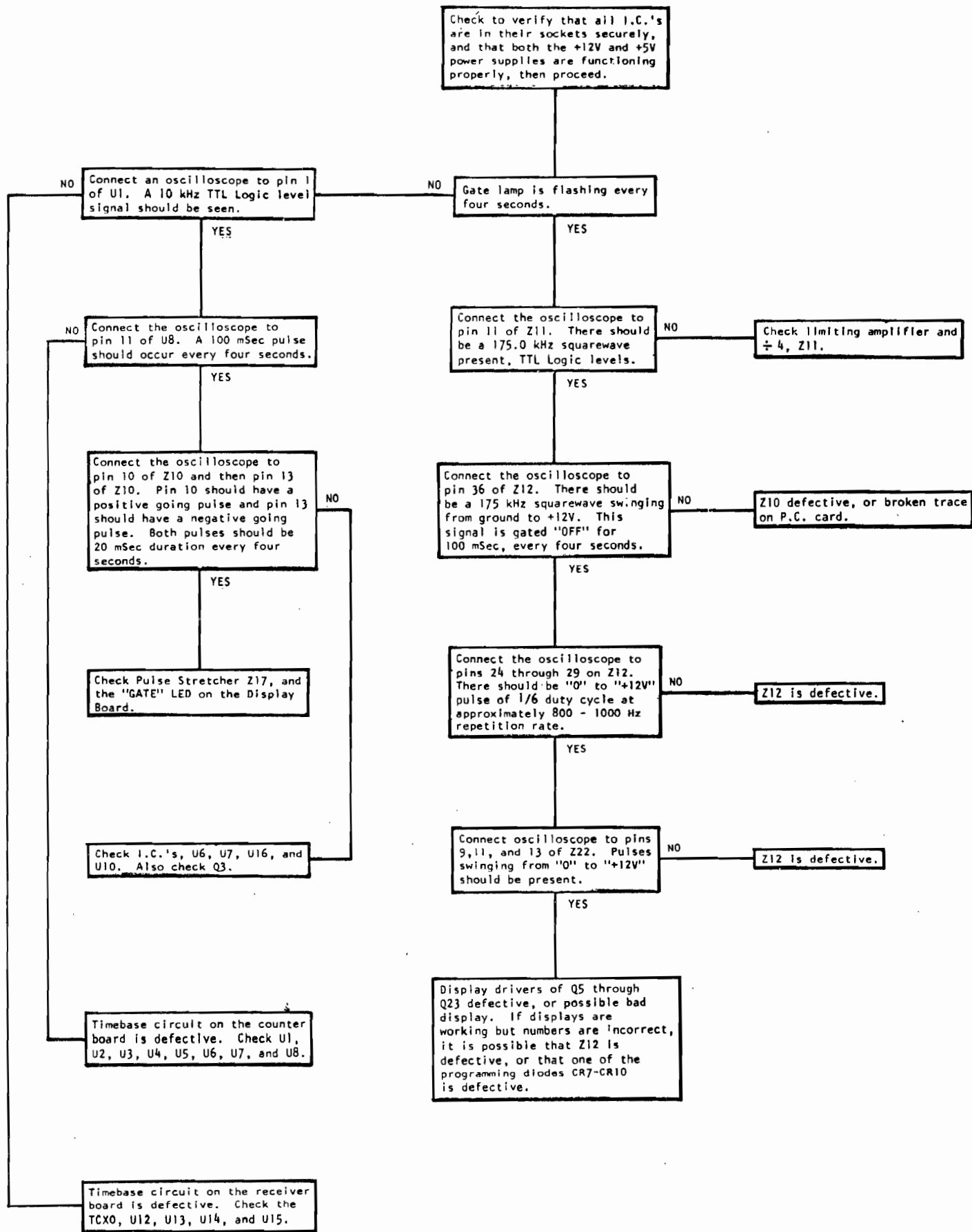
Two troubleshooting trees are presented here as an aid to isolating the cause of a failure. The Receiver Troubleshooting Guide (5.7.1) is applicable to both the Model 764A and the Model 765A. If the Model 764A, is malfunctioning, use the Receiver Troubleshooting Guide first, and then, if necessary, the Counter Troubleshooting Guide (5.7.2.). If only the counter is malfunctioning, go directly to the Counter Troubleshooting Guide.

For both guides, start at the top and do whatever is required to answer the question in the first box. Then proceed to the next operation along the route determined by the answer to the first question. Continue this sequence until the fault is found.

5.7.1 Receiver Does Not Work

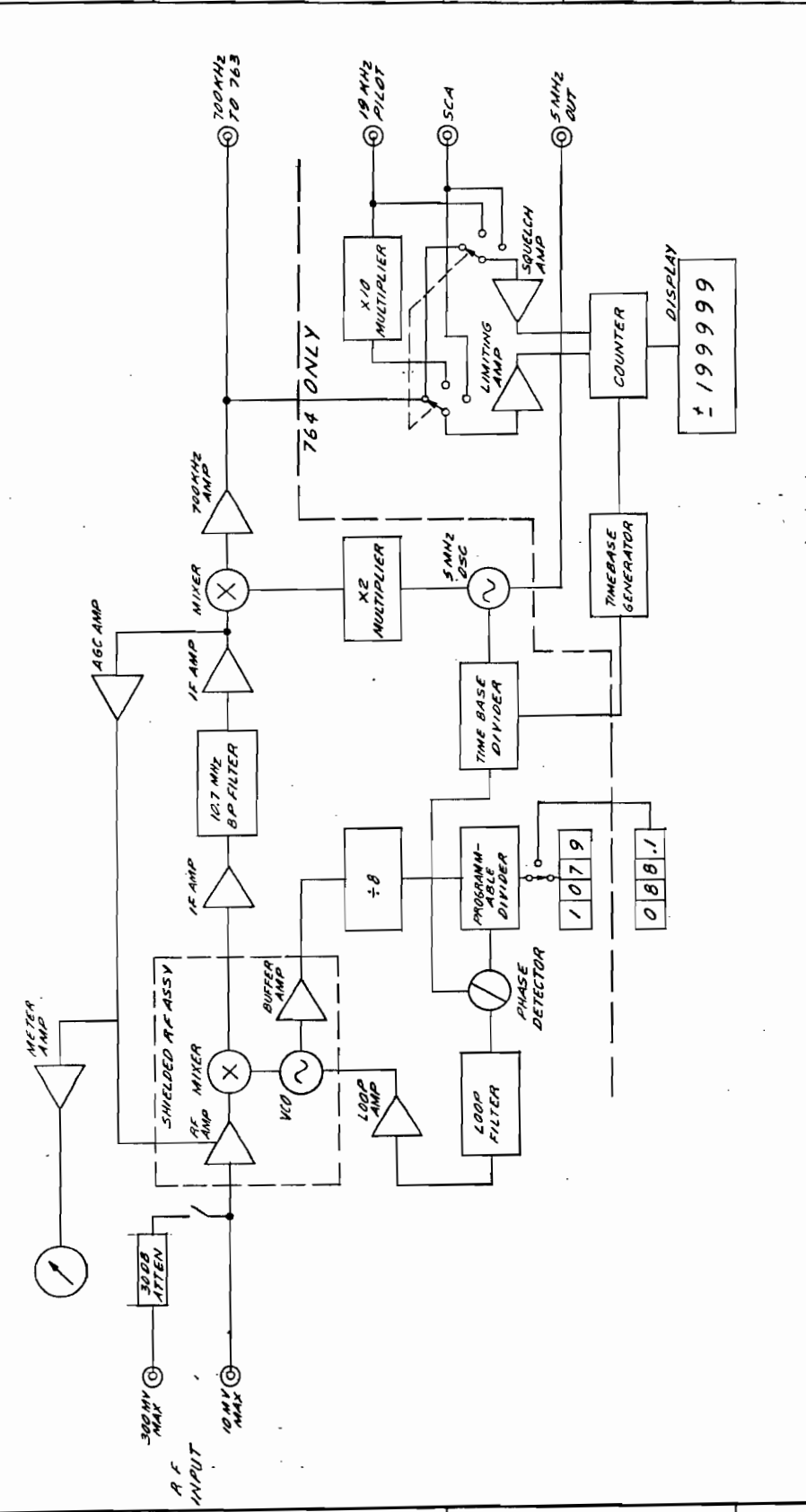


5.7.2 Counter Does Not Work



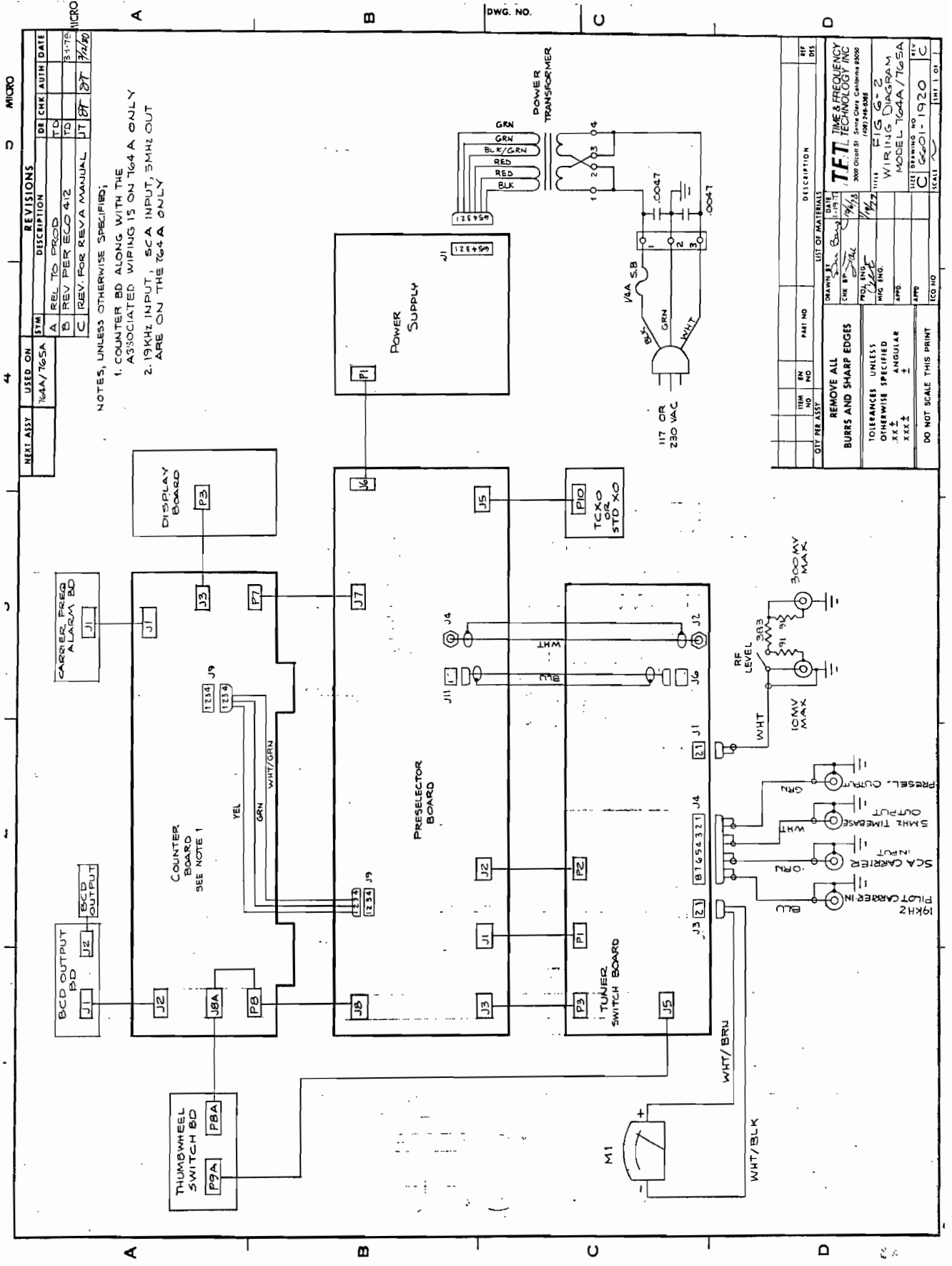
NEXT ASST		USED ON		REVISIONS	
		SYM	DESCRIPTION	BY	CHK
		164A/165A	764 ONLY	A	REV TO PRODUCTION
		B	REV PEN ELO	B	REV PEN ELO

DATE	BY	CHK
10/27/64
...



ITEM NO	IN	QTY	PER ASST	DESCRIPTION	REF DES
				REMOVE ALL BURRS AND SHARP EDGES	
				TOLERANCES UNLESS OTHERWISE SPECIFIED	
				XXX	
				DO NOT SCALE THIS PRINT	

ITEM NO	IN	QTY	PER ASST	DESCRIPTION	REF DES
				DRAWN BY: J.C.	
				CHK BY: J.C.	
				MOD ENG: J.C.	
				WFO ENG: J.C.	
				APP: J.C.	
				ECO NO: J.C.	
				SCALE: NONE	
				LIST OF MATERIALS	
				TFT TIME & FREQUENCY TECHNOLOGY INC	
				3000 Grant St., Santa Clara, California 95051	
				1081748285	
				BLOCK DIAGRAM	
				MODEL 764A/765A	
				REV: C	
				6600-1110	
				1/1	
				1/1	



REV. NO.	USED ON	SYMBOL	DESCRIPTION	BY	CHEK	AUTH	DATE
4	7644/765A	A	REL TO PRSD	TG			3-1-76
		B	REV PER ECO 412	TD			
		C	REV. FOR REV A MANUAL	JT	BT	BT	7/2/80

NOTES, UNLESS OTHERWISE SPECIFIED;
 1. COUNTER BD ALONG WITH THE ASSOCIATED WIRING IS ON 764A ONLY
 2. 19KHZ INPUT, SCA INPUT, 5MHZ OUT ARE ON THE 764A ONLY

REV. NO.	DESCRIPTION	BY	DATE
1	REMOVE ALL BURRS AND SHARP EDGES		
2	TOLERANCES UNLESS OTHERWISE SPECIFIED		
3	.XX ±		
4	.XXX ±		
5	ANGULAR		
6	DO NOT SCALE THIS PRINT		

REV. NO.	DESCRIPTION	BY	DATE
1	REMOVE ALL BURRS AND SHARP EDGES		
2	TOLERANCES UNLESS OTHERWISE SPECIFIED		
3	.XX ±		
4	.XXX ±		
5	ANGULAR		
6	DO NOT SCALE THIS PRINT		

TIME & FREQUENCY TECHNOLOGY INC
 3000 Ocean St. Santa Clara, California 95050
 (408) 242-8888
 WIRING DIAGRAM
 MODEL 7644A / 765A
 ULI DRAWING NO. C
 SCALE 1:1
 INT 1 OF 1

Model 764A/765A

FM Preselector PC Assy.

Assembly # 6608-1291
Rev F

CKT. REF.	DESCRIPTION	TFT STOCK NO.
C1	Capacitor Cer Disc .01uf	1005-1039
C2	Capacitor Cer Disc .05uf	1005-5039
C3	Capacitor Cer Disc .05uf	1005-5039
C4	Capacitor Cer Disc .05uf	1005-5039
C5	Capacitor Cer Disc .05uf	1005-5039
C6	Capacitor Mica 10pf	1001-0100
C7	Capacitor Tubular 6.8pf	1000-0068
C8	Capacitor Cer Disc .05uf	1005-5039
C9	Capacitor Cer Disc .05uf	1005-5039
C10	Capacitor Cer Disc 1uf	1005-0001
C11	Capacitor Cer Disc .05uf	1005-5039
C12	Capacitor Cer Disc .05uf	1005-5039
C13	Capacitor Cer Disc .05uf	1005-5039
C14	Capacitor Cer Disc .05uf	1005-5039
C15	Capacitor Cer Disc .05uf	1005-5039
C16	Capacitor Cer Disc .01uf	1005-1039
C17	Capacitor Cer Disc .01uf	1005-1039
C18	Capacitor Cer Disc .01uf	1005-1039
C19	Capacitor Cer Disc .01uf	1005-1039
C20	Capacitor Mica 470pf	1001-0471
C21	Capacitor Mica 1500pf	1001-0152
C22	Capacitor Mica 360pf	1001-0361
C23	Capacitor Mica 270pf	1001-0271
C24	Capacitor Cer Disc .05uf	1005-5039
C25	Capacitor Mica 120pf	1001-0121
C26	Capacitor Cer Disc .05uf	1005-5039
C27	Capacitor Cer Disc .05uf	1005-5039
C28	Capacitor Cer Disc .05uf	1005-5039
C29	Capacitor Elect 15uf	1010-0150
C30	Capacitor Tant 10uf	1008-0100
C31	Capacitor Mica 27pf	1001-0270
C32	Capacitor Cer Disc .05uf	1005-5039
C33	Capacitor Cer Disc .05uf	1005-5039
C34	Capacitor Poly Carb .0027uf	1006-0027
C35	Capacitor Cer Disc .01uf	1005-1039
C36	Capacitor Poly Carb .01uf	1002-0011
C37	Capacitor Poly Carb .0013uf	1006-0013
C38	Capacitor Mica 2200pf	1001-0222
C39	Capacitor Mica 10pf	1001-0100
C40	Capacitor Mica 680pf	1001-0681
C41	Capacitor Mica 22pf	1001-0220
C42	Capacitor Tant 10uf	1008-0100

Model 764A/765A

FM Preselector PC Assy.

Assembly # 6608-1291

Rev. F

Ckt. Ref.	Description	TFT Stock No.
C43	Capacitor Poly Carb .01uf	1002-0011
C44	Capacitor Mica 300pf	1001-0301
C45	Capacitor Mica 51pf	1001-0510
C46	Capacitor Mica 2200pf	1001-0222
C47	Capacitor Tant 100uf	1008-0102
C48	Capacitor Poly .01uf	1002-0011
C49	Capacitor Mica 510pf	1001-0511
C50	Capacitor Tant 6.8UF 35V 10%	1008-0068
C51	Capacitor Poly Carb .0039uf	1002-0392
C52	Capacitor Cer Disc .05uf	1005-5039
C53	Capacitor Tant 1uf	1008-0011
C54	Capacitor Tant 100uf	1008-0102
C55	Capacitor Mica 10pf	1001-0100
C56	Capacitor Cer Disc .05uf	1005-5039
C57	Capacitor Cer Disc .05uf	1005-5039
C58	Capacitor Cer Disc .05uf	1005-5039
CR1	Diode IN3064	1281-3064
CR2	Diode IN3064	1281-3064
CR3	Diode IN281	1280-0281
CR4	Diode IN3064	1281-3064
CR5	Diode IN3064	1281-3064
CR6	Diode IN3064	1281-3064
CR7	Diode IN3064	1281-3064
CR8	Diode IN3064	1281-3064
CR9	Diode IN3064	1281-3064
CR10	Diode IN3064	1281-3064
CR11	Diode IN3064	1281-3064
CR12	Diode IN3064	1281-3064
CR13	Diode IN3064	1281-3064
CR14	Diode IN3064	1281-3064
CR15	Diode IN3064	1281-3064
CR16	LED HP 5082-4487 Clear	1285-4487
CR17	LED HP 5082-4487 Clear	1285-4487
CR18	Diode IN3064	1281-3064
CR19	Diode IN3064	1281-3064
CR20	Diode IN3064	1281-3064
CR21	Diode IN3064	1281-3064
CR22	Diode IN3064	1281-3064
CR23	Diode Zener IN4731	1283-4731
FL1	Filter 10.7 MHz	1052-0001
J1	Connector 12 Pin Molex	2250-6412
J2	Plug 6 Pin Locking PC MT	2250-6506
J3	Plug 6 Pin Locking PC MT	2250-6506

Model 764A/765A

FM Preselector PC Assy.

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Rev. F

Ckt. Ref.	Description	TFT Stock No.
J4	Connector RF Sub Mini 50 ohm	2200-0004
J5	Plug 10 pin	2250-6510
J6	Plug 10 pin	2250-6510
J7	Plug 10 pin	2250-6510
J8	Connector 12 Pin Molex	2250-6412
J9	Plug 4 pin Locking PC MT	2250-6504
J10	Plug 2 pin Locking PC MT	2250-6502
J11	Plug 2 pin Locking PC MT	2250-6502
L1	Inductor Var 18uh	1577-0018
L2	Inductor Molded 68 uh	1530-0682
L3	Inductor Var .5uh	1550-0011
L4	Inductor Molded 180uh	1530-0180
L5	Inductor 82uh	1530-0820
L6	Inductor 100uh	1530-0101
L7	Inductor 15uh	1530-0150
L8	Inductor 100uh	1530-0101
Q1	Xistor 2N4121	1271-4121
Q2	Xistor 2N3645	1271-3645
Q3	Xistor 2N5179	1271-5179
Q4	Xistor 2N5179	1271-5179
Q5	Xistor 2N5179	1271-5179
Q6	Xistor 2N4275	1271-4275
Q7	Xistor 2N4275	1271-4275
Q8	Xistor 2N3563	1271-3563
Q9	Xistor 2N4275	1271-4275
Q10	Xistor 2N5087	1271-5087
Q11	Xistor 2N4275	1271-4275
Q12	Xistor 2N4275	1271-4275
Q13	Xistor 2N4275	1271-4275
R1	Resistor Car Comp 1/4 W 5% 4.7K	1065-4701
R2	Resistor Car Comp 1/4 W 5% 12K	1065-1202
R3	Resistor Car Comp 1/4 W 5% 10K	1065-1002
R4	Resistor Car Comp 1/4 W 5% 2.2K	1065-2201
R5	Resistor Car Comp 1/4 W 5% 390 ohm	1065-0390
R6	Resistor Car Comp 1/4 W 5% 2.7K	1065-2701
R7	Resistor Car Comp 1/4 W 5% 2.7K	1065-2701
R8	Resistor Car Comp 1/4 W 5% 3.6K	1065-3601
R9	Resistor Car Comp 1/4 W 5% 5.6K	1065-5601
R10	Resistor Car Comp 1/4 W 5% 4.7K	1065-4701
R11	Resistor Car Comp 1/4 W 5% 22K	1065-2202
R12	Resistor Car Comp 1/4 W 5% 100K	1065-1003
R13	Resistor Car Comp 1/4 W 5% 10K	1065-1002

Model 764A/765A

FM Preselector PC Assy.

Assembly # 6608-1291

Rev. F

Ckt. Ref.	Description	TFT Stock No.
R14	Resistor Car Comp 1/4 W 5% 3.3K	1065-3301
R15	Pot PC MT 5K IT	1072-5001
R16	Resistor Car Comp 1/4 W 5% 120	1065-0120
R17	Resistor Car Comp 1/4 W 5% 3.3K	1065-3301
R18	Resistor Car Comp 1/4 W 5% 1.5K	1065-1501
R19	Resistor Car Comp 1/4 W 5% 1.2K	1065-1201
R20	Resistor Car Comp 1/4 W 5% 470 ohm	1065-0470
R21	Resistor Car Comp 1/4 W 5% 75 ohm	1065-0075
R22	Resistor Car Comp 1/4 W 5% 330 ohm	1065-0330
R23	Resistor Car Comp 1/4 W 5% 1K	1065-1001
R24	Resistor Car Comp 1/4 W 5% 1K	1065-1001
R25	Resistor Car Comp 1/4 W 5% 1K	1065-1001
R26	Resistor Car Comp 1/4 W 5% 33K	1065-3302
R27	Resistor Car Comp 1/4 W 5% 33K	1065-3302
R28	Resistor Car Comp 1/4 W 5% 100 ohm	1065-0100
R29	Resistor Car Comp 1/4 W 5% 4.7K	1065-4701
R30	Resistor Car Comp 1/4 W 5% 4.7K	1065-4701
R31	Resistor Car Comp 1/4 W 5% 4.7K	1065-4701
R32	Resistor Car Comp 1/4 W 5% 4.7K	1065-4701
R33	Resistor Car Comp 1/4 W 5% 4.7K	1065-4701
R34	Resistor Car Comp 1/4 W 5% 4.7K	1065-4701
R35	Resistor Car Comp 1/4 W 5% 4.7K	1065-4701
R36	Resistor Car Comp 1/4 W 5% 4.7K	1065-4701
R37	Resistor Car Comp 1/4 W 5% 4.7K	1065-4701
R38	Resistor Car Comp 1/4 W 5% 4.7K	1065-4701
R39	Resistor Car Comp 1/4 W 5% 4.7K	1065-4701
R40	Resistor Car Comp 1/4 W 5% 1K	1065-1001
R41	Resistor MF 1/8 W 1% 10.0K	1061-1002
R42	Resistor Car Comp 1/4 W 5% 1K	1065-1001
R43	Resistor Car Comp 1/4 W 5% 1K	1065-1001
R44	Resistor Car Comp 1/4 W 5% 1K	1065-1001
R45	Resistor Car Comp 1/4 W 5% 2.2K	1065-2201
R46	Resistor Car Comp 1/4 W 5% 6.8K	1065-6801
R47	Resistor Car Comp 1/4 W 5% 1K	1065-1001
R48	Resistor Car Comp 1/4 W 5% 10K	1065-1002
R49	Resistor Car Comp 1/4 W 5% 3.6K	1065-3601
R50	Resistor Car Comp 1/4 W 5% 1K	1065-1001
R51	Resistor Car Comp 1/4 W 5% 4.7K	1065-4701
R52	Resistor Car Comp 1/4 W 5% 1.2K	1065-1201
R53	Resistor MF 1/8W 1% 2.87K	1061-2871
R54	Resistor MF 1/8 W 1% 4.75K	1061-4751

Model 764A/765A

FM Preselector PC Assy.

Assembly # 6608-1291
Rev. F

Ckt. Ref.	Description	TFT Stock No.
R55	Resistor Car Comp 1/4 W 5% 4.7K	1065-4701
R56	Resistor MF 1/8 W 1% 5.76K	1061-5761
R57	Resistor MF 1/8 W 1% 21.0K	1061-2102
R58	Resistor MF 1/8 W 1% 10.0K	1061-1002
R59	Resistor MF 1/8 W 1% 11.3K	1061-1132
R60	Resistor Car Comp 1/4 W 5% 2.2K	1065-2201
R61	Resistor Car Comp 1/4 W 5% 1K	1065-1001
R62	Resistor MF 1/8 W 1% 3.74K	1061-3741
R63	Resistor MF 1/8W 1% 23.7K	1061-2372
R64	Resistor MF 1/8 W 1% 7.50K	1061-7501
R65	Resistor MF 1/8 W 1% 107K	1061-1073
R66	Resistor MF 1/8 W 1% 10.0K	1061-1002
R67	Resistor MF 1/8 W 1% 1.00K	1061-1001
R68	Resistor Car Comp 1/4 W 5% 1K	1065-1001
R69	Resistor Car Comp 1/4 W 5% 10K	1065-1002
R70	Resistor Car Comp 1/4W 5% 220 ohm	1065-0220
R71	Resistor Car Comp 1/4 W 5% 1.5K	1065-1501
R72	Resistor Car Comp 1/4 W 5% 8.2K	1065-8201
R73	Resistor Car Comp 1/4 W 5% 100 ohm	1065-0100
R74	Resistor Car Comp 1/4 W 5% 100 ohm	1065-0100
R75	Resistor MF 1/8 W 1% 11.0K	1061-1102
R76	Resistor Car Comp 1/4 W 5% 820 ohm	1065-0820
R77	Resistor Car Comp 1/4 W 5% 5.6K	1065-5601
R78	Resistor Car Comp 1/4 W 5% 150K	1065-1503
R79	Resistor Car Comp 1/4 W 5% 6.2K	1065-6201
R80	Resistor Car Comp 1/4 W 5% 12K	1065-1202
R81	Resistor Car Comp 1/4 W 5% 15K	1065-1502
R82	Resistor Car Comp 1/4 W 5% 1.5K	1065-1501
R83	Resistor Car Comp 1/4 W 5% 100 ohm	1065-0100
R84	Resistor Car Comp 1/4 W 5% 2.2K	1065-2201
R85	Resistor Car Comp 1/4 W 5% 15K	1065-1502
R86	Resistor Car Comp 1/4 W 5% 1.2K	1065-1201
S1	Switch Thumbwheel	1875-5037
T1	ML IND Trifilar	1501-0001
U1	I/C LM741	1100-0741
U2	I/C 74LS00	1101-7400
U3	I/C 74LS10	1101-7410
U4	I/C 74LS10	1101-7410
U5	I/C 74LS00	1101-7400
U6	ua 796	1100-0796
U7	I/C 74LS196	1101-7496
U8	I/C 74LS196	1101-7496

Model 764/765A

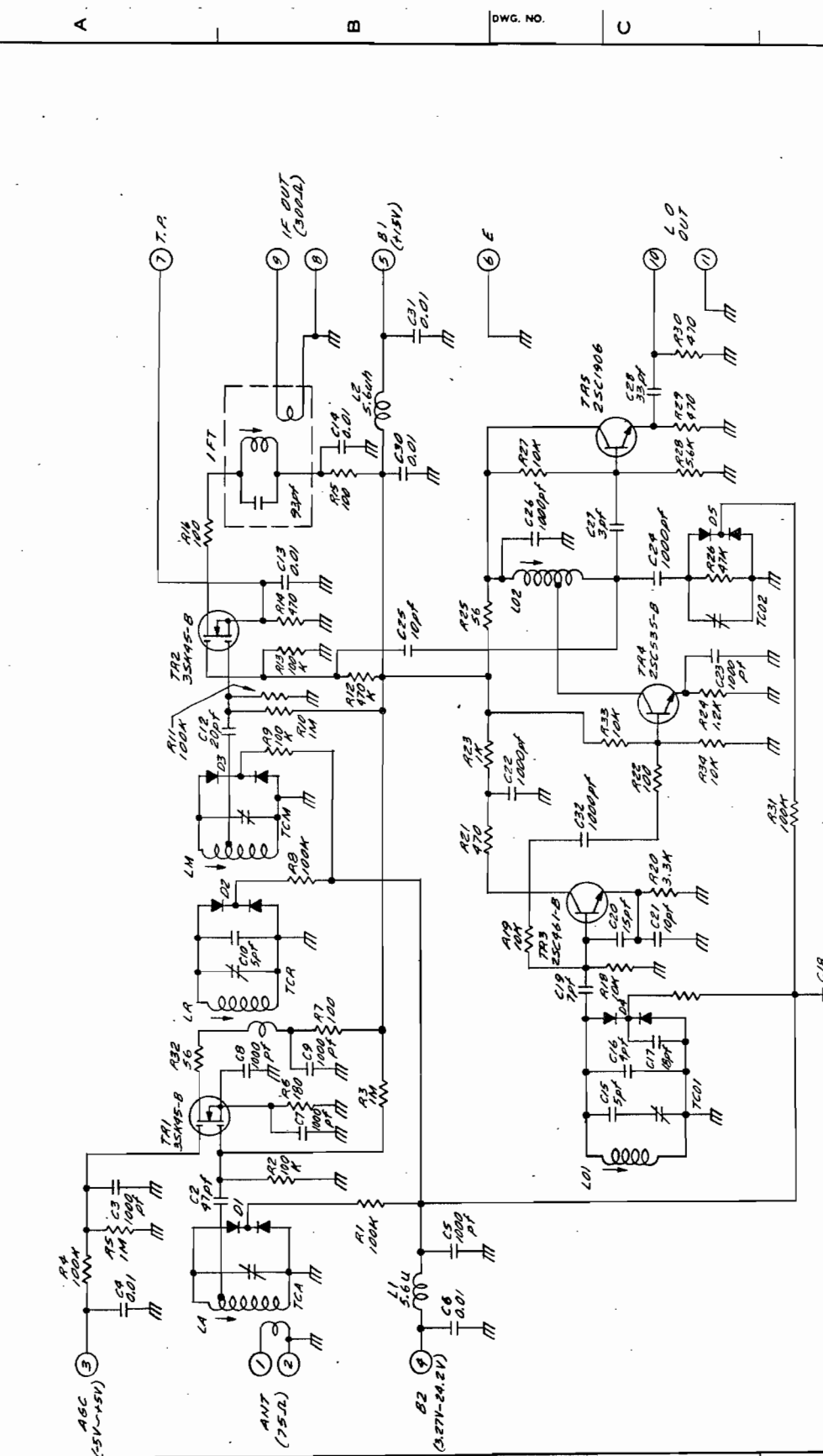
FM Preselector PC Assy

Assembly # 6608-1291
Rev F

Ckt. Ref.	Description	TFT Stock No.
U9	I/C 74LS196	1101-7496
U10	I/C 74LS196	1101-7496
U11	I/C 74LS00	1101-7400
U12	I/C 74LS10	1101-7410
U13	I/C 74LS90	1101-7490
U14	I/C 74LS90	1101-7490
U15	I/C 74LS76	1101-7476
U16	I/C LM302	1101-0302
U17	I/C 74LS90	1101-7490
U18	INT CKT LM710	1100-0710
U19	INT CKT 74LS76	1101-7476
U20	INT CKT LM741	1101-0741
U21	INT CKT LM741	1100-0741
U22	INT CKT CA3140	1100-3140
	IC Spreader 8 Pin	1150-0008
	IC Spreader 10 Pin	1150-0010
	Socket 8 Pin Dip	2250-1008
	Socket 14 Pin Dip	2250-1014
	Socket 16 Pin Dip	2250-1016
	Socket Transistor	2250-1010
	PC Board	1600-1290
	Angle Bkt	2130-9001
	Screw PH 4-40 x 1/4	2104-0001
	Nut Kep 4-40	2111-0001

REVISIONS		DE	CHK	AUTH	DATE
1	A REL TO PARD				1/12/54

NEXT ASSY	USED ON	SYM
66007-300	704AA/705A	A



ITEM NO	IN NO	PART NO	DESCRIPTION	REV	DIS

QTY PER ASSY	LIST OF MATERIALS	DATE
		1/12/54

DRAWN BY	CHK BY	PROJ ENG	PROJ MGR	AMP	AMP	ECO NO	REV	DATE

REMOVE ALL BURS AND SHARP EDGES		TOLERANCES UNLESS OTHERWISE SPECIFIED	
XXX I	ANGULAR	XXX I	ANGULAR

SCALE	TITLE	REV	DATE
SCALE AS SHOWN	Z1 TUNER ASSY	1	1/12/54

REV	DATE
1	1/12/54

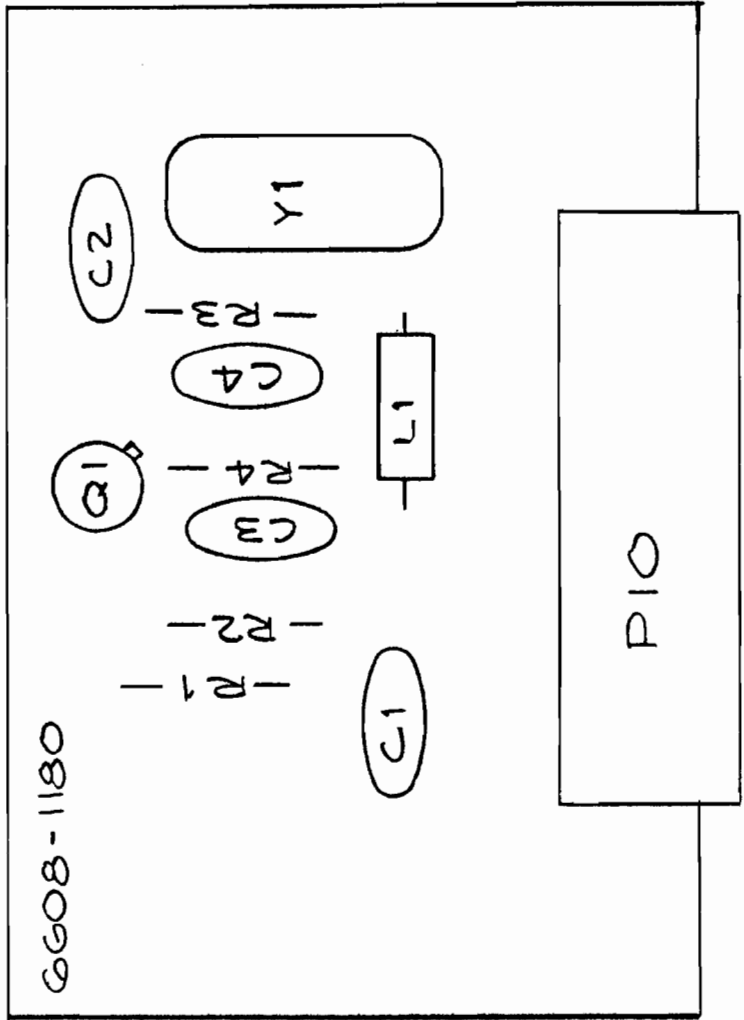
66007-300 Z1 TUNER ASSY 1/12/54

Model 755

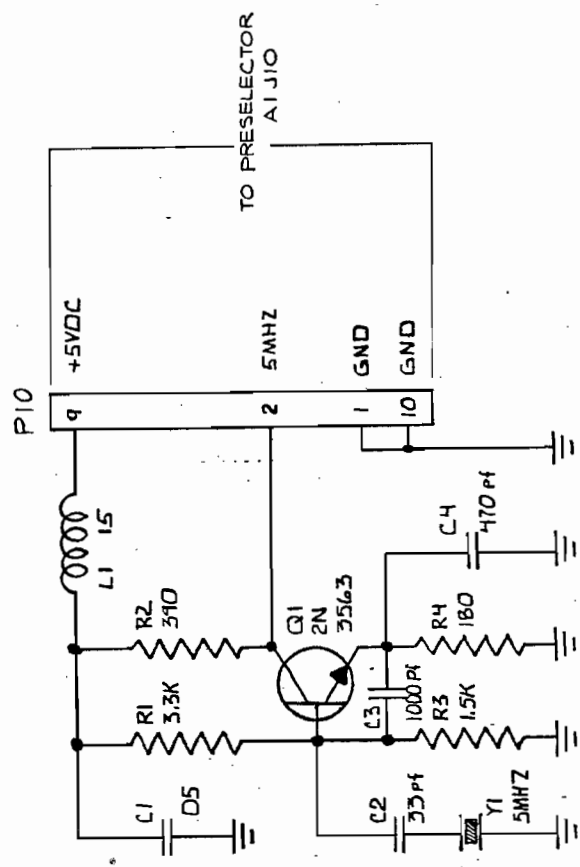
PC BD STD 5MHz OSC

Assembly # 6608-1180

Ckt. Ref.	Description	TFT Stock No.
C1	Cap Cer Disc .05MFD	1005-5039
C2	Cap Mica 33 pF	1001-0330
C3	Cap Mica 1000 pF	1001-0102
C4	Cap Mica 470 pF	1001-0471
L1	Choke RF 15 MH	1530-0150
P10	Plug, 10Pin	2250-5210
Q1	Transistor 2N3563	1271-3563
R1	Res Car Comp 1/4W 5% 3.3k	1065-3301
R2	Res Car Comp 1/4W 5% 390	1065-0390
R3	Res Car Comp 1/4W 5% 1.5k	1065-1501
R4	Res Car Comp 1/4W 5% 180	1065-0180
Y1	Crystal 5 MHz	2400-0502
	P.C. Board STD 5 MHz OSC	1600-1180 REV A



NEXT ASSY		USED ON		REVISIONS	
SYM	DESCRIPTION	DR	CHK	AUTH	DATE
6608-1180	755 6755A	A	RELEASED PER	ECO 324	RG
					4-7-76



ITEM NO.	IN NO.	PART NO.	DESCRIPTION	REF. DES.
LIST OF MATERIALS				
DRAWN BY: RAYM		DATE: 5-18-76		
CHK. BY: [Signature]		1/16/77		
PROJ. ENG. [Signature]		4/1/77		
MFG. ENG. [Signature]				
APPD. [Signature]				
APPD. [Signature]				
ECO NO.		SCALE		SMT. / OF /
6601-1580		B		5

TIME & FREQUENCY TECHNOLOGY INC.
 3000 Olicott St., Santa Clara, California 95050
 (408) 246-6365

TITLE: FIGURE 6-5
 STANDARD 5MHZ
 OSCILLATOR A3

SIZE: B
 DRAWING NO.: 6601-1580
 REV: A

REMOVE ALL
 BURRS AND SHARP EDGES

TOLERANCES UNLESS
 OTHERWISE SPECIFIED

.XX ±
 ANGULAR ±

.XXX ±

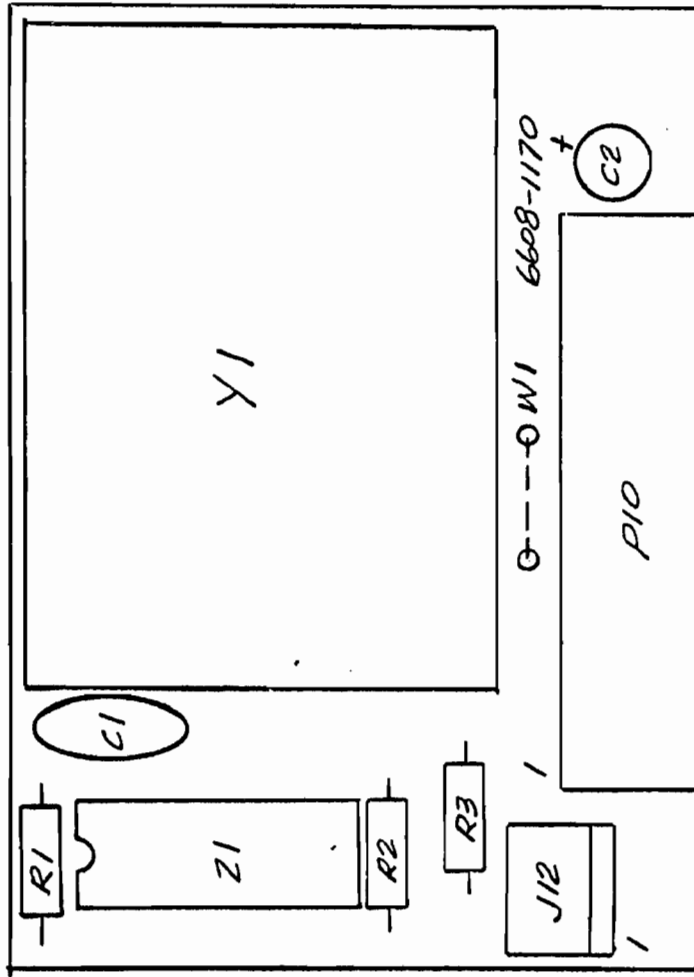
DO NOT SCALE THIS PRINT

Model 764

PC BD TCXO 5 MHz Osc

Assembly # 6608-1170

Ckt. Ref.	Description	TFT Stock No.
C1	Cap Cer Disc .2 Mfd	1005-2029
C2	Cap Dip Tan 10MF/25V	1008-0100
J12	Plug 2 Pin	2250-6002
P10	Socket 10 Pin	2250-5210
R1	Res Car Comp 1/4W 5% 2.2K	1065-2201
R2	Res Car Comp 1/4W 5% 2.2K	1065-2201
R3	Res Car Comp 1/4W 5% 10	1065-0010
U1	I/C SN7472N	1100-7472
	Socket I/C 14 Pin	2250-1014
	Crystal Osc TCXO 10 MHz	2450-1002
	PC Board 764 TCXO 5 MHz Osc	1600-1170



NOTE:

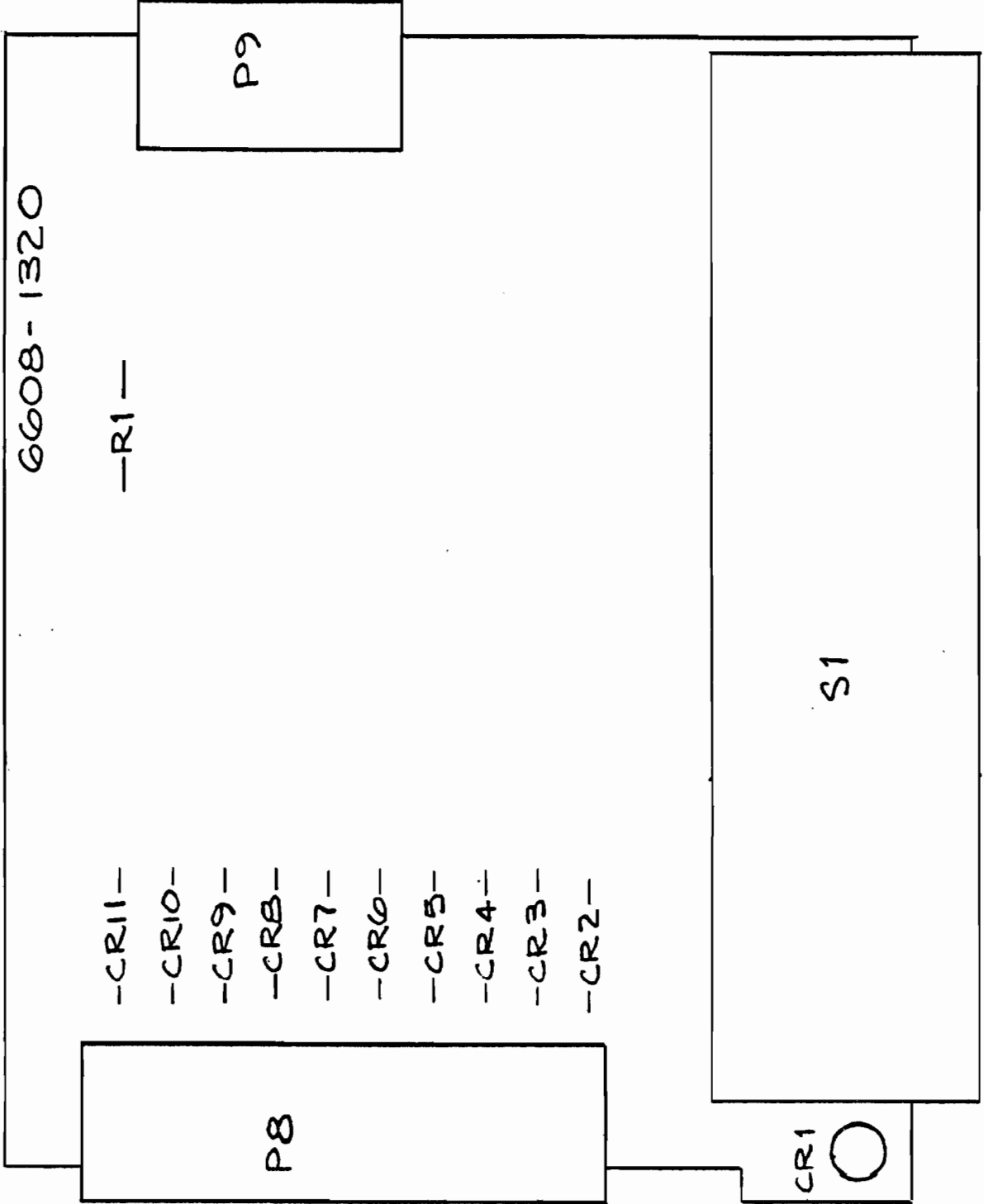
1. REF: SEE SCHEMATIC 6601-1590
2. JUMPER W1 USED ON MODELS 764 AND 769A ONLY

Model 764

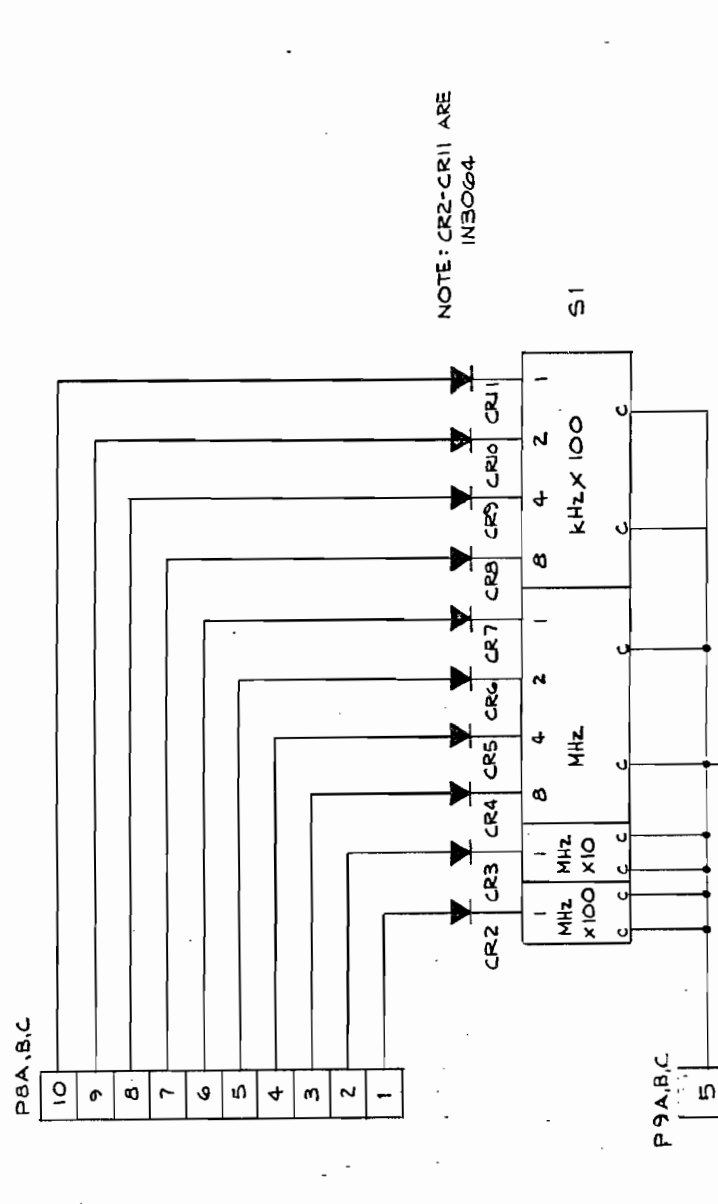
Thumbwheel Switch Board

Assembly # 6608-1320

Ckt. Ref.	Description	TFT Stock No.
CR1	LED HP 5082-4487 Clear	1285-4487
CR2	Dio IN3064	1281-3064
CR3	Dio IN3064	1281-3064
CR4	Dio IN3064	1281-3064
CR5	Dio IN3064	1281-3064
CR6	Dio IN3064	1281-3064
CR7	Dio IN3064	1281-3064
CR8	Dio IN3064	1281-3064
CR9	Dio IN3064	1281-3064
CR10	Dio IN3064	1281-3064
CR11	Dio IN3064	1281-3064
J8	Socket 10 Pin	2250-5210
J9	Socket Molex 5 Pin	2250-5205
R1	Res Car Comp 1/4W 5% 330	1065-0330
S1	Switch Thumbwheel 764	1875-5037
	PCB Thumbwheel SW 764	1600-1320 REVA



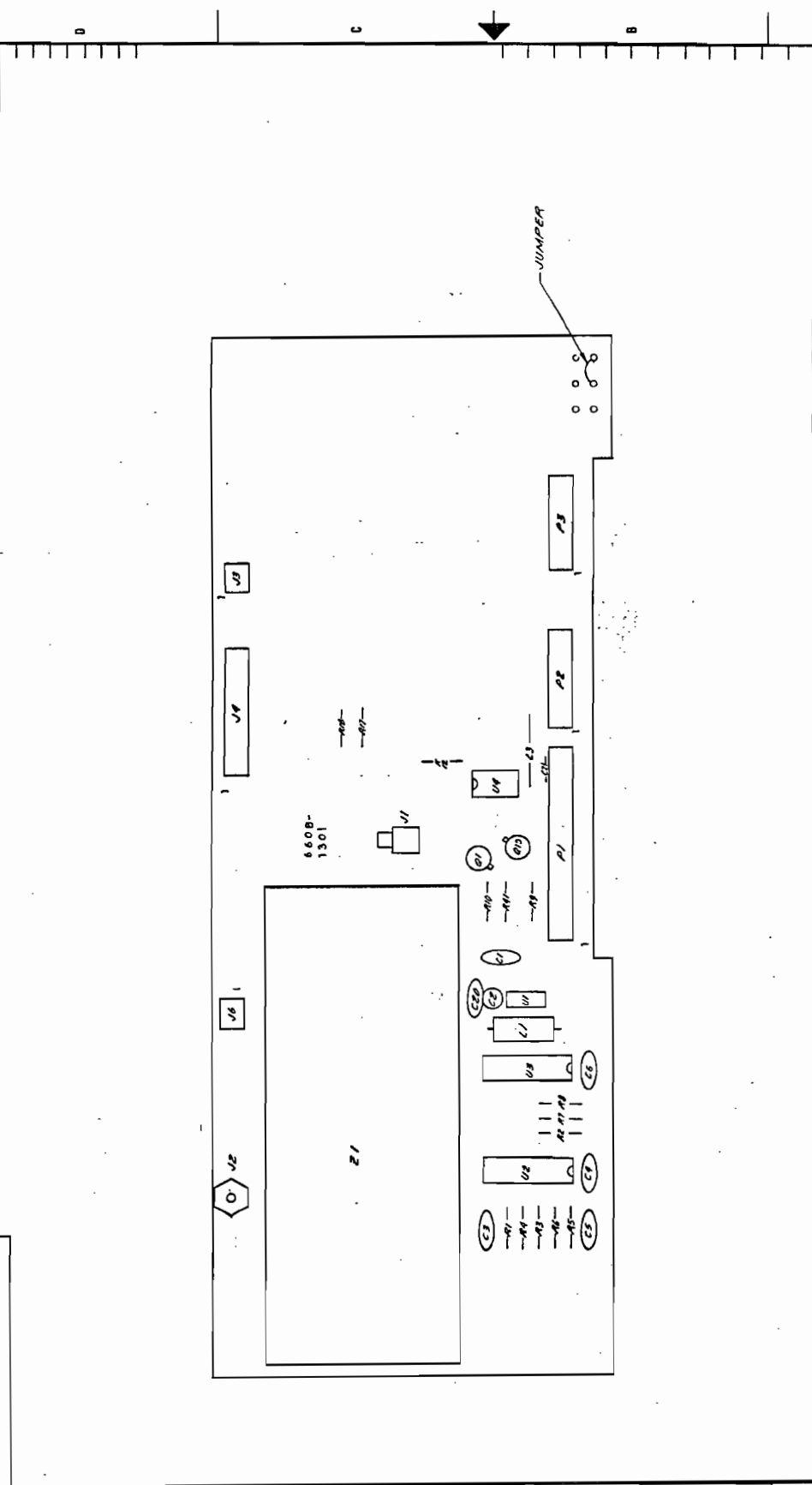
NEXT ASSY	USED ON	REVISIONS	
6001-1320	7644764A	DESCRIPTION	DR CHK AUTH DATE
		A REL TO PRODUCTION	TD 11/15/76 MICRC



ITEM NO.	PART NO.	DESCRIPTION	REF. DES.
QTY PER ASSY			
LIST OF MATERIALS			
DRAWN BY	DATE		
CHK. BY	11-15-76		
PROJ. ENG.	1/16/77		
MFG. ENG.	1/14/77		
APPD.			
APPD.			
ECO NO.			
REMOVE ALL BURRS AND SHARP EDGES		TIME & FREQUENCY TECHNOLOGY INC.	
TOLERANCES UNLESS OTHERWISE SPECIFIED		3000 Olcott St., Santa Clara, California 95050	
.XX ±		TITLE	
.XXX ±		FIGURE G-7	
ANGULAR ±		SCHEMATIC: THUMBWHEEL SW.	
DO NOT SCALE THIS PRINT		SIZE DRAWING NO.	
		B 6001-1830	
		SCALE	
		SHT. 1 OF 1	

REV	DESCRIPTION	DR	DATE	APPD
A	REVISED PER ECO 1422	KC	9/2/81	

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ITEM	QTY	PART NO.	NOMENCLATURE OR DESCRIPTION
			3090 OAKMEAD VILLAGE DR. SANTA CLARA, CA. 95051 TPT INC (408) 727 2222 TWX 910 38 0584
			PC BO ASSY TUNER 765A
			CODE IDENT NO. 9-3-81
			SIZE 6
			DRAWING NO. 6608-1301
			REV. A
SPECIFICATIONS UNLESS OTHERWISE NOTED: ANGULAR = ° DECIMAL = . 2 PLACE = . 3 PLACE = . BREAK - DOWN SURFACE FINISHES - MAX. MAX. DIAMETERS - CONCENTRIC WITHIN .003 TIR. FILLET RADIUS - MAX THREADS - CLASS 2 MARK IN ACCORDANCE WITH TPT SPEC 3000-1058			
765A		5102-2001	
MODEL		NEXT ASSY	
APPLICATION			
DO NOT SCALE PRINT			
SHEET 1 OF 1			

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
C1	Capacitor Cer Disc .2uf/50V	1	1005-2030
C2	Capacitor Tant 1uf	1	1008-0011
C3	Capacitor Cer Disc .01uf	1	1005-1039
C4	Capacitor Cer Disc .01uf	1	1005-1039
C5	Capacitor Cer Disc .01uf	1	1005-1039
C6	Capacitor Cer Disc .01uf	1	1005-1039
C20	Capacitor Cer Disc .01uf	1	1005-1039
C21	Capacitor Cer Disc 33pf 5%	1	1005-0330
J1	Conn RF Sub Mini RT Ang	1	2210-5153
J2	Conn RF Sub Mini 50 ohm	1	2200-0004
J3	Plug 2 Pin Locking PC MT	1	2250-6502
J4	Conn 8 Pin Molex	1	2250-6008
J6	Plug 2 Pin Locking PC MT	1	2250-6502
L1	Choke RF 15uh	1	1530-0150
L3	Choke RF 15uh	1	1530-0150
P1	Connector Molex 12 Pin	1	2250-5212
P2	Connector Molex 6 Pin	1	2250-5206
P3	Connector Molex 6 Pin	1	2250-5206
Q1	Xistor 2N4121	1	1271-4121
Q10	Xistor 2N4121	1	1271-4121
R1	Resistor Car Comp 1/4W 5% 100 phm	1	1065-0100
R2	Resistor Car Comp 1/4W 5% 1K	1	1065-1001
R3	Resistor Car Comp 1/4W 5% 220 ohm	1	1065-0220
R4	Resistor Car Comp 1/4W 220 ohm	1	1065-0220
R5	Resistor Car Comp 1/4W 5% 560 ohm	1	1065-0560
R6	Resistor Car Comp 1/4W 5% 560 ohm	1	1065-0560
R7	Resistor Car Comp 1/4W 5% 1K	1	1065-1001
R8	Resistor Car Comp 1/4W 5% 1K	1	1065-1001
R9	Resistor Car Comp 1/4W 5% 1K	1	1065-1001
R10	Resistor Car Comp 1/4W 5% 220 ohm	1	1065-0220
R11	Pot PC MT 5K 1T	1	1072-5001
R12	Resistor Car Comp 1/4W 5% 4.7K	1	1065-4701
R17	Resistor Car Comp 1/4W 5% 1K	1	1065-1001
R18	Resistor Car Comp 1/4W 5% 330	1	1065-0330
R41	Resistor Car Comp 1/4W 5% 68 ohm	1	1065-0068
U1	I/C LM342-15	1	1100-7817
U2	I/C MC10135	1	1100-1135
U3	I/C MC10135	1	1100-1135
U4	I/C LM741	1	1100-0741

*Assembly 6608-1301 is the basic Tuner/Switch Board, excluding the Switch assembly portion. It is used only in the Model 765A.

Model 765A

Tuner PC Assembly

Assembly #6608-1301*
Rev A

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
Z1	Tuner 3Q	1	4500-1811
	PC Board	1	1600-1300
	Socket I/C 8 Pin	1	2250-1008
	Socket I/C 16 Pin	2	2250-1016
	Nut Kep 4-40	A/R	2111-0001

*Assembly 6608-1301 is the basic Tuner/Switch Board, excluding the Switch assembly portion. It is used only in the Model 765A.

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
C1	Cap Cer Disc .2UF 50V	1	1005-2030
C2	Cap Dip Tant 1UF 35V	1	1008-0011
C3	Cap Cer Disc .01UF	1	1005-1039
C4	Cap Cer Disc .01UF	1	1005-1039
C5	Cap Cer Disc .01UF	1	1005-1039
C6	Cap Cer Disc .01UF	1	1005-1039
C7	Cap Dip Tant 1UF 35V	1	1008-0011
C8	Cap Cer Disc .2UF 25V	1	1005-2029
C9	Cap Dip Tant 1UF 35V	1	1008-0011
C10	Cap Cer Disc .2UF 25V	1	1005-2029
C11	Cap Mica 390PF	1	1001-0391
C12	Cap Cer Disc .2UF 25V	1	1005-2029
C13	Cap Mica 1000PF	1	1001-0102
C14	Cap Cer Disc .02UF 25V	1	1005-2039
C15	Cap Dip Tant 1UF 35V	1	1008-0011
C16	Cap Cer Disc .05UF	1	1005-5039
C17	Cap Dip Tant 1UF 35V	1	1008-0011
C18	Cap Cer Disc .05UF	1	1005-5039
C19	Cap Cer Disc .2UF 25V	1	1005-2029
C20	Cap Cer Disc .01UF	1	1005-1039
C21	Cap Cer Disc 33PF 5%	1	1005-0330
CR1	Diode Zener 1N4744	1	1283-4744
CR2	Diode Zener 1N3064	1	1281-3064
J1	Conn RF Sub Mini RT Ang	1	2210-5153
J2	Conn RF Sub Mini 50 OHM	1	2200-0004
J3	Plug 2 Pin Locking PC MT	1	2250-6502
J4	Conn 8 Pin Molex	1	2250-6008
J5	Plug Molex 5 Pin	1	2250-6505
J6	Plug 2 Pin Locking PC MT	1	2250-6502
L1	Choke RF 15UH	1	1530-0150
L2	Choke RF 100UH	1	1530-0101
L3	Choke RF 15UH	1	1530-0150
P1	Conn Molex 12 Pin	1	2250-5212
P2	Conn Molex 6 Pin	1	2250-5206
P3	Conn Molex 6 Pin	1	2250-5206
Q1	Xistor 2N4121	1	1271-4121
Q2	Xistor 2N4121	1	1271-4121
Q3	Xistor 2N4275	1	1271-4275
Q4	Xistor 2N2222	1	1271-2222
Q5	Xistor 2N4275	1	1271-4275

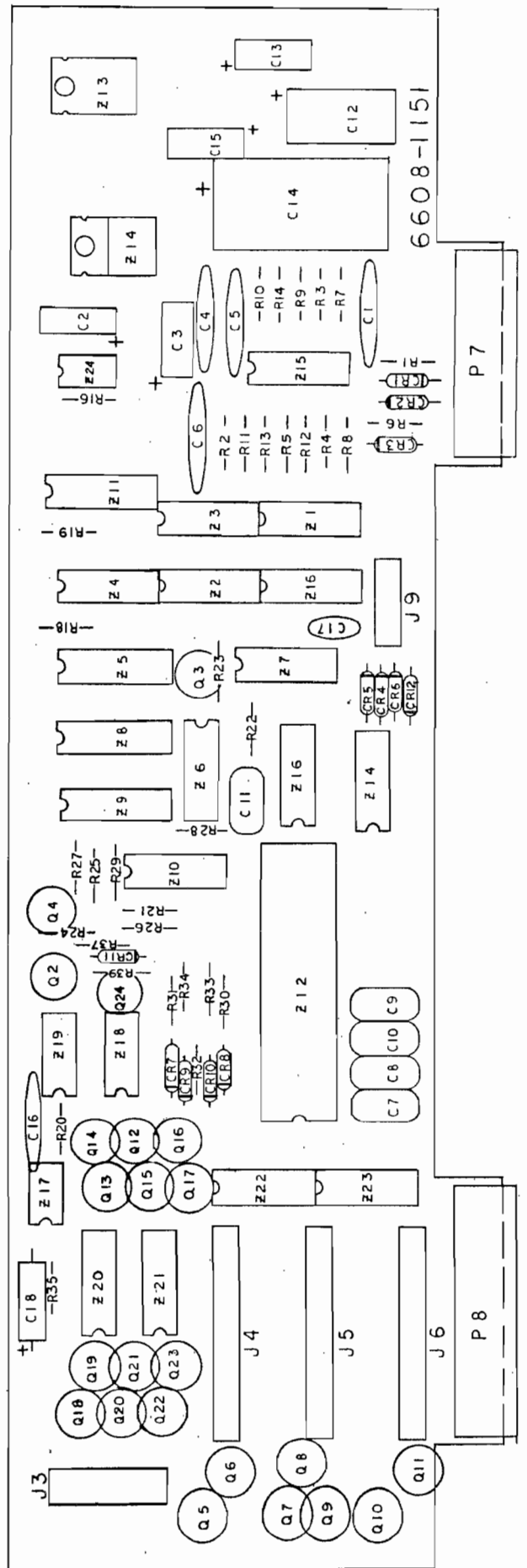
*Assembly 6608-1302 is the switch assembly portion of the Tuner/Switch Board. It is used only in the Model 764A.

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
Q6	Xistor 2N4275	1	1271-4275
Q7	Xistor 2N4275	1	1271-4275
Q8	Xistor 2N3643	1	1271-3643
Q9	Xistor 2N3643	1	1271-3643
Q10	Xistor 2N4121	1	1271-4121
R1	Res Car Comp 1/4W 5% 100	1	1065-0100
R2	Res Car Comp 1/4W 5% 1K	1	1065-1001
R3	Res Car Comp 1/4W 5% 220	1	1065-0220
R4	Res Car Comp 1/4W 5% 220	1	1065-0220
R5	Res Car Comp 1/4W 5% 560	1	1065-0560
R6	Res Car Comp 1/4W 5% 560	1	1065-0560
R7	Res Car Comp 1/4W 5% 1K	1	1065-1001
R8	Res Car Comp 1/4W 5% 1K	1	1065-1001
R9	Res Car Comp 1/4W 5% 1K	1	1065-1001
R10	Res Car Comp 1/4W 5% 220	1	1065-0220
R11	Pot PC MT 5K 1T	1	1072-5001
R12	Res Car Comp 1/4W 5% 4.7K	1	1065-4701
R13	Res Car Comp 1/4W 5% 4.7K	1	1065-4701
R14	Res Car Comp 1/4W 5% 1K	1	1065-1001
R15	Res Car Comp 1/4W 5% 10K	1	1065-1002
R16	Res Car Comp 1/4W 5% 220	1	0165-0220
R17	Res Car Comp 1/4W 5% 1K	1	1065-1001
R18	Res Car Comp 1/4W 5% 330	1	1065-0330
R19	Res Car Comp 1/4W 5% 6.8K	1	1065-6801
R20	Res Car Comp 1/4W 5% 1K	1	1065-1001
R21	Res Car Comp 1/4W 5% 4.7K	1	1065-4701
R22	Res Car Comp 1/4W 5% 1K	1	1065-1001
R23	Res Car Comp 1/4W 5% 10K	1	0165-1002
R24	Res Car Comp 1/4W 5% 4.7K	1	1065-4701
R25	Res Car Comp 1/4W 5% 10	1	1065-0010
R26	Res Car Comp 1/4W 5% 1K	1	1065-1001
R27	Res Car Comp 1/4W 5% 22K	1	1065-2202
R28	Res Car Comp 1/4W 5% 4.7K	1	1065-4701
R29	Res Car Comp 1/4W 5% 10K	1	1065-1002
R30	Pot PC MT 2K 1T	1	1072-2001
R31	Res Car Comp 1/4W 5% 2.7K	1	1065-2701
R32	Res Car Comp 1/4W 5% 4.7K	1	1065-4701
R33	Res Car Comp 1/4W 5% 33K	1	1065-3302
R34	Res Car Comp 1/4W 5% 470	1	1065-0470
R35	Res Car Comp 1/4W 5% 4.7K	1	1065-4701
R36	Res Car Comp 1/4W 5% 470	1	1065-0470
R37	Res Car Comp 1/4W 5% 270	1	1065-0270
R38	Res Car Comp 1/4W 5% 2.2K	1	1065-2201
R39	Res Car Comp 1/4W 5% 12K	1	1065-1202
R40	Res Car Comp 1/4W 5% 1K	1	1065-1001

*Assembly 6608-1302 is the switch assembly portion of the Turner/Switch Board. It is used only in the Model 764A.

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
R41	Res Car Comp 1/4W 5% 68	1	1065-0068
U1	I/C LM342-15	1	1100-7817
U2	I/C MC10135	1	1100-1135
U3	I/C MC10135	1	1100-1135
U4	I/C LM741	1	1100-0741
U5	INT CKT LM565	1	1100-0565
U6	INT CKT 74LS90	1	1101-7490
S1	Switch P/B 17.5	1	1850-1002
S2	Switch P/B 12.5	1	1850-1003
Z1	Tuner FM 3Q	1	4500-1811
	PC BD 764A/765A	1	1600-1300
	Socket I/C 8 Pin	1	2250-1008
	Socket I/C 14 Pin	2	2250-1014
	Socket I/C 16 Pin	2	2250-1016

*Assembly 6608-1302 is the switch assembly portion of the Tuner/Switch Board. It is used only in the Model 764A.



Model 764A

PC Bd Counter

Assembly # 6608-1151

Ckt. Ref.	Description	TFT Stock No.
C1	Cap Cer Disc .2 Mfd	1005-2029
C2	Cap Elect 15 Mfd 25V	1010-0150
C3	Cap Elect 15 Mfd 25V	1010-0150
C4	Cap Cer Disc .2 Mfd	1005-2029
C5	Cap Cer Disc .2 Mfd	1005-2029
C6	Cap Cer Disc .2 Mfd	1005-2029
C7	Cap Mica 150 PF	1001-0151
C8	Cap Mica 150 PF	1001-0151
C9	Cap Mica 150 PF	1001-0151
C10	Cap Mica 150 PF	1001-0151
C11	Cap Mica 470 PF	1001-0471
C12	Cap Elect 100 Mfd 25V	1010-0103
C13	Cap Tan 10 Mfd 20V 10%	1008-0101
C14	Cap Elect 1000 Mfd 15V	1010-0102
C15	Cap Tan 10 Mfd 20V 10%	1008-0101
C16	Cap Cer Disc .2 Mfd	1005-2029
C17	Cap Cer Disc .05 Mfd	1005-5039
C18	Cap Tan 10 Mfd 20V 10%	1008-0101
CR1	Dio IN281	1280-0281
CR2	Dio IN281	1280-0281
CR3	Dio ZNR IN4735	1283-4735
CR4	Dio IN3064	1281-3064
CR5	Dio IN3064	1281-3064
CR6	Dio IN3064	1281-3064
CR7	Dio IN3064	1281-3064
CR9	Dio IN3064	1281-3064
CR10	Dio IN3064	1281-3064
CR11	Dio IN3064	1281-3064
CR12	Dio ZNR IN4744	1283-4744
Q1	Xistor 2N3643	1271-3643
Q2	Xistor 2N4275	1271-4275
Q3	Xistor 2N4275	1271-4275
Q4	Xistor 2N4275	1271-4275
Q5	Xistor 2N3643	1271-3643
Q6	Xistor 2N3643	1271-3643
Q7	Xistor 2N3643	1271-3643
Q8	Xistor 2N3643	1271-3643
Q9	Xistor 2N3643	1271-3643
Q10	Xistor 2N3643	1271-3643
Q11	Xistor 2N3643	1271-3643
Q12	Xistor 2N3643	1271-3643
Q13	Xistor 2N3643	1271-3643
Q14	Xistor 2N3643	1271-3643
Q15	Xistor 2N3643	1271-3643

Model 764 A

PC Bd Counter

Assembly # 6608-1151

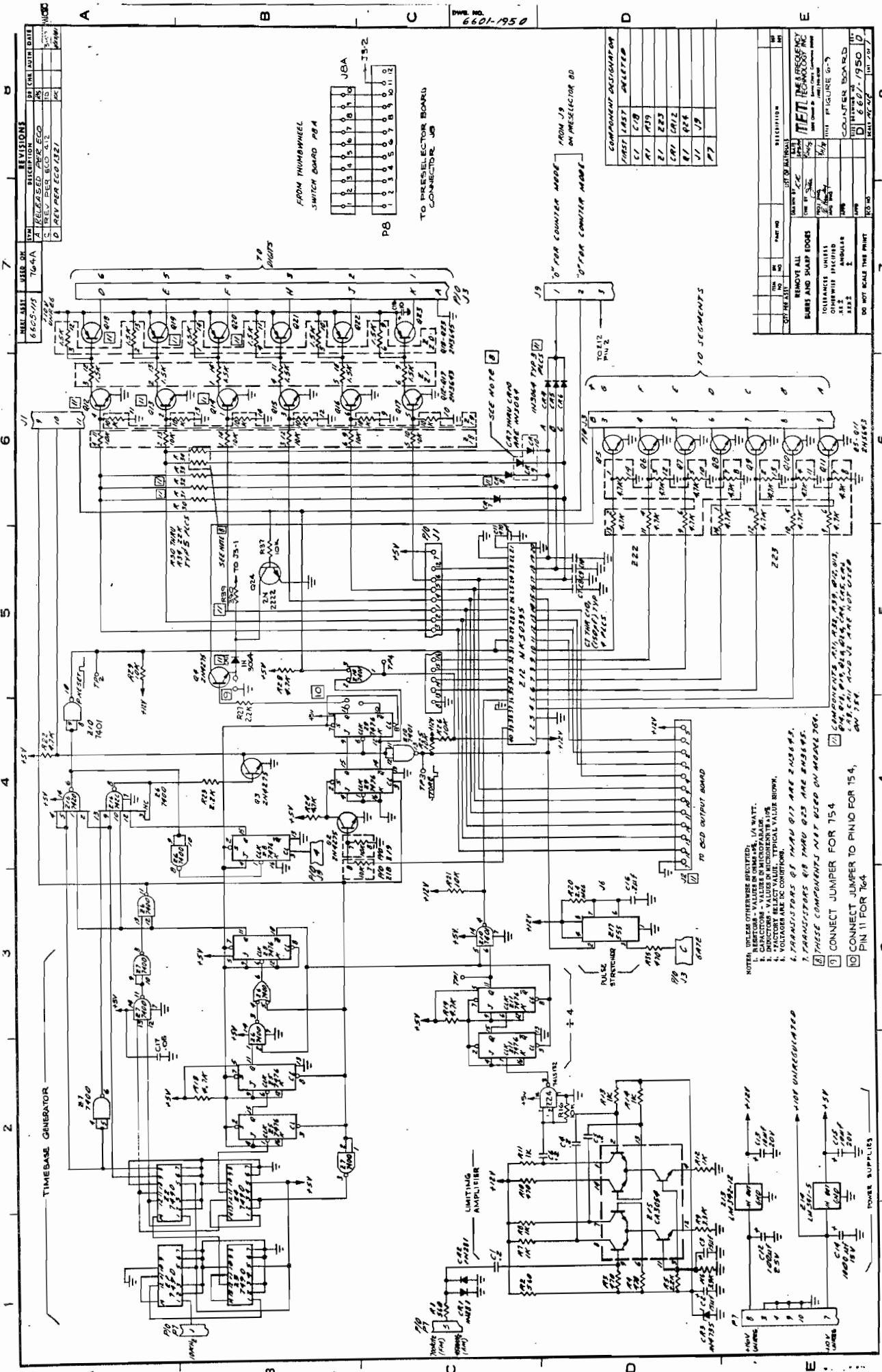
Ckt. Ref.	Description	TFT Stock No.
Q16	Xistor 2N3643	1271-3643
Q17	Xistor 2N3643	1271-3643
Q18	Xistor 2N3643	1271-3643
Q19	Xistor 2N3643	1271-3643
Q20	Xistor 2N3643	1271-3643
Q21	Xistor 2N3643	1271-3643
Q22	Xistor 2N3643	1271-3645
Q23	Xistor 2N3643	1271-3645
Q24	Xistor 2N4275	1271-4275
R1	Res Car Comp 1/4W 5% 560	1065-0560
R2	Res Car Comp 1/4W 5% 560	1065-0560
R3	Res Car Comp 1/4W 5% 470	1065-0470
R4	Res Car Comp 1/4W 5% 470	1065-0470
R5	Res Car Comp 1/4W 5% 2.2K	1065-2201
R6	Res Car Comp 1/4W 5% 3.9K	1065-3901
R7	Res Car Comp 1/4W 5% 1K	1065-1001
R8	Res Car Comp 1/4W 5% 1K	1065-1001
R9	Res Car Comp 1/4W 5% 3.3K	1065-3301
R10	Res Car Comp 1/4W 5% 470	1065-0470
R11	Res Car Comp 1/4W 5% 1K	1065-1001
R12	Res Car Comp 1/4W 5% 1K	1065-1001
R13	Res Car Comp 1/4W 5% 1K	1065-1001
R14	Res Car Comp 1/4W 5% 1K	1065-1001
R15	Res Car Comp 1/4W 5% 1K	1065-1001
R16	Res Car Comp 1/4W 5% 10K	1065-1002
R17	Res Car Comp 1/4W 5% 1K	1065-1001
R18	Res Car Comp 1/4W 5% 4.7K	1065-4701
R19	Res Car Comp 1/4W 5% 4.7K	1065-4701
R20	Res Car Comp 1/4W 5% 2.4MEG	1065-2404
R21	Res Car Comp 1/4W 5% 10K	1065-1002
R22	Res Car Comp 1/4W 5% 4.7K	1065-4701
R23	Res Car Comp 1/4W 5% 2.2K	1065-2201
R24	Res Car Comp 1/4W 5% 4.7K	1065-4701
R25	Res Car Comp 1/4W 5% 10K	1065-1002
R26	Res Car Comp 1/4W 5% 10K	1065-1002
R27	Res Car Comp 1/4W 5% 2.2K	1065-2201
R28	Res Car Comp 1/4W 5% 4.7K	1065-4701
R29	Res Car Comp 1/4W 5% 10K	1065-1002
R30	Res Car Comp 1/4W 5% 22K	1065-2202
R31	Res Car Comp 1/4W 5% 22K	1065-2202
R32	Res Car Comp 1/4W 5% 22K	1065-2202
R35	Res Car Comp 1/4W 5% 470	1065-0470
R37	Res Car Comp 1/4W 5% 10K	1065-1002

Model 764 A

PC Bd Counter

Assembly # 6608-1151

Ckt. Ref.	Description	TFT Stock No.
R38	Res Car Comp 1/4W 5% 100K	1065-1003
R39	Res Car Comp 1/4W 5% 390	1065-0390
Z1	I/C SN74LS90N	1101-7490
Z2	I/C SN74LS90N	1001-7490
Z3	I/C SN74LS90N	1101-7490
Z4	I/C SN74LS90N	1001-7490
Z5	I/C DM74LS76N	1101-7476
Z6	I/C SN74LS00PC	1101-7400
Z7	I/C SN74LS00PC	1101-7400
Z8	I/C DM74LS76N	1101-7476
Z9	I/C DM74LS76N	1101-7476
Z10	I/C DM74LS01N	1101-7401
Z11	I/C DM74LS76N	1101-7476
Z12	I/C MK 50395N	1100-5039
Z13	I/C REG 1/2 Amp +12V	1100-4212
Z14	I/C REG 1/2 Amp +5V	1100-4105
Z15	I/C CA3054	1100-3054
Z16	I/C SN74LS20N	1101-7420
Z17	I/C LM555CN	1100-0555
Z18	Resistor Network 10K	1073-1002
Z19	Resistor Network 10K	1073-1002
Z20	Resistor Network 1.5K	1073-1501
Z21	Resistor Network 1.5K	1073-1501
Z22	Resistor Network 4.7K	1073-4701
Z23	Resistor Network 4.7K	1073-4701
	Xistor Socket 3 Pin	1150-0001
	Screw 4-40X 1/4	2104-0001
	Nut Kep 4-40	2111-0001
	Socket 18 Pin	2250-0018
	Socket, I/C 8 Pin	2250-1008
	Socket, I/C 14 Pin	2250-1014
	Socket, I/C 16 Pin	2250-1016
	Socket, I/C 40 Pin	2250-1040
	Socket, 10 Pin	2250-5210
	Socket, 12 Pin	2250-5212
	Plug, 4 Pin	2250-6004
	Plug, 10 Pin	2250-6510
	P.C. Bd	1600-1310



REVISIONS

NO.	DATE	BY	CHKD.	REVISION
1	10/15/50	W. J. G.		REV. PER ECO 152
2	10/15/50	W. J. G.		REV. PER ECO 152
3	10/15/50	W. J. G.		REV. PER ECO 152
4	10/15/50	W. J. G.		REV. PER ECO 152

COMPONENT DESIGNATION

FIRST LAST	SELECTED
C1	C18
R1	R19
Z1	Z23
C2	C21
R2	R24
J1	J9
P1	P7

REMOVED ALL BURS AND SHARP EDGES OTHERWISE PREPARED AS SHOWN

NO.	DATE	BY	CHKD.	REVISION
1	10/15/50	W. J. G.		REV. PER ECO 152
2	10/15/50	W. J. G.		REV. PER ECO 152
3	10/15/50	W. J. G.		REV. PER ECO 152
4	10/15/50	W. J. G.		REV. PER ECO 152

DO NOT SCALE THIS PRINT

NO.	DATE	BY	CHKD.	REVISION
1	10/15/50	W. J. G.		REV. PER ECO 152
2	10/15/50	W. J. G.		REV. PER ECO 152
3	10/15/50	W. J. G.		REV. PER ECO 152
4	10/15/50	W. J. G.		REV. PER ECO 152

NOTES UNLESS OTHERWISE SPECIFIED:
 1. RESISTOR VALUES IN MICROHMS.
 2. CAPACITOR VALUES IN MICROSECONDS.
 3. DIODES - VALUES IN MICROSECONDS.
 4. VOLTAGE ARE DC UNLESS OTHERWISE NOTED.
 5. VOLTAGE ARE AC UNLESS OTHERWISE NOTED.
 6. TRANSISTORS Q1 THRU Q17 ARE 2N3638.
 7. TRANSISTORS Q18 THRU Q23 ARE 2N3637.
 8. THESE COMPONENTS NOT USED ON MODAL 704.
 9. CONNECT JUMPER FOR 754
 10. CONNECT JUMPER TO PIN 10 FOR 754,
 PIN 11 FOR 764

TO THUMBWHEEL SWITCH BOARD P84

TO PRESSELECTOR BOARD CONNECTOR J8

FROM J9 ON PRESSELECTOR BOARD

TO 10 SEGMENTS

TO 10\"/>

TO 10\"/>

TO 10\"/>

TO 10\"/>

TO 10\"/>

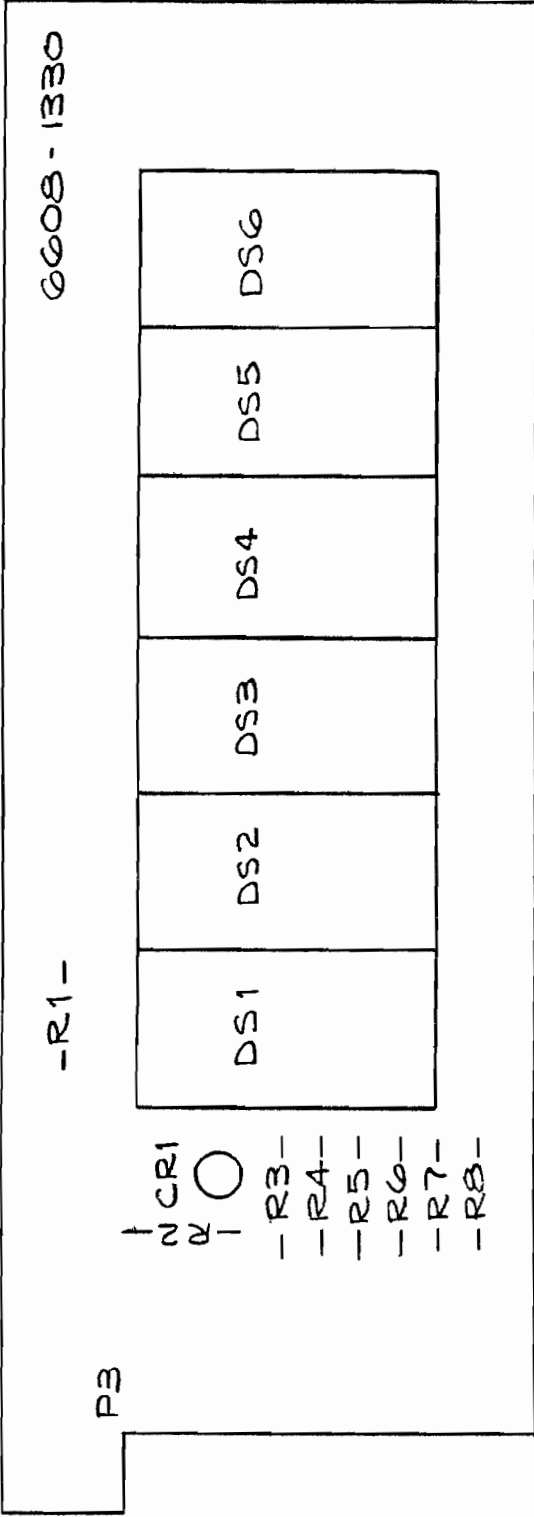
TO 10\"/>

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Model 764

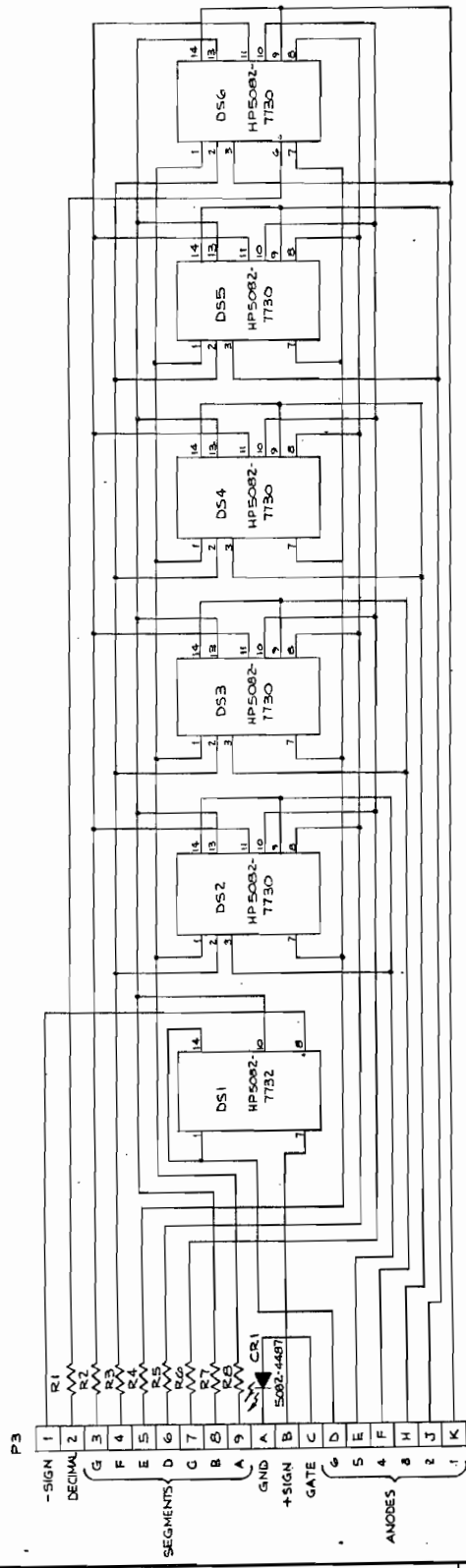
Display Board Assembly

Assembly # 6608-1330

Ckt. Ref.	Description	TFT Stock No.
CR1	LED HP 5082-4487 Clear	1285-4487
DS1	LED HP 5082-7732	1285-7732
DS2	LED HP 5082-7730 8	1285-4404
DS3	LED HP 5082-7730 8	1285-4404
DS4	LED HP 5082-7730 8	1285-4404
DS5	LED HP 5082-7730 8	1285-4404
DS6	LED HP 5082-7730 8	1285-4404
R1	Res Car Comp 1/4W 5% 390	1065-0390
R2	Res Car Comp 1/4W 5% 390	1065-0390
R3	Res Car Comp 1/4W 5% 390	1065-0390
R4	Res Car Comp 1/4W 5% 390	1065-0390
R5	Res Car Comp 1/4W 5% 390	1065-0390
R6	Res Car Comp 1/4W 5% 390	1065 0390
R7	Res Car Comp 1/4W 5% 390	1065 0390
R8	Res Car Comp 1/4W 5% 390	1065-0390
	PCB Display 764	1600-1330 REVA

NEXT ASSY 6608-1330	USED ON 7601-A 7604	SYM A	DESCRIPTION REL TO PRODUCTION	DR TD	CHK TO	AUTH H834	DATE 1/8/74
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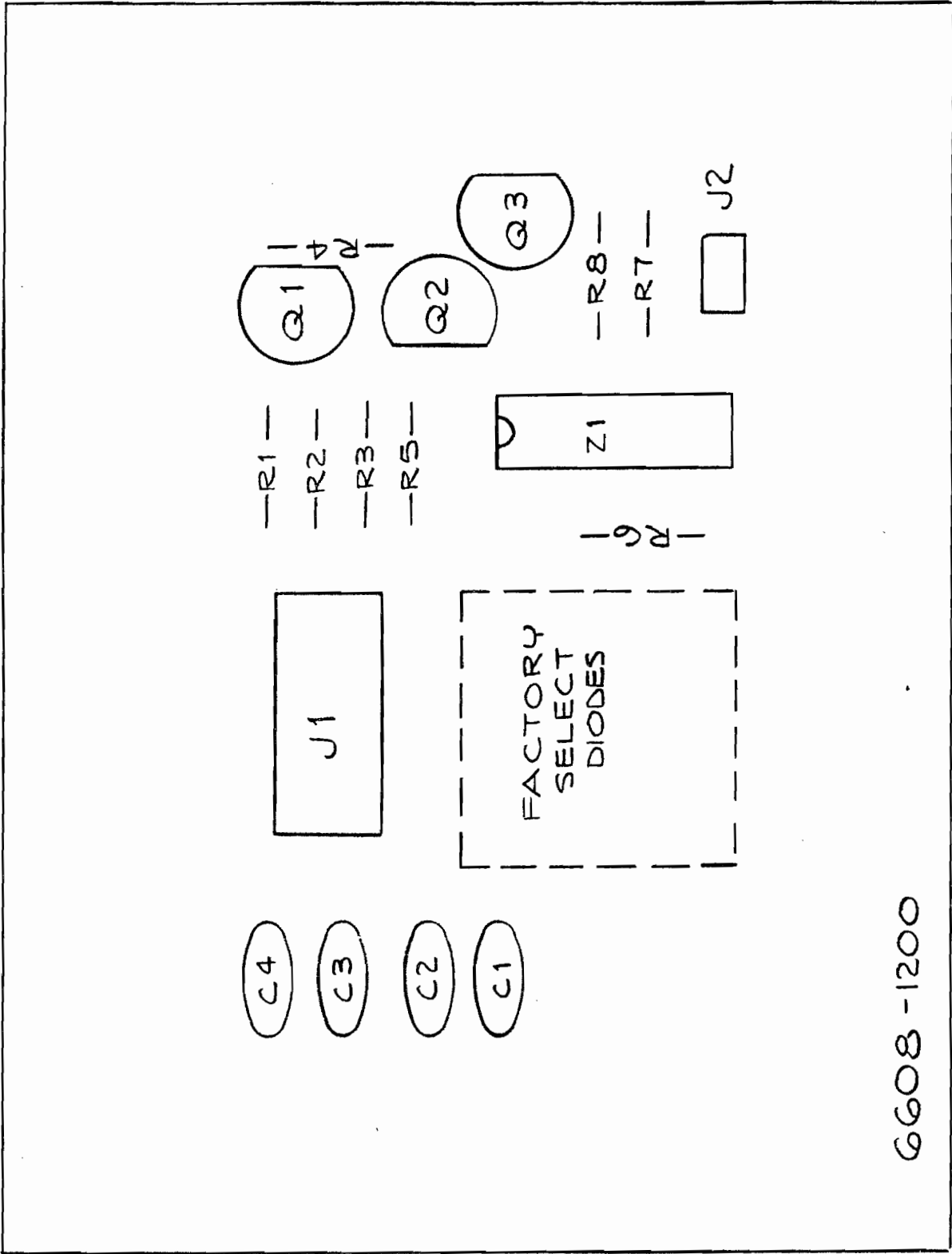
REVISIONS



DWG. NO.

QTY PER ASSY	ITEM NO	ITEM NO	PART NO	DESCRIPTION	REV	DATE
REMOVE ALL BURRE AND SHARP EDGES				TFT TIME & FREQUENCY TECHNOLOGY INC 3000 Ocean St, Santa Clara, California 95050		
TOLERANCES UNLESS OTHERWISE SPECIFIED				DRAWN BY: [Signature]		
.XX ±				CHK BY: [Signature]		
XXX ±				PROJ. ENG. [Signature]		
DO NOT SCALE THIS PRINT				APP. [Signature]		
				ECO NO		
				SCALE		
				SHEET I OF 1		

2. P.C. ASSY: 6608-1330
 1 RESISTORS ARE 350Ω, 1/8W 1%
 NOTES, UNLESS OTHERWISE SPECIFIED:



6608-1200

DWG. NO.
6601-1680

5

4

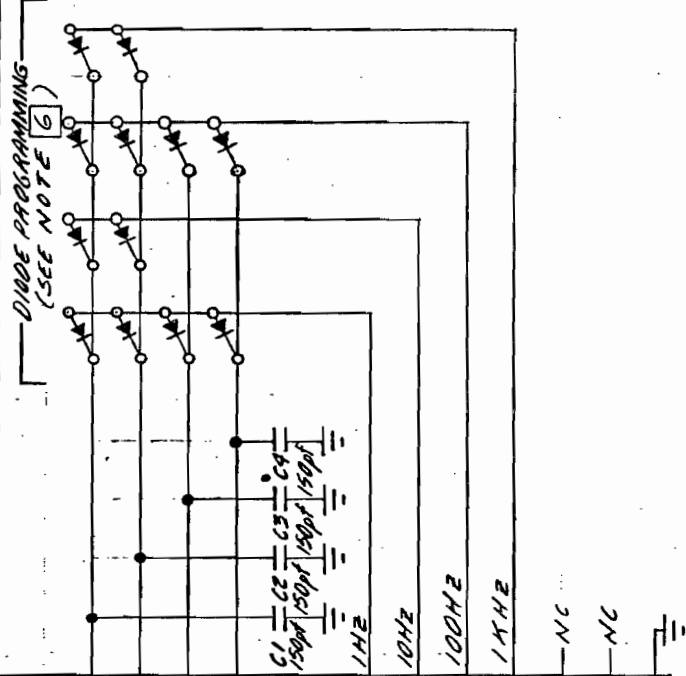
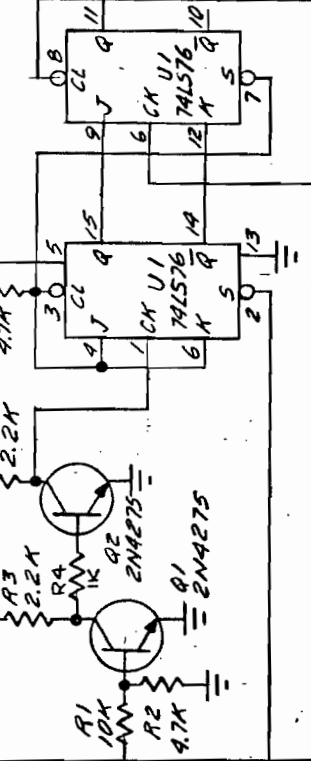
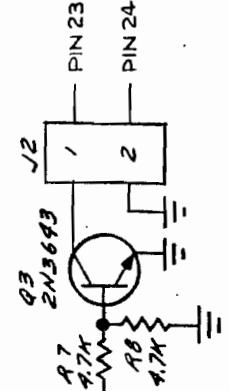
3

2

1

REVISIONS			
SYM	DESCRIPTION	DR	CHK AUTH DATE
A	RELEASE PER ECO 324	RS	4-7-76
B	REV PER ECO 329	TD	6-17-76

REAR PANEL
TO BCD OUTPUT CONN
30V DC., 50MA MAX



DIODE PROGRAMMING
(SEE NOTE 6)

FROM
COUNTER
BOARD
A4-J1

- NOTES: PLEASE OBSERVE THE FOLLOWING:
1. RESISTORS - ALL IN OHMS UNLESS OTHERWISE SPECIFIED.
 2. CAPACITORS - ALL IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
 3. DIODES - ALL IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
 4. FACTORY SET VALUES TO BE OBTAINED FROM THE FACTORY DATA SHEET.

PROGRAMMING DIODES ARE FACTORY INSTALLED.

ITEM NO.	EN NO.	PART NO.	DESCRIPTION	REF. DES.
LIST OF MATERIALS				
DRAWN BY: <i>JK</i>				
CHK. BY: <i>JK</i>				
PROJ. ENG. <i>JK</i>				
MFG. ENG. <i>JK</i>				
APPD. <i>JK</i>				
APPD. <i>JK</i>				
ECO NO. <i>JK</i>				
DO NOT SCALE THIS PRINT				
TOLERANCES UNLESS OTHERWISE SPECIFIED				
.XX ±				
.XXX ±				
ANGULAR ±				
REMOVE ALL BURRS AND SHARP EDGES				

TIME & FREQUENCY TECHNOLOGY INC.
3000 Duffell St., Santa Clara, California 95050
(408) 246-8266

TITLE: FIGURE 6-11 A9
CARRIER FREQUENCY ALARM
MODEL TS4 (OPTIONAL)

REV. B
SIZE: DRAWING NO. 6601-1680
SCALE: NONE
SHEET 1 OF 1

5

4

3

2

1

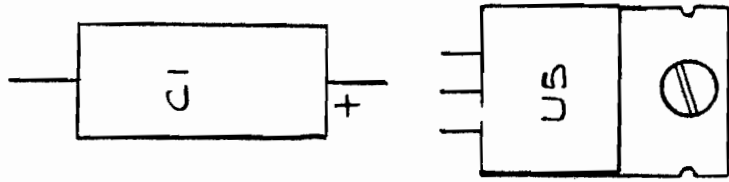
Model 764/765

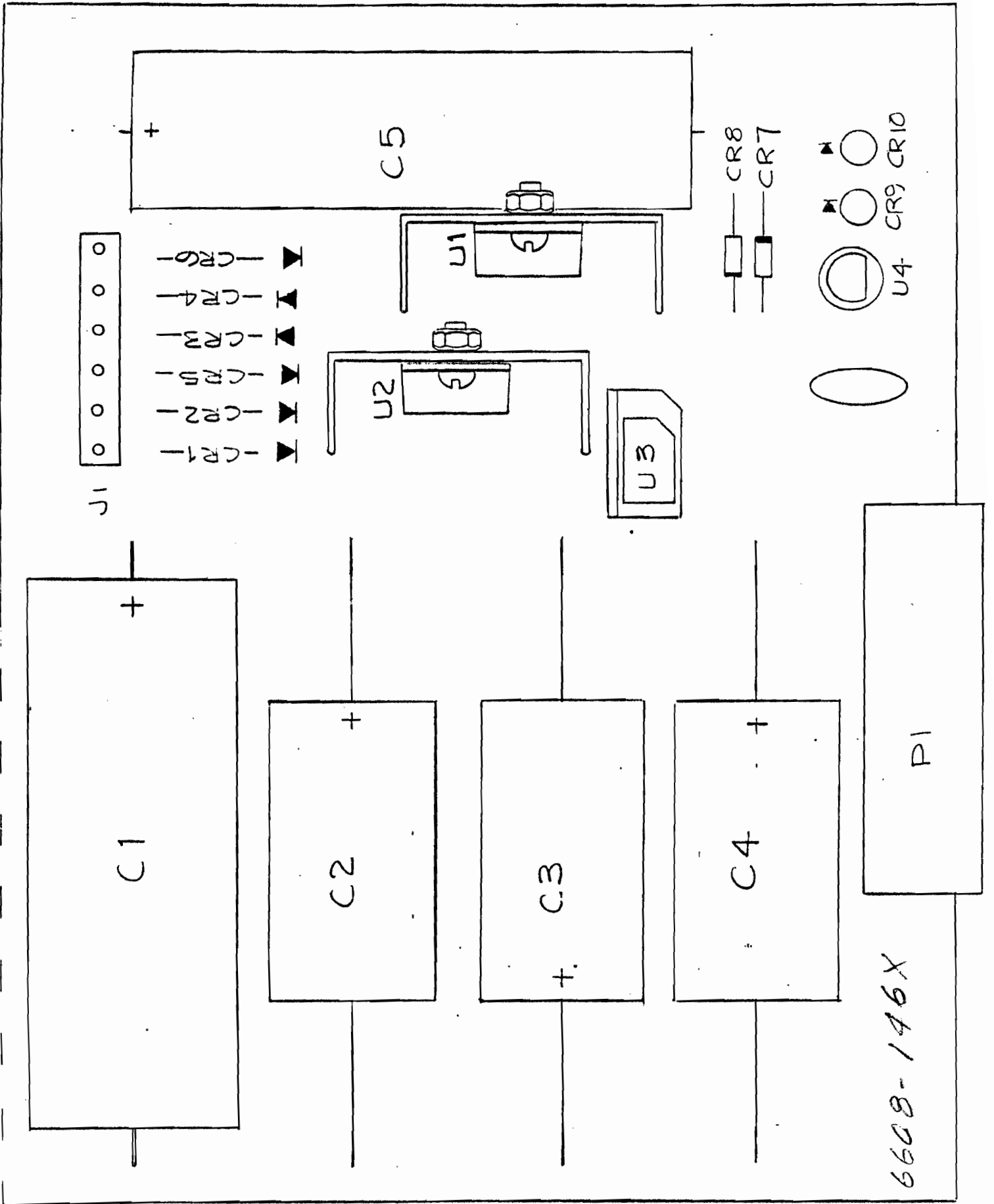
PC BD BCD OUTPUT

Assembly # 6608-1190

Ckt. Ref.	Description	TFT Stock No.
C1	Cap. Tan 10 mfd 20V	1008-0101
U1	I/C MM74C04	1102-7404
U2	I/C MM74C195	1102-4195
U3	I/C MM74C195	1102-4195
U4	I/C MM74C195	1102-4195
U5	I/C LM341-5	1100-4105
U6	I/C MM74C902	1102-4902
U7	I/C MM74C902	1102-4902
	I/C 14 Pin	2250-1014
	I/C 16 Pin	2250-1016
	PC Board BCD OUTPUT	1600-1190 REVA

6608-1190





Model 764/765

Chassis Parts

Ckt. Ref.	Description	TFT Stock No.
	Switch Rotary Knob for 1825-0025 Transformer, Power Display Window LED, panel mount for 765 Manual 764/765	1825-0025 2370-1523 1500-0016 REVA 3000-0150 1285-4403 5004-0764