FM FREQUENCY AND MODULATION MONITOR

MODEL 723

TFT

TIME AND FREQUENCY TECHNOLOGY, INC.

TFT TIME & FREQUENCY TECHNOLOGY INC.

TO: MODEL 723/734 FM MONITOR USERS

FROM: TFT

DATE: 16 September 1974

We are pleased to enclose the final version of the Instruction Manual for your monitor. Older manuals and supplements have been replaced by the new manual.

If you have any questions or if you would like to let us know how your monitor is performing, don't hesitate to call or write TFT.

09164rd

3000 Olcott Street, Santa Clara, California 95051 (408) 246-6365

Updated Copy
9-16-74

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MODEL 723

TIME AND FREQUENCY TECHNOLOGY, INC.
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SECTION 1

GENERAL INFORMATION

1.1 General Description

The Model 723 FM Frequency and Modulation Monitor is designed for continuous monitoring of an FM broadcast transmitter operating in the frequency range of 88 to 108 MHz. The monitor is factory-adjusted for the customer's assigned transmitter frequency and provides digital display of the carrier frequency error* as well as quasi-peak reading meter indication of total modulation percentage.

The Model 723 can be used with a rooftop antenna for off-the-air monitoring, or it can be connected to the transmitter through an attenuator (furnished) for operation at the transmitter site.

The six-digit frequency display on the Model 723 can also be used as a 10 MHz general purpose counter with 10 Hz or 1 Hz resolution. Conversion is made by depressing a single front-panel pushbutton.

Other features of the Model 723 include:

Frequency stability of ±100 Hz per year

Two flashers that indicate when modulation peaks exceed a preset value in either the positive or negative direction

Built-in calibrator for modulation indicators

Carrier-off alarm

Outputs for remote modulation monitoring

IF outputs for the TFT Model 724 Stereo Monitor and the TFT Model 730 SCA Monitor

Optional analog or BCD output for automatic logging of carrier frequency error

Optional output for off-frequency alarm

Provision for reading pilot and SCA carrier frequencies with addition of Model 724 or 730

Residual Amplitude Modulation Measurement at the Hi level R. F. input.

The Model 723 complies with all FCC regulations relating to FM broadcast monitors, including Section 73.331 pertaining to FM frequency monitors and Section 73.332, Subsections a, b, and c, pertaining to FM modulation monitors.

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* Readout indicates frequency error and not the carrier frequency itself.

In addition, the Model 723, when used with the Model 724 Stereo Monitor, meets the requirements of Section 73.332, Subsections d and e, for stereo monitors; and, when used with the Model 730 SCA Monitor, meets the requirements of Section 73.332, Subsections f and g, for SCA monitors.

1.2 Specifications

RF Input

Frequency range	88 to 108 MHz
Sensitivity	Approximately 250 μV, 60 dB automatic gain control range
Input Level:	
Low-level input	250 μV to 250 mV (75 ohms)
Hi-level input	1V to 10 V (50 ohms)
Selectivity:	
3 dB bandwidth	375 kHz
40 dB bandwidth	800 kHz
Input impedance	75 ohms (nominal)
Input connector	BNC
Image rejection	60 dB
Signal-to-noise ratio	70 dB below 100% modulation at 400 Hz with 75 μs de-emphasis and 500 μV input.
Carrier level meter	Front panel meter to indicate relative signal level

Carrier Frequency Error Measurement

Digital readout	Zero to ± 10 kHz in 1 Hz increments from assigned center frequency
Accuracy	±100 Hz per year
Internal frequency standard	Uses a precision 5 MHz crystal oscillator in a proportionally controlled oven. A 1 MHz output is provided on the front panel for calibration against WWVB or a precision frequency source.

Off-frequency alarm - - - - - - - -	Available as an option to provide contact closure. Can be wired for desired frequency limits.
Automatic logging output - - - - - -	Available as an option. BCD output or a ±1 Vdc output representing ±1 kHz of carrier frequency error.

Modulation Meter

Meter range - - - - - - - - - - - -	0 to ±133% on positive or negative peaks. (±100% = ±75 kHz FM deviation)
Accuracy - - - - - - - - - - - - -	±4% over entire scale.
Frequency response - - - - - - - -	0.5 dB from 50 Hz to 75 kHz
Meter characteristics - - - - - -	Peak-reading circuit, scale, and ballistics conform to FCC requirements.
Remote metering - - - - - - - -	Output provided for Model 704B Remote Readout Panel.

Peak Modulation Indicators

Variable peak indicator - - - - - -	Level set by a front-panel 3-digit thumbwheel switch in 1% steps from 50% to 129% on positive and negative peaks. 100% setting corresponds to an FM deviation of ±75 kHz.
Accuracy - - - - - - - - - - - -	±4%
Response time - - - - - - - - -	20 μs pulse

Modulation Calibrator

Built-in modulation calibrator for calibration of the modulation meter and peak flashers from the front panel.

Six-Digit Frequency Counter

Frequency range - - - - - - - - -	10 Hz to 10 MHz
Input sensitivity - - - - - - - - -	200 mV to 2 V rms

Input impedance - - - - - - - - - -	500 kilohms shunted by 25 pF
Resolution - - - - - - - - - - - - -	1 Hz or 10 Hz, front-panel switchable
Display accuracy - - - - - - - - - -	±1 count
Time-base aging rate - - - - - - - -	1×10^{-8}/day after 30 days of operation

Rear-Panel Outputs

700 kHz output - - - - - - - - - - - -	Output to drive TFT Model 724 Stereo Monitor
Standard Frequency - - - - - - - - -	1 kHz, TTL level
Remote meter and peak flasher - - -	For use with Model 704B remote readout panel.
Audio outputs - - - - - - - - - - - - -	Two outputs are provided, one with de-emphasis and one without.

Amplitude Modulation Measurements

Range - - - - - - - - - - - - - - - - -	Residual AM measurements up to 20% can be made on the R F signal at the high level input.
Frequency Response - - - - - - - - -	75μsec de-emphasis network is incorporated in this output.
Signal-To-Noise Ratio - - - - - - - -	70dB below 100% with 75μsec de-emphasis

Physical and Environment Specifications

Power required - - - - - - - - - - - -	115/230 V, 50 to 400 Hz, 30 watts maximum
Operating temperature - - - - - - - -	0° to +50° C
Dimensions - - - - - - - - - - - - - -	19"w x 7"h x 16"d
Weight - - - - - - - - - - - - - - - - -	17 pounds
Cabinet - - - - - - - - - - - - - - - - -	Rack mounted

1.3 Accessory Equipment

1.3.1 Accessories Furnished

Instruction Manual

1.3.2 Accessories Available

Model 704B Remote Readout Panel. Duplicates meter and peak-flasher readings of the Model 723.

Model 724 Stereo Monitor. For use by stereo FM stations to meet all FCC stereo monitoring requirements.

Model 730 SCA Monitor. Enables FM stations broadcasting SCA information on the carrier to meet all FCC SCA monitoring requirements.

1.4 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.

1.5 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.
3000 Olcott Street
Santa Clara, California 95051
408-246-6365

SECTION 2

INSTALLATION

2.1 Unpacking and Inspection.

Upon receiving the instrument, inspect the packing box and instrument for signs of possible shipping damage. Operate the instrument in accordance with the procedures of Section 3 of this manual. 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.

The Model 723 is factory wired to operate from either a 115-volt or a 230-volt ac source. A marking on the rear panel of the instrument indicates which voltage is to be used. The line frequency must be between 50 and 400 Hz. Maximum power required is 30 watts.

2.3 Installation Remote from Transmitter.

When the instrument is installed in the studio, or any place distant from the transmitter, a rooftop antenna must be used. Any conventional FM or television antenna is satisfactory for this purpose. A 75-ohm coaxial cable should be used to feed the signal from the antenna to the RF INPUT connector on the rear panel of the Model 723. The procedure for proper adjustment of the input level is as follows:

a. Depress the PWR and MAIN CARR switches on the Model 723 front panel.

b. Rotate the antenna for maximum reading on the CARRIER LEVEL meter. The meter reading must be in the green region for proper Monitor operation. If the meter reading is above the green region, insert the 40 dB attenuator in the RF input.

The monitor is now ready for use.

2.4 Installation at Transmitter Site

When the instrument is installed at the transmitter site, connect the modulated R. F. sampling point on the transmitter to the HIGH LEVEL INPUT on the rear panel using a 50-ohm coaxial cable. The voltage at this point must not exceed 10 V rms.

CAUTION

DO NOT CONNECT THE LOW-LEVEL INPUT TO THE TRANSMITTER R. F. SAMPLING POINT.

Install a one-quarter inch wide braided ground wire from the Model 723 chassis to the transmitter ground bus.

The procedure for proper adjustment of input level to the Model 723 is as follows:

a. Depress the PWR and MAIN CARR switches on the Model 723 front panel.

b. Adjust coupling of the RF signal from the transmitter for a CARRIER LEVEL meter reading in the green region.

The Monitor is now ready for use.

2.5 Model 724 Stereo Monitor Connection.

When a Model 724 is to be used with the Model 723, proceed as follows:

a. Connect a 5 wire cable from J13 on the rear panel of the Model 723 to the power input terminal strip on the Model 724, also a #18 AWG or larger wire between the two chassis.

b. Connect a coaxial cable from J10 or J11 on the rear panel of the Model 723 to the 700 kHz INPUT connector on the Model 724.

c. Connect a coaxial cable from the PILOT CARRIER OUTPUT connector of the Model 724 to PILOT CARRIER connector J6 on the rear panel of the Model 723.

d. Refer to the Model 724 manual for calibration instructions.

2.6 Model 730 SCA Monitor Connection.

When a Model 730 is to be used with the Model 723, proceed as follows:

a. Connect a coaxial cable from J2 on the rear panel of the Model 723 to the composite input connector on the Model 730.

b. Connect a coaxial cable from the SCA CARRIER OUTPUT connector on the Model 730 to SCA CARR connector J5 on the Model 723.

c. Refer to the Model 730 manual for calibration instructions.

2.7 Model 704B Remote Readout Panel Connection (Optional).

When a Model 704B is to be used with the Model 723, connect the 5-wire cable of the Model 704 to terminals A, C, F, G, and H of J12 on the rear panel of the Model 723.

2.8 Automatic Logging Connection (Optional).

Two automatic logging options are available -- one providing a BCD output and the other providing an analog output. For the BCD option, rear panel

connector J14 on the Model 723 will be a 50-pin connector. For the analog option, J14 will be a pair of banana jacks. In either case, an appropriate cable must be connected between J14 on the rear panel of the Model 723 and the input connector(s) on the logging equipment. Refer to the Rear Panel Wiring Diagram, Figure 6-3, for J14 pin connections.

2.9 Off-Frequency Alarm Connection (Optional).

If an off-frequency alarm is to be used with the Model 723, connect terminals B and F of terminal strip J12 on the Model 723 rear panel to the appropriate terminals on the alarm device. When the carrier frequency error exceeds the preset value, terminal B of J12 shorts to ground (terminal F). Maximum power-handling capability is 0.5 amperes at 50 volts.

2.10 Carrier-Off Alarm Connection.

Connect the external alarm device to banana jacks J3 and J4 on the Model 723 rear panel. These jacks are shorted together when the transmitter carrier goes off. Neither of the jacks is grounded in the Monitor. Maximum power-handling capability is 0.5 amperes at 50 volts.

2.11 Modulation Alarm Connection (Optional)

Connect the external alarm device to terminals "D" and "E" of J12 on the Model 723 rear panel. These terminals are shorted together when the total modulation drops below 10% for a period of time which can be adjusted on the modulation alarm (A10). Neither of the jacks is grounded in the monitor. Maximum power-handling capability is 0.5 amperes at 50 volts.

SECTION 3

OPERATION

3.1 General.

The Model 723 FM Frequency and Modulation Monitor displays the frequency error of the carrier being monitored. * It also displays the total modulation percentage and provides a flashing indication when either the positive or negative modulation peaks exceed the percentage set on the front-panel thumbwheel switches. When used in conjunction with the Model 724, the frequency of the stereo pilot carrier can be displayed; and when used with the Model 730, the frequency of the SCA subcarrier can be displayed. The Model 723 can also be used as a general-purpose six-digit counter.

3.2 Controls, Connectors, and Indicators.

3.2.1 Front Panel.

Fig. 3-1 Ref. No.	Name	Function
1	COUNTER INPUT/ 1 MHz OUPUT connector	In the General Purpose Counter mode, provides a means of introducing the signal to be counted (see Ref. No. 4 below). In the Monitor mode (see Ref. No. 7 below), this connector delivers a 1 MHz output from the internal time base, for calibrating the time base.
2	PWR switch	When depressed, energizes the instrument. NOTE: The crystal oven is not controlled by this switch; power is supplied to the oven circuit whenever the instrument is plugged into a power source.
3	10 Hz/ 1 Hz switch	Used in the Counter and Main Carrier modes only. When depressed, provides 1 Hz resolution of the frequency count; when in the out position, provides 10 Hz resolution.

* Note that when the main carrier is being monitored, the digital display indicates the frequency error rather than the carrier frequency.

Fig. 3-1 Ref. No.	Name	Function
4	FREQ CTR switch, COUNTER lamp, and O. F. lamp	The FREQ CTR switch is mechanically connected to the SCA CARR, PILOT CARR, and MAIN CARR switches so that when one is pressed the others are out. Depressing the FREQ CTR switch puts the instrument in the general-purpose counter mode and turns on the COUNTER lamp. In this mode only, if the counter overflows, the O.F. lamp comes on.
5	SCA CARR switch and SCA lamp	Used with Model 730 SCA Monitor. When depressed, connects J5 to input of counter board and counts frequency present at J5. Counter reads with 1 Hz resolution. Depressing the SCA CARR switch also turns on the SCA lamp.
6	PILOT CARR switch and PILOT lamp	When PILOT CARR switch is depressed, it turns on PILOT lamp and connects input at J6 into counter to indicate pilot carrier frequency. Resolution is 0.1 Hz. Used with Model 724 Stereo Monitor.
7	MAIN CARR switch and MAIN CARR lamp	When MAIN CARR switch is depressed, it places the Model 723 in its normal mode and turns on the MAIN CARR lamp. Digital display indicates main carrier frequency error.
8	METER (-) switch	Causes meter to read negative modulation peaks.
9	METER (+) switch	Causes meter to read positive modulation peaks.
10	METER CAL switch	When depressed, provides an internal calibration signal for the modulation meter and the peak flashers (see Section 3.4).
11	FLASHER CAL control	Used in calibrating the peak flashers (see Section 3.4).
12	METER CAL control	Used in calibrating the modulation meter (see Section 3.4).
13	Modulation meter	Reads carrier total modulation directly in percentage. The modulation being monitored, positive or negative, depends on the setting of the (-) and (+) switches.

Fig. 3-1 Ref. No.	Name	Function
14	PEAK MODULATION switches and lamps	The PEAK MODULATION switches set the peak modulation percentage at which the lamps will flash. The PEAK MODULATION lamps flash when the modulation peaks exceed the setting of the PEAK MODULATION switches -- the + lamp for positive modulation peaks and the - lamp for negative peaks.
15	CARRIER LEVEL meter	A meter reading in the green region indicates that the RF input level is correct for proper Monitor operation.
16	"+" and "-" lamps	"+" lamp indicates that the carrier frequency is above its assigned frequency; "-" lamp indicates that the carrier frequency is below its assigned frequency.
17	GATE lamp	Flashes every two seconds or every 20 seconds depending upon resolution selected, to indicate that the counter gating is operating properly, and that frequency sampling is taking place.
18	OVEN lamp	Lighted when crystal oven is operating. Relative brightness of OVEN lamp is an indication of the amount of current being drawn by the oven.
19	Frequency error display	In the Main Carrier mode, indicates the carrier frequency error in kHz. In other modes, indicates frequency being counted.

3.2.2 Rear Panel.

Fig. 3-2 Ref. No.	Name	Function
1	RF INPUT connector J1	Provides a means for connecting a 75-ohm cable from a rooftop antenna at a remote site, or from the transmitter RF coupler through a 40-dB pad at the transmitter site. Maximum input is 1 V.
2	COMPOSITE OUTPUT connector J2	Delivers the recovered composite audio signal. Output is 1 V rms for ±75 kHz FM deviation.

Fig. 3-2 Ref. No.	Name	Function
3	CARRIER ALARM connectors J3 and J4	Provides connection to an external carrier-off alarm. A relay in the Monitor shorts together the two connectors when the monitored carrier goes off.
4	PILOT CARR connector J6	Provides means for connecting the pilot carrier input from a Model 724 Stereo Monitor.
5	SCA CARR connector J5	Provides means for connecting the SCA carrier input from a Model 730 SCA Monitor.
6	5 MHz INPUT connector J7 and switch	Connector provides means for introducing an external 5 MHz time-base signal (0.5 V rms or greater). Switch must be in EXT position when using external time base.
7	Audio output IF connector J8	Delivers the recovered audio from the 75 μs de-emphasis network. The audio level is 1 V rms for ±75 kHz deviation.
8	1 KHz connector J9	Delivers a 1 kHz signal divided down from the 5 MHz time base, for driving external devices such as a digital clock and calendar system. TTL level.
9	700 KHz output connectors J10 and J11	This is the 700 kHz second IF signal used to drive the Model 724 Stereo Monitor. The level should be 100mV rms into 50 ohms.
10	1A SLO BLO fuse	Fuses the ac power circuit.
11	115 V AC line cord	For connecting the Monitor to a power source. If the Monitor is wired for a 230 V input, the line cord will be so marked.
12	POWER SUPPLY TO MODEL 724 terminal strip J13	Supplies +15 V, +10V, -15V, and a CAL signal to the Model 724 when used.

Fig. 3-2 Ref. No.	Name	Function
13	AUTOMATIC LOGGING OUTPUT connector J14	If this option is ordered, J14 will be a 50-pin connector providing BCD output of the digital display or a pair of banana plugs providing an analog output of the carrier frequency error (±1 Vdc for ±1 kHz frequency error), as specified by the customer.
14	Terminal strip J12	Provides the following outputs: A: The same voltage that operates the modulation meter, to operate the Model 704B Remote Readout Panel. Connect 704B red wire. B: Closes a circuit to ground when the measured carrier frequency error exceeds a preset limit, for operation of an external alarm. Will handle a load of 0.5 A at 50 V. Optional. C: The same voltage that operates the front-panel + PEAK MODULATION lamp, for operating the corresponding lamp on the Model 704B Remote Readout Panel. Connect the 704B brown wire. F: Ground. Connect 704B black wire. G: The same voltage that operates the front-panel - PEAK MODULATION lamp, for operating the corresponding lamp on the Model 704B Remote Readout Panel. Connect the 704B white wire. H: +5 Vdc. Connect 704B green wire.
15	RF LEVEL HIGH Connector J15	Provides a means for direct connection to the transmitter RF coupler at the transmitter site. Input range is 1V to 10 V.
16	AM DETECTOR OUTPUT	Provides a D.C. output propotional to the R.F. input level at the High-Level R.F. input, and an A.C. voltage proportional to the A.M. on the carrier at the High-Level input.

REVISIONS		
LTR	Description	Date
A	RELEASED TO PRODUCTION	10-24-72
B	REVISED PER ECO # 116	12-27-73
C	REVISED PER ECO # 145	4-23-74
D	REVISED PER ECO # 170	7-2-74

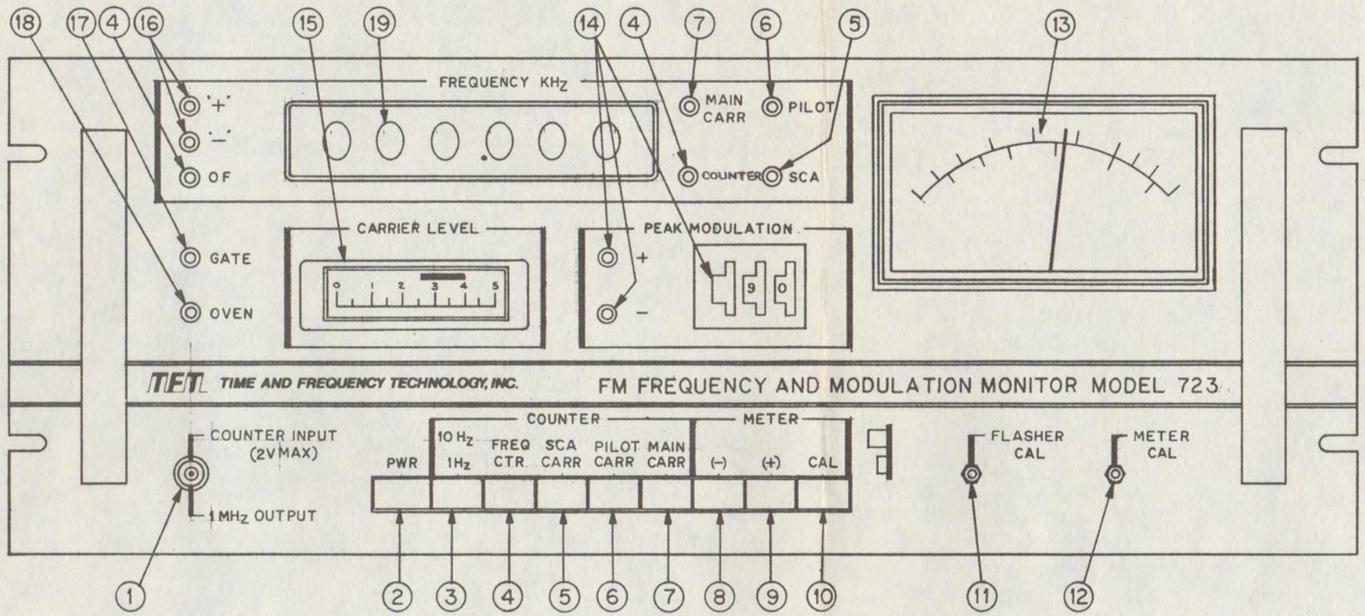


FIGURE 3-1

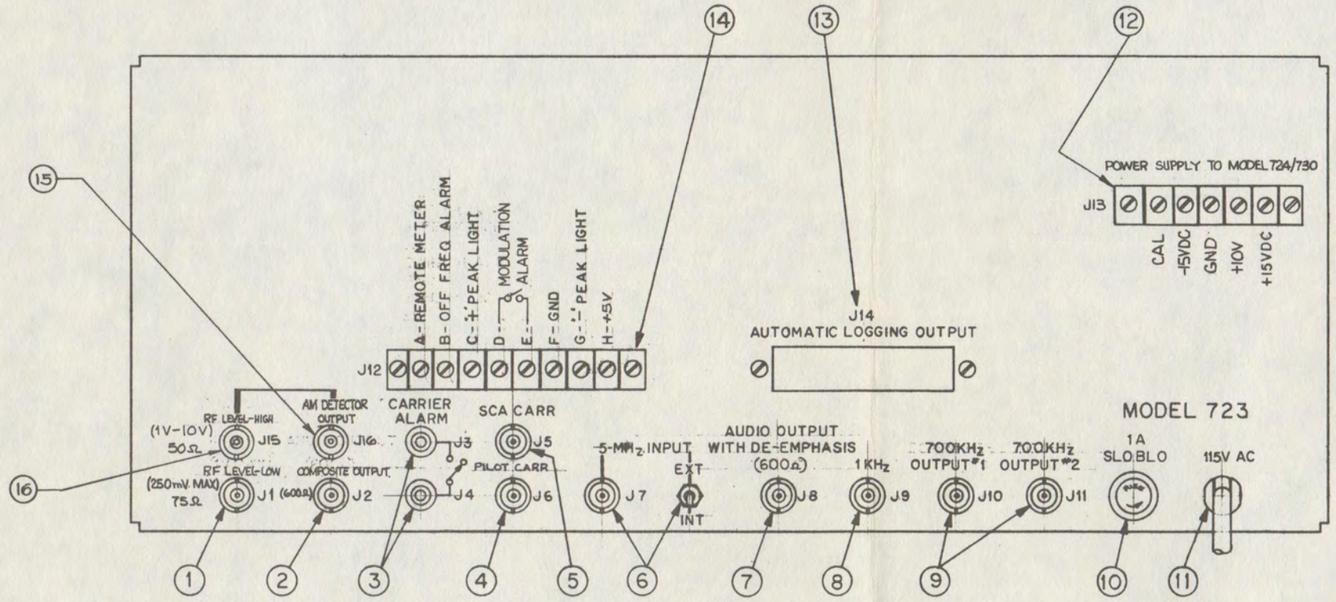


FIGURE 3-2

TFT		
SCALE 1/1	APPROVED BY	DRAWN BY D.S.
DATE 11-16-72		REVISED
PANEL - FRONT & REAR		
MODEL 723		DRAWING NUMBER 6600-0280

3.3 Turn-On and Warm-Up.

Check the marking on the rear panel to make sure the instrument is wired for the line voltage to be used (115 volts or 230 volts). Plug the line cord into the power source, and allow 30 minutes for the crystal oscillator oven temperature to stabilize. Energize the instrument by depressing the PWR switch. Depress the MAIN CARR switch to place the instrument in the monitoring mode.

If the Monitor is at the transmitter site, make sure the rear-panel RF INPUT connector is connected to the transmitter RF coupler through a 40 dB pad, as described in Section 2.4, and that the input level is adjusted as described in that section.

If the Monitor is used at the remote control location, make sure that it has been adjusted as described in Section 2.3 of this manual.

3.4 Calibration of Modulation Meter and Peak Flashers.

For maximum accuracy, the calibration of the modulation meter and peak flashers should be checked regularly and adjusted if necessary.

To calibrate the modulation meter, depress the CAL switch button and adjust the METER CAL control until the meter reads exactly 100 percent.

To calibrate the peak flashers, depress the CAL switch button, set the PEAK MODULATION thumbwheel switches to 100 percent, and adjust the FLASHER CAL control so that PEAK MODULATION flasher lamps just come on.

3.5 Measurement of Frequency Modulation Using the Modulation Meter.

Make sure the CARRIER LEVEL meter indication is in the green region; if it is not, refer to Section 2.3 or 2.4 of this manual, as appropriate. Then depress the METER (-) or METER (+) button; the meter will then give a quasi-peak indication of negative or positive peak modulation, respectively. A meter reading of 100 percent corresponds to an FM deviation of ±75 kHz.

3.6 Measurement of Frequency Modulation Using the Peak Flashers.

The peak flashers catch fast transients and peaks that the meter cannot respond to. To operate the peak flashers, set the PEAK MODULATION thumbwheel switches to the desired modulation percentage. (A setting of 100 percent corresponds to an FM deviation of ±75 kHz.) If the positive modulation peaks then exceed that percentage, the + lamp will go on and stay on for approximately two seconds; likewise, the - lamp will go on for approximately 2 seconds if the negative modulation peaks exceed the preset percentage.

3.7 Main Carrier Frequency Error Measurements.

When the MAIN CARR button is depressed and the CARRIER LEVEL meter is reading in the green region, the digital display indicates the carrier frequency

error with 1 Hz resolution. The "+" and "-" lamps to the left of the digital display indicate whether the carrier is above or below its assigned frequency, respectively.

3.8 Stereo Pilot Carrier Frequency Measurement.

When the Model 723 is used with the Model 724 to monitor an FM stereo signal, the stereo pilot carrier frequency can be measured by depressing the PILOT CARR button on the front panel of the Model 723. The digital display will then indicate the pilot frequency (nominally 19 kHz) with 0.1 Hz resolution.

3.9 SCA Subcarrier Frequency Measurement.

When the Model 723 is used with the Model 730 to monitor an FM signal containing an SCA subcarrier, the subcarrier frequency can be measured by depressing the SCA CARR button on the front panel of the Model 723. The digital display will then indicate the subcarrier frequency (typically 67 kHz) with 1 Hz resolution.

3.10 Use of the Model 723 as a General Purpose Counter.

The Model 723 can be used as a six-digit precision frequency counter at frequencies up to 10 MHz by depressing the front-panel FREQ CTR switch and applying the signal to be measured to the front-panel COUNTER INPUT connector. The signal level must not exceed 2 volts. If it does, the use of a 10:1 oscilloscope voltage-divider probe is recommended.

When operating in the Counter mode, the instrument performs as a conventional counter, with the count being displayed on the six-digital readout tubes. When the 10 Hz/1 Hz COUNTER switch is depressed, frequency measurements are in 1 Hz steps from 0 to 999.999 kHz; when the 10 Hz/1 Hz switch is out, measurements are in 10 Hz steps from 0 to 9,999.99 kHz. Illumination of the O.F. lamp indicates that the counter's limit has been exceeded.

3.11 Audio Output.

The recovered audio signal (main channel for monaural, left plus right channels for stereo) out of the de-emphasis network is available at rear-panel AUDIO OUTPUT connector J8. Its level is approximately 1 V rms into 600 ohms for 75 kHz deviation, and it can be fed into a distortion analyzer to measure system distortion. It can also be used to operate high-impedance earphones if desired. The same signal is available at J2 without going through the de-emphasis network.

3.12 Operation of Model 723 from External 5 MHz Time Base.

To operate the Monitor from an external time base, apply the external 5 MHz signal at a level of 0.5 V rms to the rear-panel 5 MHz INPUT connector, and set the 5 MHz INPUT switch to EXT. All timing functions, including the counter, the local oscillator, and the signal at the front-panel 1 MHz OUTPUT connector, will be derived from the external time base.

3.13 Carrier-Off Alarm.

Whenever the monitored carrier goes off, a relay within the Model 723 shorts together rear-panel CARRIER ALARM jacks J3 and J4. These jacks can be connected to an external alarm device, as described in Section 2.10, to produce a visual or aural alarm.

3.14 Carrier Off-Frequency Alarm (Optional).

When this option is selected, a relay within the Model 723 shorts terminal B of rear-panel terminal strip J12 to ground whenever the carrier frequency error exceeds a predetermined value, which can be any one of the following, as specified by the customer:

10 Hz	100 Hz	1 kHz
20	200	2
40	400	
80	800	

The Monitor is factory-wired to operate the relay at the specified frequency error. The external alarm device must be connected to the Model 723 as described in Section 2.9.

3.15 Model 704 Remote Readout Panel (Optional).

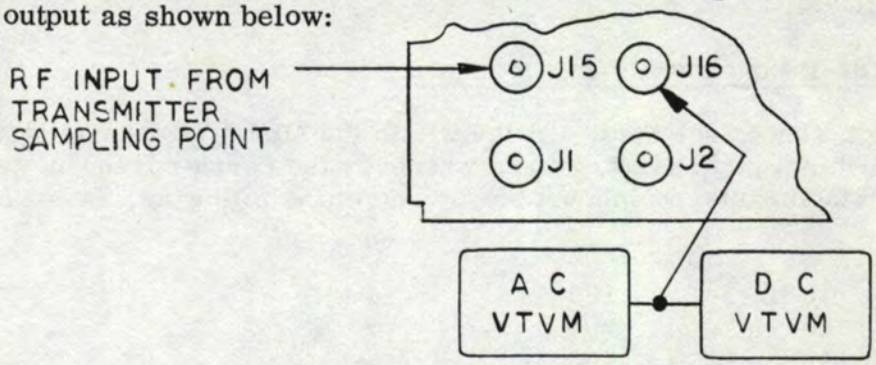
Model 704B Remote Readout Panel will duplicate the indications of the modulation meter and peak flashers.

3.16 Automatic Logging Output (Optional).

When this option is selected, either the BCD output of the digital display or an analog output of the carrier frequency error (as ordered by the customer) is brought out to the rear-panel AUTOMATIC LOGGING OUTPUT connector(s) to drive automatic logging equipment. For the analog output, an output of ±1 Vdc represents a frequency error of ±1 kHz. The main carrier switch must be depressed during this type of operation. Section 2.8 gives information on the connections required.

3.17 Measurement of Amplitude Modulation

When the Model 723 is operated at the transmitter, amplitude modulation can be measured when the signal is fed into high-level R.F. Input (J15). The residual AM signal is brought out at J16 on the rear panel. The AM detector has a 75μs de-emphasis network built in. To measure the residual AM, first measure the DC and AC voltages at the AM detector output as shown below:



The DC voltage should be measured in volts, and the AC voltage in millivolts. It is important that readings be taken in volts and millivolts respectively so that the decimal point works out in the correct position in the final result. Taking the DC voltage, go to the curve given in the graph provided and read the appropriate correction factor. The correct percentage of AM is calculated by using the following formula:

$$\% \text{ AM} = (\text{C.F.}) \times (\text{mV, AC})$$

C.F. is the correction factor taken from Figure 3-3.

To convert this to dB below 100%, the following formula may be used:

$$dB_{(100\%)} = 20 \log_{(10)} \left(\frac{\%}{100}\right)$$

For convenience, a graph of % modulation Vs dB below 100% has been provided to eliminate this calculation. (See Figure 3-4).

As an example, given a DC voltage output from the AM detector of 2VDC, and an AC output of 2mVAC, the correction factor from the graph is 0.06.

$$\% \text{ AM} = 0.06 \times 2 = 0.12\%$$

$$dB_{(100\%)} = 20 \log_{(10)} \left(\frac{0.12\%}{100}\right)$$

$$dB_{(100\%)} = -58.4 \text{ dB}$$

These formulas are correct for modulation percentages typically below 20%.

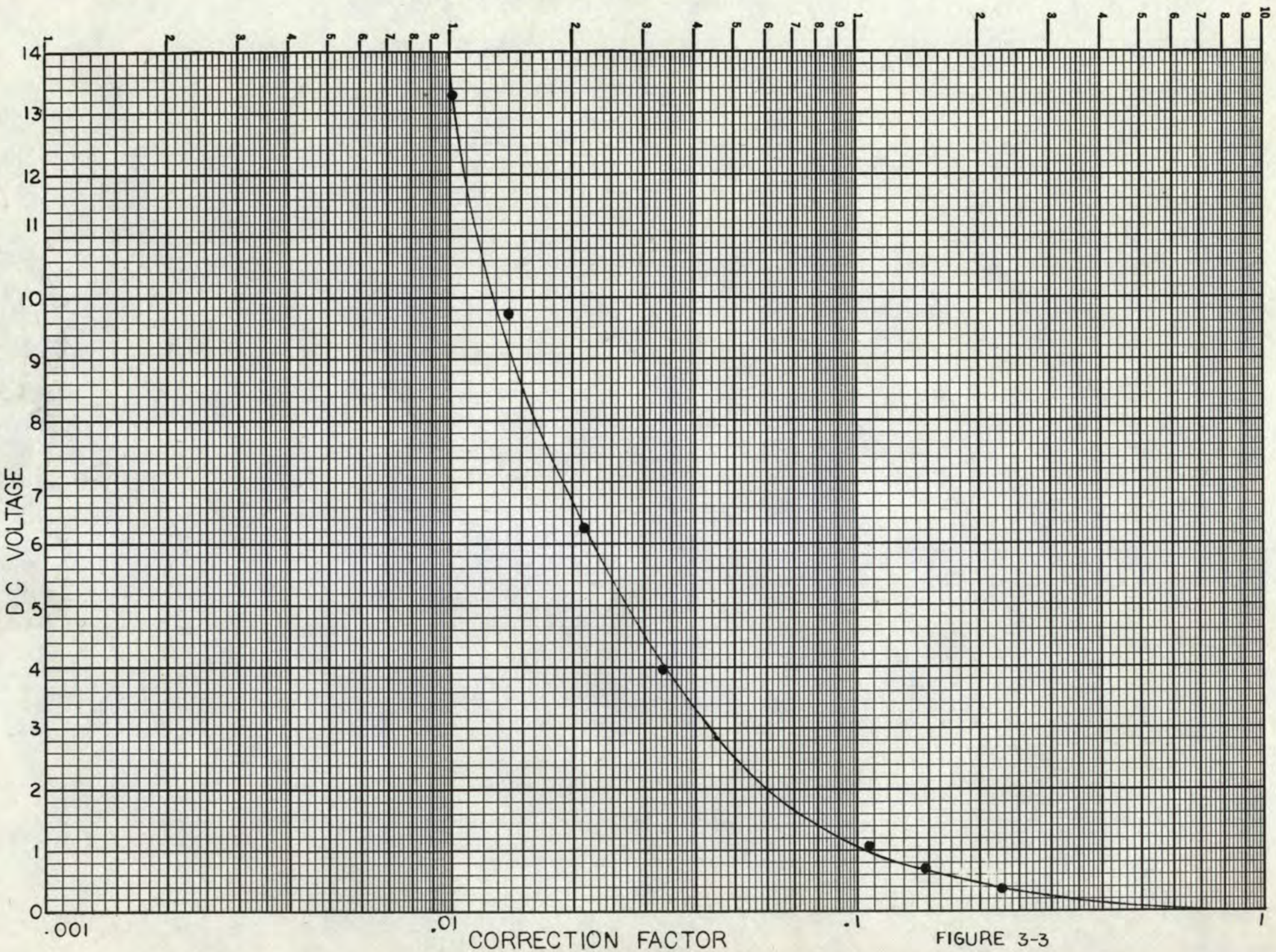


FIGURE 3-3

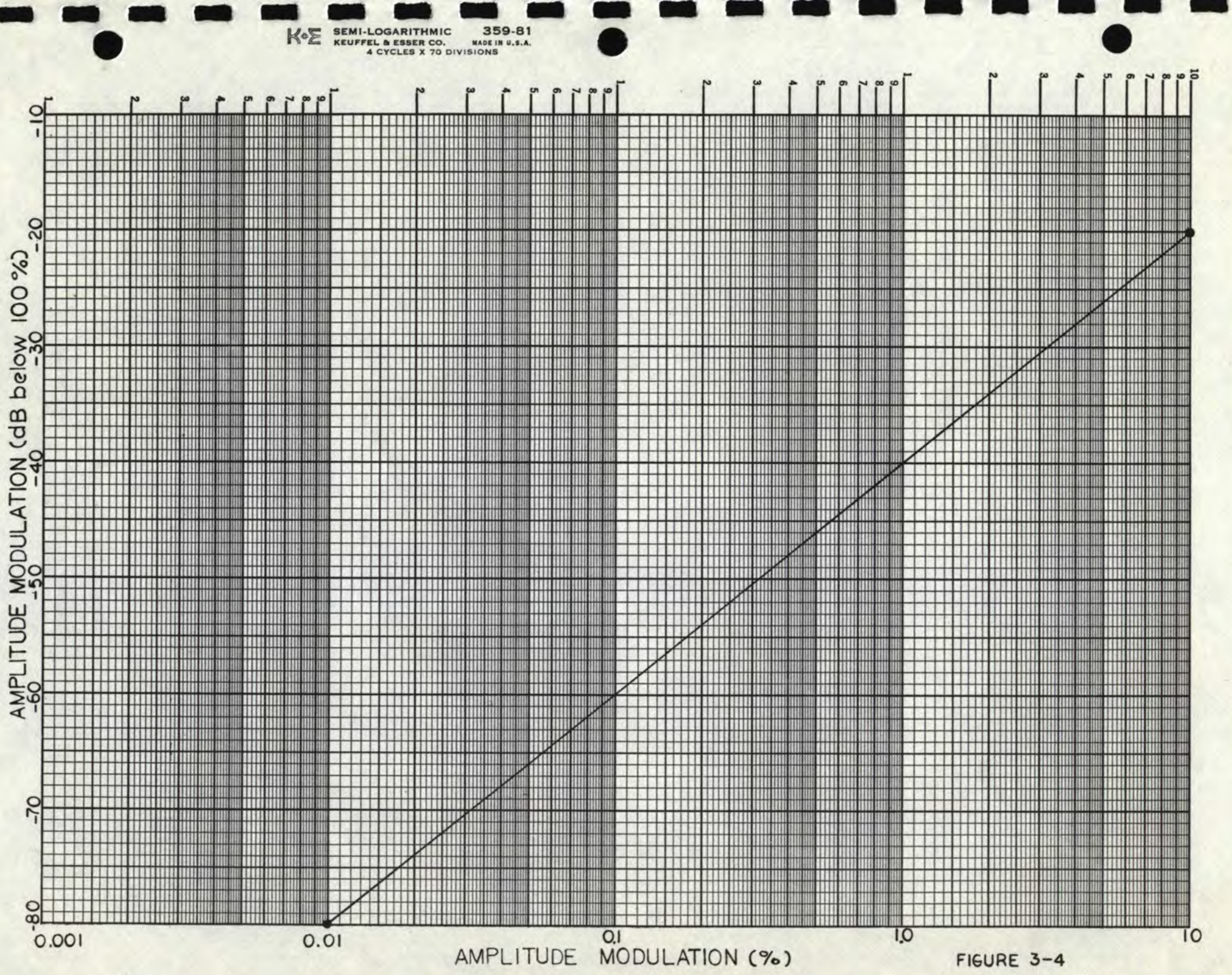


FIGURE 3-4

SECTION 4

THEORY OF OPERATION

4.1 General Block Diagram Discussion.

The Model 723 FM Frequency and Modulation Monitor is a double-conversion superheterodyne receiver capable of accurately measuring the carrier frequency error and total modulation percentage of an FM broadcast signal.

4.1.1 Main Carrier Monitoring.

The discussion in this subsection assumes that the front-panel MAIN CARR switch is depressed (closed) so that the FREQ CTR, SCA CARR, and PILOT CARR switches are out (opened). As shown in the block diagram, Figure 6.1, the signal to be monitored enters the instrument at rear-panel RF INPUT connector J1, and is fed through an image-rejection filter to a double-balanced mixer. The filter is factory adjusted to reject image signals at 21.4 MHz above the transmitter's assigned frequency.

The local-oscillator (LO) signal, at 10.7 MHz above the transmitter's assigned frequency, is produced by a voltage-controlled oscillator (VCO) in a phase locked loop. The 200 kHz reference for the phase detector in the loop is obtained by dividing down the 5 MHz output of a precision crystal oscillator. Thus the stability of the LO input to the double-balanced mixer is as good as that of the crystal oscillator.

The 10.7 MHz first IF signal out of the mixer is passed through a 10.7 MHz filter on Board A3 to reject adjacent-channel interference and then applied to the second mixer. An AGC voltage is derived from the 10.7 MHz first IF. This AGC voltage is applied to an amplifier following the double-balanced mixer to hold the IF level constant; to the 700 kHz limiting amplifier to turn it off when there is no input signal; to an amplifier that drives the front-panel CARRIER LEVEL meter; and to the carrier-off alarm circuit.

In the second mixer, the 10.7 MHz signal is mixed with a 10 MHz LO signal derived from the crystal oscillator. The resulting 700 kHz second IF signal is fed two ways -- to Counter Board A7 and to Discriminator Board A4.

The counter on Board A7 is preset to 700,000 before each counting interval. The IF signal, nominally 700 kHz, in gated through to the counter for one second, causing it to count down. The 1-second counting interval is derived from the 1 kHz frequency, which in turn is derived from the precision 5 MHz source. If the IF is exactly 700 kHz, the frequency error displayed will be zero. If the frequency is less than 700 kHz, the counter will display the number of Hz it falls short of 700 kHz, and the "-" lamp will light. If the frequency is greater than 700 kHz, the counter will count down through zero and back up to display the number of Hz the frequency exceeds 700 kHz; and when the count passes through zero it will turn on the "+" lamp. Since an error in the IF represents an error of the same number of Hz in the carrier frequency, the number displayed will be the carrier frequency error.

The Counter Board also can supply three optional outputs:

a. A digital output to D/A Board A9, which provides an analog output of the monitored carrier's frequency error for logging purposes.

b. The BCD output of the counter, representing the carrier's frequency error, to operate BCD logging equipment.

c. A contact closure to ground when the carrier frequency error exceeds a predetermined amount, to operate an external alarm.

The 700 kHz IF from the limiting amplifier is also fed to a one-shot multivibrator on Board A4, which acts as a pulse-averaging discriminator to extract the modulation; the modulation is then fed through a 95 kHz low-pass filter (to remove the 700 kHz IF signal) to the meter amplifier on Board A5. The input to the meter amplifier is inverted by the "-1" amplifier on Board A5 to measure negative peaks when the front-panel METER (-) switch is depressed. The METER CAL potentiometer allows adjustment of the input to the meter amplifier for calibration purposes. The modulation is peak-detected and fed to the modulation meter.

The modulation from the discriminator is also fed, both direct and inverted, to the threshold detectors on Board A5 where it is compared with a voltage set by the front-panel PEAK MODULATION thumbwheel switches. When the modulation input exceeds the preset voltage, the threshold detectors turn on the PEAK light-emitting diodes (LEDs).

Power for operating the Monitor circuits comes from Power Supply Assembly A6, which furnishes +170 V for the counter display tubes, and +5 V, -15 V, and +15 V for all other circuits.

4.1.2 Calibration Circuits for Modulation Indicators.

When the METER CAL switch is depressed, a 200 kHz signal gated by a 10 kHz square wave is applied from Board A1 to the discriminator on Board A4 to simulate a 100-percent-modulated input, and the resulting demodulated signal is fed to the modulation meter and peak flasher circuits to calibrate them. The modulation meter is calibrated by adjusting the level of the calibration signal at the input of the meter amplifier by means of the METER CAL potentiometer so that the meter reads 100 percent. The peak flasher lamps are calibrated by setting the thumbwheel switches to 100 percent, applying the calibration signal to the threshold detectors, and then adjusting the reference voltage to the threshold detectors so that the lamps just light.

4.1.3 Other Functions.

When the FREQ CTR switch is depressed, the frequency to be counted at front-panel connector J1 is applied through the counter amplifier to Counter Board A7. Likewise, when the SCA CARR or PILOT CARR switch is depressed, the input at the corresponding rear-panel connector is connected through the counter amplifier to the Counter Board.

4.2 Crystal Oscillator (A8).

(Circuit Diagram: Figure 6-11)

This circuit delivers a highly stable 5-MHz output at a level of at least 100 mV to Fixed Frequency Board A1. The oscillator circuit, including the crystal, is on a printed-circuit board mounted in a proportionally controlled oven. The output frequency is factory adjusted to provide an output of 5 MHz $\pm 1 \times 10^{-8}$ MHz at the crystal operating temperature. A 1-MHz signal, obtained from the Crystal Oscillator by means of a divider circuit on Board A1, is fed to a front-panel BNC connector to provide a means for checking the oscillator frequency against WWVB or other precision frequency source. The crystal oscillator can be recalibrated by adjusting capacitor C2.

4.3 Fixed Frequency Board (A1).

(Circuit Diagram: Figure 6-4)

This board divides the 5-MHz output of the Crystal Oscillator to provide a 10-MHz LO input to the mixer on IF Board A3; a 1-MHz output for external use, available at front-panel connector J1; a 200-kHz reference for the phase-locked loop on LO Board A2; a 200-kHz signal for calibration purposes; and a 1-kHz timing input to the counter. Board A1 also contains circuitry for amplifying the input to the counter when the frequency of a signal other than the main carrier is to be measured.

The 5-MHz sinewave input to Board A1 comes from Crystal Oscillator A8 when the rear-panel EXT/INT switch is in the INT position, or from an external precision source fed into rear-panel connector J7 when the switch is in the EXT position. The sinewave input is shaped to a rectangular waveform by Z1 and Z2 to drive the divider chain, Z3 through Z6. Z1 and Z2 also shape the 5-MHz sinewave input into narrow pulses at a 5-MHz rate to drive the 10-MHz harmonic filter, Q1/Q2. The output of the harmonic filter is the LO input to the mixer on Board A3.

In the divider chain, the 1-MHz output from Z3-11 is buffered and fed to front-panel connector J1 when MAIN CARR switch SW4 is pressed. When the front-panel CAL switch is pressed, it applies +5 volts to Z7-12 to gate the 200-kHz output to Z4-11 through to one input of gate Z7. The other input to Z7 is the 10-kHz output of Z5-12. Thus the calibration signal at P1-8 is a 200-kHz signal turned on and off at a 10-kHz rate. The 200-kHz output from Z4-11 is also buffered by Q3 and delivered to P1-12 for use on Board A2. The 1-kHz signal at the end of the divider chain (pin 11 of Z6) is applied directly through P1-11 to Counter/Display Board A7; it is also buffered by Z7-6 and delivered to rear-panel connector J9.

The counter amplifier consists of FET amplifier Q4, differential amplifier Q5/Q6, and NAND gate Z8 which functions as a Schmitt trigger to shape the input into a good square wave to operate the counter. Input to the counter amplifier is from front-panel COUNTER INPUT connector J1 when the FREQ CTR switch is depressed; from rear-panel SCA CARR connector

J5 when the SCA CARR switch is depressed; and from rear-panel PILOT CARR connector J6 when the PILOT CARR switch is depressed. When the MAIN CARR switch is depressed there is no input to this amplifier. The amplifier output is delivered to the Counter/Display Board through MAIN CARR switch SW4 when that switch is not depressed.

4.4 Local Oscillator Board (A2).

(Circuit Diagram: Figure 6-5)

This board produces a local-oscillator (LO) signal that is 10.7 MHz above the assigned frequency of the transmitter to be monitored. The LO signal is generated by a voltage-controlled oscillator (VCO) in a phase-locked loop (PLL) that is referenced to a 200-kHz signal derived from the 5-MHz Crystal Oscillator. See Figure 6-1 for a block diagram of Board A2.

The VCO consists of Q6 and associated circuitry. Inductor L12 in the VCO tuned circuit is factory selected so that the nominal oscillator frequency is 10.7 MHz above the assigned transmitter frequency when a +4VDC voltage is applied to voltage-variable capacitor CR2. The VCO output is buffered by tuned amplifier Q4 and fed to one port of the receiver first mixer. The other input to this mixer is the transmitter signal from channel filter FL2. The 10.7-MHz mixer output is fed through P1-21 to IF Board A3.

The VCO output is also buffered by tuned amplifier Q5 and applied to one input of mixer CR4/CR5. The 5-MHz output of Fixed Frequency Board A1, entering Board A2 at P1-2, is shaped by Z5 and applied to tuned amplifier Q1, Q2, Q3. Inductors L4, L5, and L6 are factory selected to tune the amplifier to the 18th 19th 20th, or 21st harmonic, as required. The resulting output is applied through T1 to mixer CR4/CR5. The output of the mixer is fed through the low-pass filter and driver amplifier Q11, Q10, Q9 to the divide-by-N circuit. As shown in Figure 6-5, the appropriate terminals of dividers Z3 and Z2 are grounded to cause the divide-by-N divider to divide the output of mixer CR4/CR5 by that value of N that will produce an output of exactly 200 kHz when the output of the VCO is exactly 10.7 MHz above the assigned transmitter frequency.

The nominal 200-kHz output of the divide-by-N circuit is compared with the precision 200-kHz reference signal from Board A1 in the phase detector consisting of Z6, Q7, Q8, Z7, and associated circuitry. When the two inputs are exactly in phase, the DC output of the phase detector, applied to CR2, is the correct value to tune VCO Q6 to its nominal frequency. If the VCO frequency changes from its nominal value, the resulting phase displacement between the two inputs to the phase detector produces a change in the voltage applied to CR2 that tunes the VCO back to its nominal frequency.

4.5 IF Board (A3).

(Circuit Diagram: Figure 6-6)

The nominally 10.7-MHz input from Board A2 is amplified by Z1 and Z2 and applied to one input (pin 1) of the receiver second mixer, Z3. A 10-MHz input from Board A1 is applied to pin 8 of the mixer. The resulting nominally 700-kHz output of the mixer (at pin 6) is amplified by Z5. One output of Z5 is delivered to the counter through front-panel MAIN CARR switch SW4, and the other output is delivered to Discriminator Board A4.

The output of IF amplifier Z2 is also amplified by Q1, rectified by CR1, and amplified by Z4 to supply the AGC voltage for the first IF amplifier, Z1. The AGC voltage is also applied through differential amplifier Z6 to relay switch Q2 and squelch switch Q3. When an adequate carrier signal from the monitored transmitter is received, a negative voltage is produced at Z6-6 which turns off Q2 and allows the contacts of K1 to open. If, however, the carrier fails, a positive voltage appears at Z6-6 which turns on Q2 and closes the contacts of K1. This contact closure at rear-panel connectors J3 and J4 can be used to actuate an external alarm.

When the carrier fails, the positive voltage at Z6-6 also turns off Q3, which turns off limiting amplifier Z5 to provide a squelch action. When an adequate carrier is received, Q3 is turned on, which enables Z5 and passes the IF through to Board A4. Amplifier Z5 also applies the IF to Counter Board A7 when the front-panel MAIN CARR switch is depressed.

The AGC voltage from Z4-6 is also amplified by Z7 to drive the CARRIER LEVEL meter. Potentiometer R41 is used to calibrate the meter by adjusting the differential input to amplifier Z7.

The filter between Z1 and Z2 is a sealed unit and therefore not adjustable. This filter provides the excellent selectivity that allows the monitor to be used in an off-the-air operating mode, without being disturbed by close channels. At the same time phase linearity is maintained to allow accurate stereo separation and distortion measurements when the Model 724 Stereo Monitor is used.

4.6 Discriminator Board (A4)

(Circuit Diagram: Figure 6-7)

When the front-panel METER + or METER - switch is depressed, a ground is applied through P1-4 to Z1-11 to enable that gate and pass the 700-kHz IF from Board A3 on to one-shot Z2. This one-shot acts as a pulse-averaging discriminator; its output contains the audio modulation as well as the 700-kHz IF.

After buffering by Q1 through Q4, the one-shot output is fed through a 95-kHz low-pass filter to remove the 700-kHz IF, buffered again by Z5, and delivered to the modulation meter and peak flashers on Board A5. The audio output of Z5 is also fed to two amplifiers, one (Z6) with a 75-microsecond de-emphasis network and the other (Z7) without a de-emphasis network. These outputs are available at rear-panel connectors J8 and J2, respectively. The modulated 700-kHz output of the one-shot buffer is also delivered to rear-panel connectors J10 and J11 for use with auxiliary equipment.

When the front-panel METER CAL switch is depressed, a positive voltage is applied to P1-4 which disables the 700-kHz IF gate, Z1-13, and enables the calibration signal gate, Z1-3. The calibration input at P1-2 is a 200-kHz signal gated by a 10-kHz square wave, which simulates a 100-percent-modulated carrier. This calibration signal is demodulated by the one-shot discriminator and fed through a 10-kHz low-pass filter to P1-7. With the METER CAL switch in the CAL position, the calibration signal is delivered to the peak flasher input on Board A5, and also through front-panel METER CAL potentiometer R2 to the modulation meter input on Board A5.

4.7 Meter Amplifier and Peak Flasher Board (A5)

(Circuit Diagram: Figure 6-8)

This board drives the modulation meter and the positive and negative peak flashers. Outputs are also provided for a remote flasher and a remote modulation meter.

In normal operation, the modulation of the monitored carrier from Discriminator Board A4 enters Board A5 at P1-8. It is applied to the noninverting input (pin 3) of comparator Z5. The inverting input of Z5 (pin 4) is a DC voltage from reference amplifier Z1, which establishes the threshold at which the positive peak flasher will light. The input to reference amplifier Z1 is a positive DC voltage less than 1 volt; the exact value is set by front-panel FLASHER CAL potentiometer R1. The gain of reference amplifier Z1, and therefore its output voltage, are determined by the feedback resistance selected by the front-panel PEAK MODULATION thumbwheel switches. Thus the thumbwheel switches can be used to set the threshold at which the modulation will produce an output pulse from comparator Z5. Pulses from Z5 trigger one-shot Z4-2/Z4-13, which stretches each pulse to approximately 1.8 seconds. These stretched pulses are fed through buffer Z6-11 to amplifier Z7-5, which drives the positive peak flasher LED. This output is also delivered to rear-panel connector J12-C to operate a remote flasher.

The negative peak flasher circuit (Z3, Z4-3, Z4-14, Z6-8, Z7-3) operates in the same way, except that the input at P1-8 is first inverted by unity-gain amplifier Z2. This inverted signal at Z2-6 is also fed to front panel METER (-) switch. The other input to this switch is the noninverted signal from P1-8 of A5. Thus, either positive or negative modulation can be selected for the modulation meter. Whichever is selected is applied to front-panel METER CAL potentiometer R2; the audio signal at the wiper of thi s potentiometer enters Board A5 at P1-11, is amplified by Z8, detected by CR3, and applied through voltage follower Z9 t o both the front-panel modulation meter and the rear-panel REMOTE METER connector, J12-A.

4.8 Channel Filter

This is a band-pass filter designed to reject the image frequency 21.4 MHz above the station being monitored, and also to reject lower frequency signals whose harmonics might interfere with the signal being monitored. This unit is sealed, and not adjustable.

4.9 Power Supply (A6)

(Circuit Diagram: Figures 6-2 and 6-9)

The Power Supply provides four outputs: -15V, +15V, +5V, and +170V. In the -15V supply, AC from pins 11 and 12 of T1 on the chassis is rectified by CR1 through CR4, filtered by C1, and regulated by Q1 and Z1. The output voltage level is adjusted by R3.

The +15V supply is similar to the -15V supply, except that the rectifier for the +15V supply (CR1) is located on the chassis. The output is adjusted by R7.

In the + 5V supply, the rectifier (CR2) is located on the chassis. The output of the rectifier is delivered to pin 22 of P1 where it is filtered and returned to series regulator Q1, also located on the chassis. The series regulator is controlled by regulator Z3, and the output is adjusted by R13.

The +170V supply for the display tubes is fed from AC at pins 5 and 6 of T1 through front-panel PWR switch SW9. The AC is rectified by CR5, filtered by C4, and fed to the display tubes on Board A7 through P1-18.

4.10 Counter and Display Board (A7)

(Circuit Diagram: Figure 6-10)

If the carrier being monitored is precisely on its assigned frequency, the IF will be precisely 700 kHz. The counter measures and displays any error in this frequency. The counter can also be used for general test purposes as described below.

The source for the counter time base is the 1-kHz signal from Board A1, which enters the Counter Board at pin 16 of J1. When the front-panel PILOT CARR switch SW5 is not depressed, the 1-kHz signal is gated through to Z6 by Z41. Z6, Z5, and Z4 are decade dividers which produce a pulse train with a frequency of 1 Hz at pin 11 of Z4. When SW5 is depressed, the 1-kHz input is divided by 10 in Z40 before being applied to the divider chain; in this case, the output frequency at Z4-11 is 0.1 Hz. This 1-Hz (or 0.1-Hz) output is ANDed with 500-Hz and 100-Hz pulses from Z6-12 and Z6-11 to toggle flip-flop Z1 (pin 6) in such a way that a waveform is produced at TP2 which is high for 1 second and low for 10 milliseconds, respectively. The frequency to be counted (nominally 700 kHz) at pin 2 of J1 and at TP1 is thus gated on through NAND gate Z3-11 for 1 second and then gated off for 10 milliseconds, repetitively. This waveform is applied to one-shot Z39, which produces short pulses suitable for driving the counter.

The gated signal is applied to the up-down counter chain consisting of Z17, Z16, Z15, Z14, Z13, and Z12. This counter, which is laid out in Figure 6-10 in the same order from left to right as the display tubes appear on the front panel, is preset to a count of 700,000. During the 1 second that the monitored signal is gated through to the counter, the counter counts down. If and when the count reaches zero, all inputs to zero detector Z18 will be logic 1 and Z18 drives the set input (pin 7) of flip-flop Z20 low to produce a logic 0 at pin 10 of Z20, thus causing the counter to start counting up. The other Z20 flip-flop stores information as to whether the counter was counting up or down at the end of the 1-second counting period and drives the "+" or "-" lamp on the front-panel frequency error display to indicate whether the frequency is high or low. Gate Z19 is disabled by a control signal from Z11 when the counter is in the general-purpose counter mode.

At the end of the 1-second counting period, the level at the TP2 GATE test point drops to 0 for 10 milliseconds, as explained in a preceding

paragraph. During this 10-millisecond interval, the count reached by the six counters is transferred to the storage register consisting of latches Z21 through Z26. Transfer is effected by a logic 1 level from the 1-Hz time-base circuit which is fed to the storage register latches on the line connecting to test point TP4 TRANSFER. The count is held in the storage register during the next 1-second counting period. Each storage-register latch drives a display tube through a BCD-to-decimal decoder (Z27 through Z32) to indicate the frequency count.

After transfer of information from the counters to the storage register is completed, the counters are reset to a count of 700,000 by a logic 0 from the 1-Hz time-base circuit which is fed to counters Z12 through Z17 on the pin-11 line connecting to test point TP3 LOAD. While the level on the LOAD line is 0 , each counter is preset to a count determined by the logic level on its data inputs (pins 9, 10, 1 and 15). These data inputs are wired to ground or +5 volts, depending on the count required. At the end of the zero-level pulse on the LOAD line, the counters are ready to begin a new 1-second count.

A positive-going transfer pulse at pin 6 of Z36 is applied to pin 1 of flip-flop Z1, which produces an output at pin 15 to turn the front-panel GATE LED on and off at the counter gating rate to indicate normal operation of the gate.

When the counter is operated as a general-purpose counter, the resolution can be set to either 1 Hz or 10 Hz by a front-panel switch. When the switch is in the 10-Hz position, gates Z9 select the output of Z8 rather than the signal at pin 2 of J1. The output of Z8 is the frequency at pin 2 of J1 divided by 10.

The circuit consisting of Z33, Z10, and Z11 operates in the general-purpose counter mode to turn on the front panel OVERFLOW lamp when the count into the counter exceeds its capacity.

4.11 Digital-to-Analog Converter (A9) (Optional)

(Circuit Diagram: Figure 6-12)

This board provides a DC voltage output proportional to the digital counter reading for automatic logging equipment that requires an analog input. The digital BCD information is brought from the Counter Board and is converted to a DC voltage by Z1. Z3, Q1, and Q2 switch the output of Z5 to positive when "+" errors are detected. The output of Z5 swings ±1 volt for ±1kHz frequency error and is delivered to J14 on the rear panel.

4.12 Carrier Frequency Alarm (Optional)

Relay K1 and associated circuitry in the lower right-hand corner of Figure 6-10 are for an optional off-frequency alarm. The gate inputs can be wired to the counter BCD outputs to cause K1 to energize and place a ground on pin B of rear-panel connector J12 whenever the measured frequency error exceeds a specified limit. This limit is factory wired, and is usually ±1kHz unless otherwise specified.

4.13 BCD Automatic Logging (Optional)

The BCD Auto Log option brings the digital information for the counter display to rear-panel connector J14. This BCD information contains the error frequency only when the MAIN CARR button is depressed on the Model 723 front panel. The "+" and "-" information is also brought out for recorders equipped to accept it. The digital information is positive true BCD with TTL-compatible levels. The pin connectors for J14 are shown in the table below.

Rear-Panel J14 Wiring With BCD Auto Log Option

Pin	Function	Pin	Function
1 - D		17 - D	
2 - C	10-kHz	18 - C	1-Hz
3 - B	Digit	19 - B	Digit
4 - A		20 - A	
5 - D		21 - D	
6 - C	100-kHz	22 - C	10-Hz
7 - B	Digit	23 - B	Digit
8 - A		24 - A	
9 - D		25 - NC	
10 - C	100-Hz	26 - Gnd	
11 - B	Digit	40 - "-"	
12 - A		41 - "+"	
13 - D		50 + 5 Volts DC	
14 - C	1-kHz		
15 - B	Digit		
16 - A			

4.14 Modulation Alarm A10 (Option) Figure 6-13

The modulation alarm option takes the recovered audio signal from pin 12 of the meter amp-peak flasher board (A5). Q2 amplifies the audio to drive a switch (Q3) to discharge the integrating capacitor C22. As long as modulation greater than approximately 10% is present, C22 remains discharged. When the modulation is lost, C22 starts charging to the +15 volt supply through R38. When the voltage on C22 reaches the voltage set by R40 on the input of Z7, Relay K3 shorts terminals D and E of the rear panel connector J12 together. Adjusting the voltage at the input to Z7 using R40 varies the delay from loss of modulation to contact closure by making C22 charge to a higher voltage.

SECTION 5

MAINTENANCE

5.1 General.

Since the Model 723 is a solid-state instrument and its 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 and periodic maintenance are covered in Sections 5.2 and 5.3. Three methods of calibrating the master oscillator are described in Section 5.4. Other calibration procedures are covered in Sections 5.5 through 5.7.

5.2 Access.

To gain access to the top-of-chassis components (all printed-circuit boards and the master oscillator assembly) remove six screws from the top cover, three on each side, and then remove the top cover. Removing six similar screws from the bottom cover provides access to the below-chassis components (connectors, power transformer, and switches).

5.3 Periodic Maintenance.

Except for the master oscillator 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 Master Oscillator Calibration.

The 5-MHz crystal master oscillator should be calibrated periodically. The aging rate of the master oscillator is typically 1 ppm per year. For a monitored frequency of 100 MHz, the local oscillator frequency is 110.7 MHz, and the typical error would be 110.7 Hz per year. Thus, calibration once a year should ensure keeping the monitor's frequency error well within the FCC allowable transmitter frequency error, even at the high-frequency end of the FM broadcast band.

Three calibration methods are described in Sections 5.4.1, 5.4.2, and 5.4.3. For all methods, to adjust the master oscillator frequency remove the instrument from the rack and remove the top cover, as described in Section 5.2. Then remove the button plug from the master oscillator module, and turn the master oscillator trimmer capacitor shaft with a nonmetallic adjusting tool.

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 Model 723 master oscillator.

a. Remove the instrument from the rack and remove the top cover.

b. Depress the front-panel MAIN CARR switch button.

c. Connect the 1-MHz output of the secondary standard to the external sync input of a 10-MHz oscilloscope. Adjust the oscilloscope for external sync.

d. Connect the 1-MHz OUTPUT connector on the front panel of the Model 723 to the vertical input of the oscilloscope.

e. Adjust the oscilloscope vertical gain for full-scale defletion and adjust the horizontal sweep speed to 0.1 microsecond per centimeter.

f. Adjust the Model 723 master oscillator frequency for the least movement of the oscilloscope display.

5.4.2 Calibration by Measuring a Standard Frequency Using Frequency Counter Mode.

If a frequency standard of higher accuracy than the monitor's master oscillator is available, such as the color subcarrier transmitted by TV network originated programs, the following method can be used to calibrate the master oscillator.

a. Depress the front-panel FREQ CTR switch button.

b. Connect the output of the frequency standard into the front-panel COUNTER INPUT jack, first making sure the standard signal does not exceed 2V RMS. (Use an attenuator to start with if the voltage is unknown).

c. Adjust the Model 723 master oscillator until the monitor readout indicates the frequency of the signal being applied.

5.4.3 Calibration Using a WWVB Receiver.

This method provides the best calibration accuracy.

a. Depress the MAIN CARR pushbutton on the Model 723 front panel to provide a 1-MHz output at the front-panel connector.

b. Connect the front-panel 1-MHz OUTPUT connector to the WWVB receiver.

c. Refer to the WWVB receiver instructions for the proper setup and method of calibrating the master oscillator.

5.5 Calibration of Modulation Meter.

a. Depress the front-panel METER CAL switch. The modulation meter should read 100%. If it does not, adjust the front-panel METER CAL potentiometer.

b. To check balance, hold the METER CAL switch down while pressing the METER (-) switch. The meter should read the same as before within 2%.

5.6 Calibration of Peak Flashers.

a. Depress the front-panel METER CAL pushbutton.

b. Set the front-panel thumbwheel switches to read 100%. The peak flashers should light or flash on and off.

c. Set the thumbwheel switches to 101%. The + and - PEAK lamps should go off.

d. If the PEAK flashers are not on or flashing at a thumbwheel setting of 100%, or if they do not remain off at a setting of 101%, adjust the front-panel FLASHER CAL potentiometer.

5.7 Adjustment of Internal Calibration Circuits.

The calibration procedures of Sections 5.5 and 5.6 assume that the internal calibration circuits are supplying a simulated FM signal modulated exactly 100% (±75-kHz deviation). The internal calibration circuits can be checked by applying a test signal known to be modulated 100% to the Model 723, adjusting the meter circuits so the meter reads 100%, and then substituting the internal calibration signal for the test signal and noting whether the meter again reads 100%. The modulation of the test signal is set to 100% by using the second Bessel null, which occurs when an FM carrier is modulated 100% with a 13.587-kHz signal.

To check the accuracy of the internal modulation meter calibration circuits, make the test setup of Figure 5-1. Either the FM transmitter being monitored or a signal generator covering the transmitter's assigned frequency and capable of being frequency-modulated by an audio generator can be used to supply the RF input to the Model 723. The METER + switch should be depressed.

a. Set the modulation level at a low level, and adjust the modulation frequency to precisely 13.587 kHz. If an audio generator is being used, its frequency can be measured by the Model 723 counter with the instrument in the general-purpose counter mode (see Section 3.10).

b. Adjust the modulation level until the spectrum analyzer or the frequency selective voltmeter indicates a carrier null. The Model 723 modulation meter should read exactly 100%.

c. If the meter does not read 100%, adjust the front-panel METER CAL control until the meter reads exactly 100%.

d. Depress the METER CAL switch on the Model 723 front panel. On Board A4, adjust potentiometer R28 so that the meter reads exactly 100%. The internal calibration circuits are now properly adjusted.

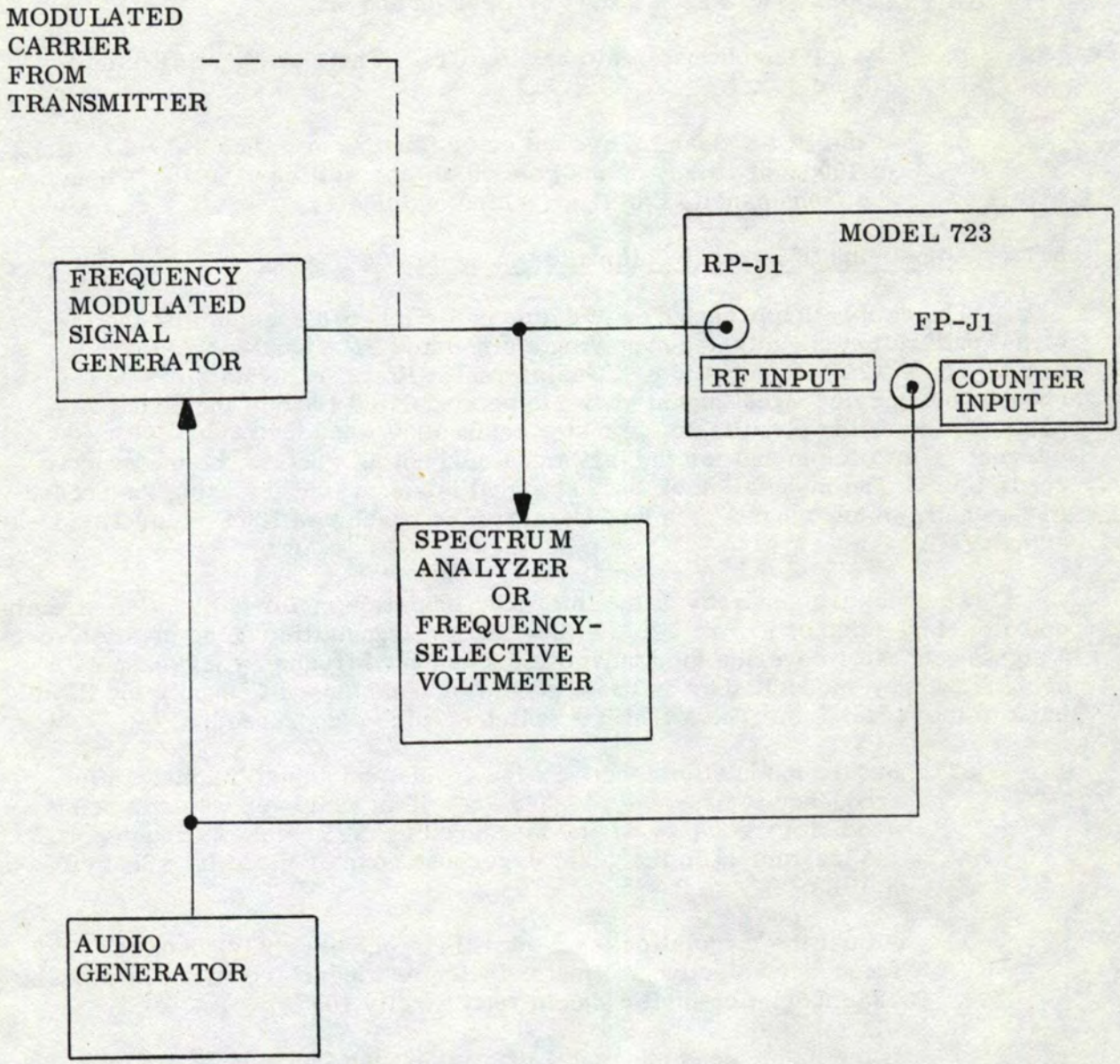


Figure 5-1. Internal Calibration Circuits Test Setup.

SCHEMATIC DIAGRAMS

REVISIONS		
LTR	Description	Date
A	RELEASED TO PRODUCTION	4-6-72
B	REVISED PER ECO # 93	10-24-73
C	REVISED PER ECO # 116	12-27-73
D	REVISED PER ECO # 145	4-11-74

SCA CARRIER INPUT
RP J5
PILOT CARRIER INPUT
RP J6
FREQUENCY COUNTER INPUT / 1MHz OUTPUT
FP J1
SCA CARRIER
PILOT CARRIER
COUNTER AMP PART OF A1
FREQUENCY COUNTER MAIN CARRIER
SCA CARRIER
PILOT CARRIER
FREQ. COUNTER
MAIN CARRIER
+ / − OF
0 0 0 0 6 6 KHz
COUNTER BOARD A7
OPTIONAL D/A CONVERTER A9
TO R.P.
BCD OUTPUT OPTION
TO R.P.
OFF FREQUENCY ALARM OPTION
TO R.P.
1 KHz
+5V
TO MODEL 724
L.O. BOARD A2
I.F. BOARD A3
DISCRIMINATOR BOARD A4
RF INPUT LOW LEVEL
RP J1
CHANNEL FILTER
DOUBLE BAL. MIXER
L.O. SIGNAL BUFFER AMP.
10.7 MHz AMP
10.7 MHz FILTER
10.7 MHz AMP
10.7 MHz
MIXER
10 MHz
700 KHz LIMITING AMP
AGC AMP & DETECTOR
SQUELCH AMP
CARRIER LEVEL METER AMP
CARRIER LEVEL METER
CARRIER LEVEL ALARM
TO R.P. J3 AND J4
OPERATE
CAL
ONE SHOT
5 KHz LOWPASS
95 KHz LOWPASS
7.00 KHz OUTPUT #1
700 KHz OUTPUT #2
AUDIO OUTPUT WITH DE-EMPHASIS
AUDIO OUTPUT
OPERATE
CAL
RF INPUT HIGH LEVEL (1V to 10V MAX)
45 dB ATTEN. 50 Ω
AM DETECTOR
AM DETECTOR OUTPUT
VOLTAGE CONTROLLED OSC
DC CONTROL VOLTAGE
BUFFER AMP
MIXER
90, 95, 100, 105 MHz FILTER
5 MHz
PHASE DETECTOR
200 KHz
÷ N
200 KHz REF.
METER AMP & PEAK FLASHER BOARD A5
+15V
I
FLASHER CAL
FRONT PANEL THUMBWHEEL SWITCH
+5V
"-1" AMP
THRESHOLD DETECTOR
"+" PEAK
TO REMOTE PANEL
THRESHOLD DETECTOR
"−" PEAK
TO REMOTE PANEL
"+" "−"
METER CAL
METER AMP
D.C. AMP
TO REMOTE PANEL
% MODULATION METER
FIXED FREQ. BOARD A1
BUFFER
200 KHz
200 KHz
÷ 20
10KHz
÷ 10
1 KHz TO R.P.
1 MHz
÷ 5
10 MHz FILTER
÷ 5
BUFFER
BUFFER
1KHz
CAL SIGNAL 200 KHz GATED BY 10 KHz SQUAREWAVE
A8 5MHz OVEN OSCILLATOR
A6 POWER SUPPLIES
+170 VDC
+15 VDC
+5 VDC
-15 VDC

TFT TIME AND FREQUENCY TECHNOLOGY, INC.

SCALE	APPROVED BY	DRAWN BY D.S.
DATE		REVISED

BLOCK DIAGRAM

FIG. 6-1 MODEL 723 DRAWING NUMBER 6600-0310

CHASSIS ASSEMBLY MODEL 723

CKT. REF	DESCRIPTION	STOCK NUMBER	MFGR.
J-J8	22 Pin Edge Connector	2250-1030	SAE
P1	16 Pin Connector	2220-1016	Cinch
T1	Transformer, Power	1500-0062	Tranex
Q1	Transistor MJE-3055 NPN	1272-3055	Motorola

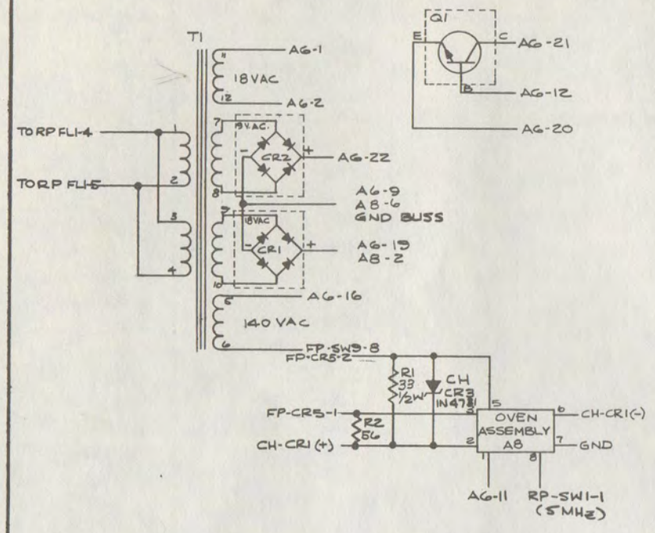
FRONT PANEL ASSEMBLY MODEL 723

CKT. REF	DESCRIPTION	STOCK NUMBER	MFGR.
J1	BNC Connector	2200-7935	Kings
CR1	Diode Light Emitting	1285-4403	H-P
CR2	Diode Light Emitting	1285-4403	H-P
CR3	Diode Light Emitting	1285-4403	H-P
CR4	Diode Light Emitting	1285-4403	H-P
CR5	Diode Light Emitting	1285-4403	H-P
CR6	Diode Light Emitting	1285-4403	H-P
CR7	Diode Light Emitting	1285-4403	H-P
CR8	Diode Light Emitting	1285-4403	H-P
CR9	Diode Light Emitting	1285-4403	H-P
CR10	Diode Light Emitting	1285-4403	H-P
CR11	Diode Light Emitting	1285-4403	H-P
M1	Carrier Level Meter	1400-1003	Beede
M2	Modulation Meter	1400-7045	API
R1	1K Potentiometer	1071-1001	CTS
R2	1K Potentiometer	1071-1001	CTS
SW9	Switch 9 Station Assembly	1850-0070	IEE
SW10)	Thumbwheel Switch	5102-0530	Interswitch
SW11)	2 Station Ganged		

REVISIONS		
LTR	Description	Date
A	RELEASED TO PRODUCTION	4-6-73
B	REVISED PER ECO # 93	10-24-73
C	REVISED PER ECO # 116	12-28-73
D	REVISED PER ECO # 131	2-7-74
E	REVISED PER ECO # 155	4-29-74
F	REVISED PER ECO # 170	7-2-74

J1 — CH-A2-21

CHASSIS WIRING



A1	
1	GND
2	FP-SW5-11
3	SWITCHED +5V
4	FP-SW4-7
5	NC
6	-15V BUSS
7	GND
8	A4-2
9	FP-SW4-11
10	GND
11	CH-A7-J1-16
12	A2-6
13	GND
14	RP-J9
15	FP-SW1-5 & CH-A4-4
16	+15V BUSS
17	A3-19
18	-15V BUSS
19	A2-2
20	RP-SW1-2
21	+5V BUSS
22	GND

FIXED FREQUENCY

A2	
1	GND
2	A1-19
3	SWITCHED +5V
4	-15V BUSS
5	+5V BUSS
6	A1-12
7	GND
8	+5V BUSS
9	-15V BUSS
10	GND
11	GND
12	GND
13	GND
14	GND
15	+15V BUSS
16	-15V BUSS
17	RP-T81-5
18	GND
19	RP-FL2
20	GND
21	CH-A3-J1
22	GND

L.O.

A3	
1	GND
2	
3	GND
4	-15V BUSS
5	GND
6	FP-M1(+)
7	GND
8	+5V BUSS
9	GND
10	FP-M1(-)
11	GND
12	RP-J3
13	+15V BUSS
14	RP-J4
15	GND
16	FP-SW4-9
17	CH-A4-5
18	GND
19	A1-17
20	GND
21	-15V BUSS
22	GND

I.F.

A4	
1	GND
2	CH-A1-8
3	N.C.
4	FR-SW1-5 & CH-A1-15
5	CH-A3-17
6	+5V BUSS
7	FP-SW1-7
8	GND
9	RP-J10
10	RP-J11
11	+15V BUSS
12	N.C.
13	-15V BUSS
14	NC.
15	GND
16	GND
17	RP-J2
18	NC.
19	FP-SW1-9
20	NC.
21	RP-J8
22	GND

DISCRIMINATOR

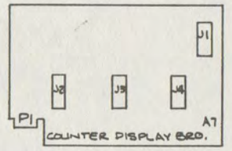
A5	
1	GND
2	FP-R1-2
3	FP-SW11
4	+15V BUSS
5	GND
6	FP-SW3-4
7	GND
8	FP-SW3-6
9	FP-SW10
10	GND
11	CH-R2-2
12	CH-A10-6
13	-15V BUSS
14	GND
15	RP-J12-A
16	FP-M2(+)
17	+5V BUSS
18	FP-CR10-2
19	RP-J12-C
20	FP-CR11-2
21	RP-J12-G
22	GND

PEAK FLASHER & METER AMP.

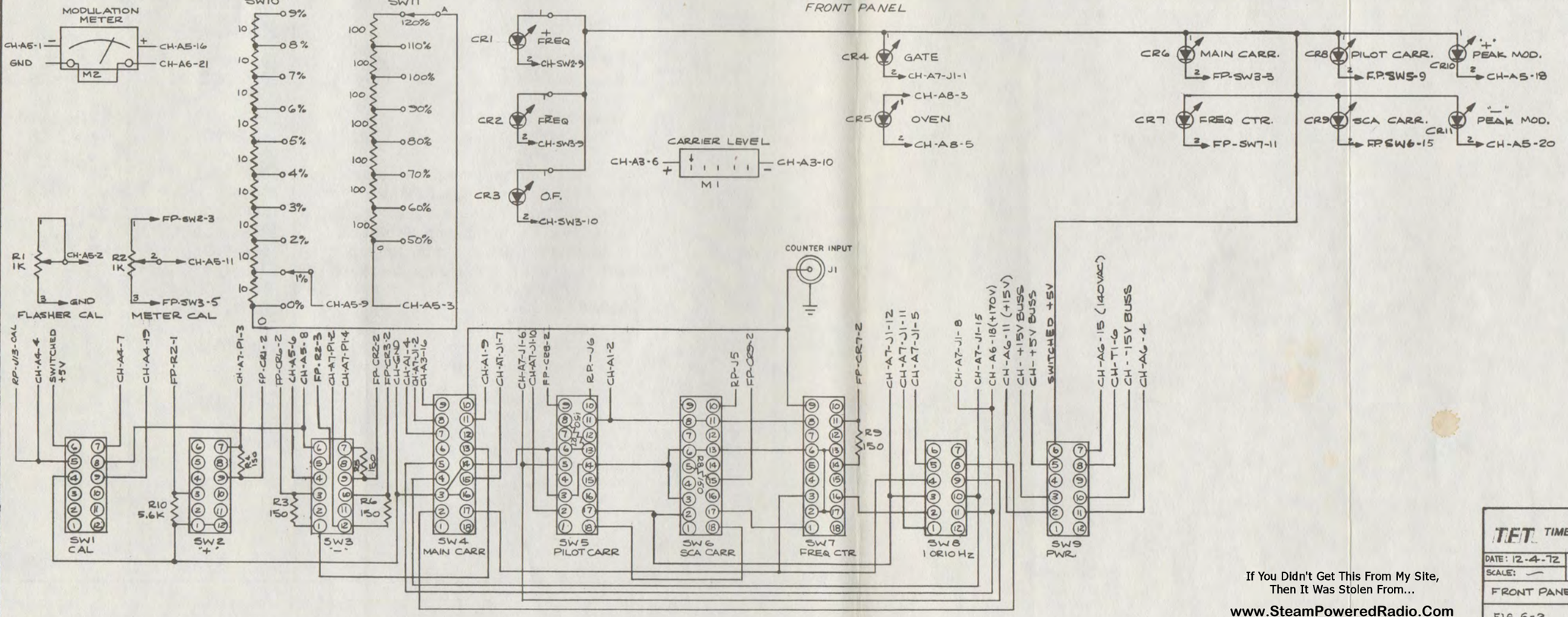
A6	
1	T1-11
2	T1-12
3	NC.
4	-15V (FP-SW9-11)
5	NC
6	GND
7	NC
8	NC
9	CR1-(-)
10	GND
11	+15V (FP-SW9-2)
12	CH-Q1-B
13	+5V BUSS
14	+5 BUSS
15	FP-SW9-7
16	T1-5 (GND)
17	GND
18	+170V-SW8-11
19	CR1-(+)
20	CH-Q1-E
21	CH-Q1-C & R.P.-J13+10V
22	CR2-(+)

POWER SUPPLY

A7		
PIN	J1	P1
1	FP-CR4-2	CH-+5V BUSS
2	FP-SW4-8	FP-SW3-12
3		FP-SW2-7
4		FP-SW3-7
5	FP-SW8-5	
6	FP-SW5-5	CH-GND
7	FP-SW4-17	
8	FP-SW8-11	
9	GND	
10	FP-SW5-2	
11	FP-SW8-1	
12	FP-SW8-3	
13	GND	
14	RP-J12-B	
15	FP-SW8-10	
16	CH-A1-11	



FRONT PANEL



A10	
1	GND
2	
3	-15V
4	
5	+15V
6	CH-A5-12
7	
8	RP-J12-D
9	
10	
11	
12	RP-J12-E
13	
14	+5V
15	
16	
17	
18	
19	
20	
21	
22	GND

MODULATION ALARM OPTION

TFT TIME AND FREQUENCY TECHNOLOGY, INC.

DATE: 12-4-72	APPR. BY	DRN. BY D.S.
SCALE: —		REVISION

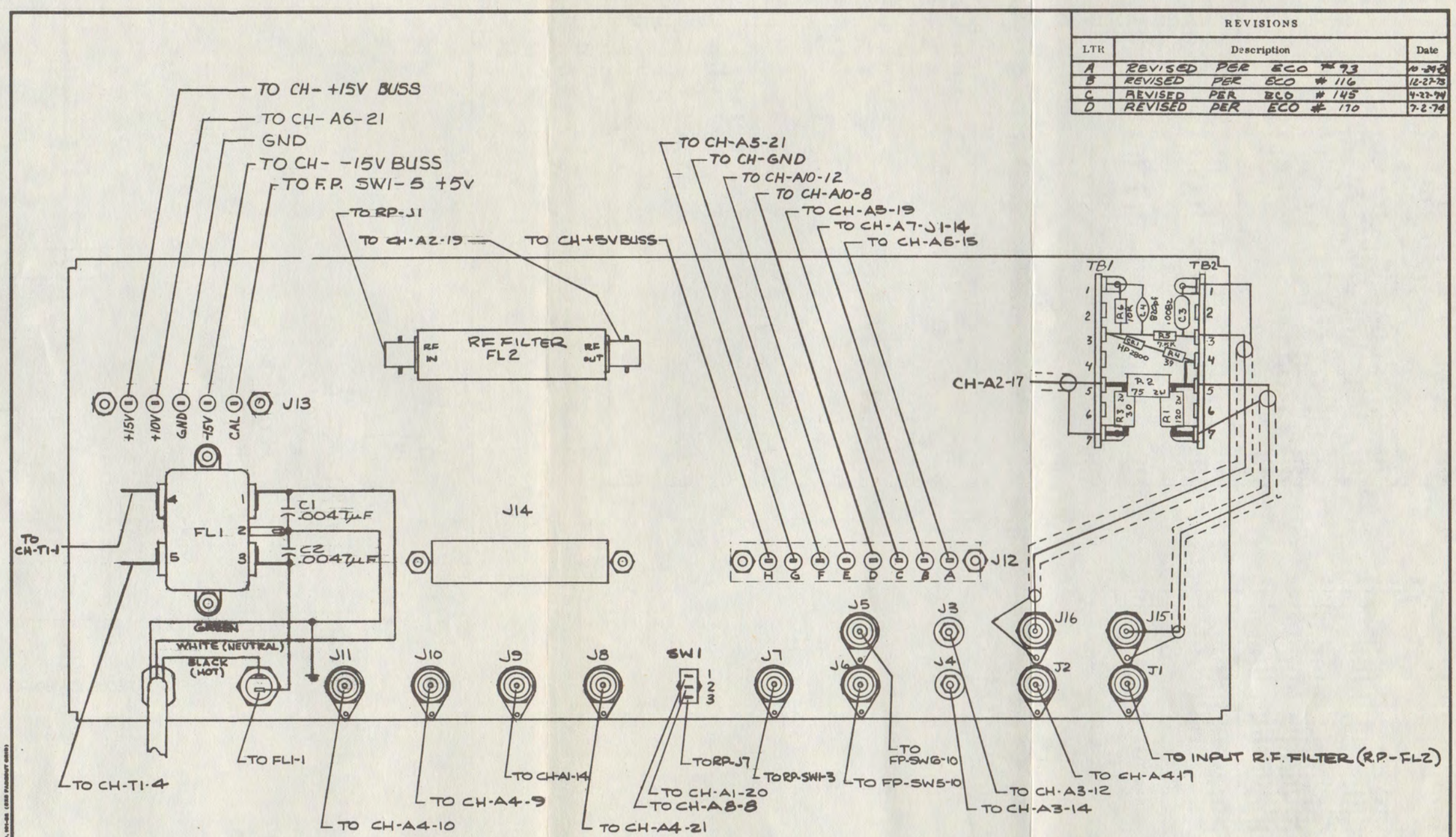
FRONT PANEL & CHASSIS WIRING DIAGRAM

FIG 6-2 MODEL 723 DWG NO. 6600-0320

REAR PANEL ASSEMBLY MODEL 723

CKT. REF	DESCRIPTION	STOCK NUMBER	MFGR.
C1	Capacitor .0047μf ±20% 1KV	1005-4749	Erie
C2	Capacitor .0047μf ±20% 1KV	1005-4749	Erie
C3	Capacitor .0082μf Orange Drop	1002-1829	Sprague
C4	Capacitor 820 pf Disc	1005-0821	
J1	BNC Connector	2200-7935	King
J2	BNC Connector	2200-7935	King
J3	5 Way Binding Post	2200-0001	Pomona
J4	5 Way Binding Post	2200-0001	Pomona
J5	BNC Connector	2200-7935	King
J6	BNC Connector	2200-7935	King
J7	BNC Connector	2200-7935	King
J8	BNC Connector	2200-7935	King
J9	BNC Connector	2200-7935	King
J10	BNC Connector	2200-7935	King
J11	BNC Connector	2200-7935	King
J12	8 Pin Terminal Block	1700-0008	Curtis
J13	5 Pin Terminal Block	1700-0005	Curtis
	Ground Lug	1710-1010	
J15	BNC Connector	2200-7935	King
J16	BNC Connector	2200-7935	King
CR1	Diode HP 2800	1282-2800	HP
FL1	Line Filter	1055-0001	CorCom
FL2	RF Filter	1055-XXXX	Factory Select
F1	1A SLO-BLO Fuse	1900-0010	Little Fuse
	Fuse Holder	1910-0001	Buss
R1	120Ω 2W Carbon Comp Resistor	1067-0121	AB
R2	75Ω 2W Carbon Comp Resistor	1069-0075	AB
R3	30Ω 2W Carbon Comp Resistor	1068-0030	AB
R4	39Ω 1/4W Carbon Comp Resistor	1065-0039	AB
R5	7.5K 1/4W Carbon Comp Resistor	1065-7501	AB
R6	10K 1/4 W Carbon Comp Resistor	1065-1002	AB
SW1	SPDT Switch	1800-1020	Alco
TB1	7 Pin Terminal Strip	1700-0007	
TB2	7 Pin Terminal Strip		
	Misc:		
	Cover for J1	2001-0023	
	Power Cord	1950-7239	Belden
	Strain Relief	1975-0504	Heyco

REVISIONS			
LTR	Description		Date
A	REVISED PER ECO # 93		10-24-72
B	REVISED PER ECO # 116		12-27-73
C	REVISED PER ECO # 145		4-22-74
D	REVISED PER ECO # 170		7-2-74



TFT TIME AND FREQUENCY TECHNOLOGY, INC.

SCALE	APPROVED BY	DRAWN BY D.S.
DATE 12-2-72		REVISED

REAR PANEL WIRING DIAGRAM

FIG. 6-3 MODEL 723 DRAWING NUMBER 6600-0330

A1, FIXED FREQUENCY BOARD, MODEL 723

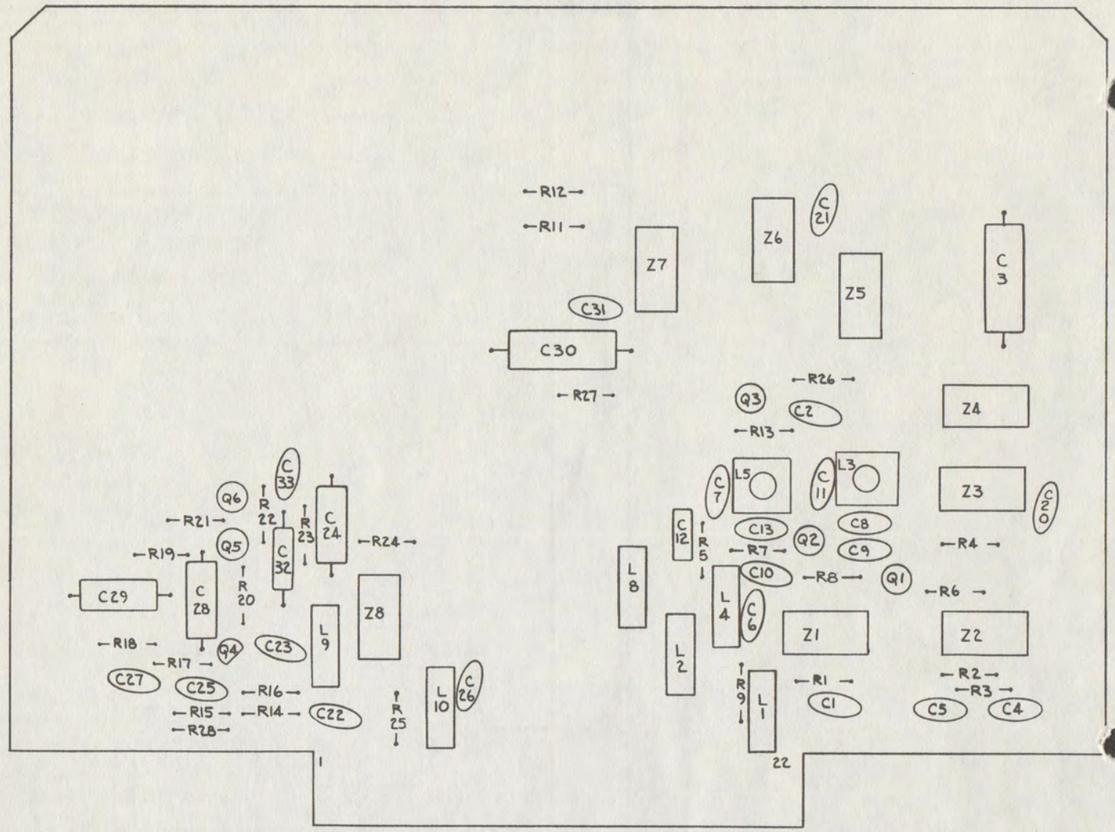
CKT. REF.	DESCRIPTION		MFG.
	CAPACITORS		
C1	.05 µf, +80%-20%, Cer. Disc. 25 WVDC	1005-5039	Erie
C2	.05 µf, +80%-20%, Cer. Disc. 25 WVDC	1005-5039	Erie
C3	250 µf, Alum. Elect 6WVDC	1010-0251	Sprague
C4	47 PF, 5%, Durmica, 500 WVDC	1001-0470	Elmenco
C5	47 PF, 5%, Durmica, 500 WVDC	1001-0470	Elmenco
C6	.05 µf, +80%-20%, Cer. Disc. 25 WVDC	1005-5039	Erie
C7	.05 µf, +80%-20%, Cer. Disc. 25 WVDC	1005-5039	Erie
C8	390 PF, 5%, Durmica, 500 WVDC	1001-0391	Elmenco
C9	27 PF, 5%, Durmica, 500 WVDC	1001-0270	Elmenco
C10	.05 µf, +80%-20% Cer. Disc. 25 WVDC	1005-5039	Erie
C11	.05 µf, +80%-20%, Cer. Disc. 25 WVDC	1005-5039	Erie
C12	2700 PF, 5%, Durmica, 500 WVDC	1001-0272	Elmenco
C13	430 PF, 5%, Durmica, 500 WVDC	1001-0431	Elmenco
C20	.05 µf, +80%-20%, Cer. Disc. 25 WVDC	1005-5039	Erie
C21	.05 µf, +80%-20%, Cer. Disc. 25 WVDC	1005-5039	Erie
C22	.05 µf, +80%-20%, Cer. Disc. 25 WVDC	1005-5039	Erie
C23	.05 µf, +80%-20%, Cer. Disc. 25 WVDC	1005-5039	Erie
C24	10 µf, TANT, 10%, 20 WVDC	1008-0100	Kemet
C25	.05 µf, +80%-20%, Cer. Disc. 25 WVDC	1005-5039	Erie
C26	.05 µf, +80%-20%, Cer. Disc. 25 WVDC	1005-5039	Erie
C27	.05 µf, +80%-20%, Cer. Disc. 25 WVDC	1005-5039	Erie
C28	20µf, TANT, 10%, 20 WVDC	1010-0250	Sprague
C29	10µf, TANT, 10%, 20 WVDC	1008-0100	Kemet
C30	250µf, ALUM, Elect, 6 WVDC	1010-0251	Sprague
C31	.05 µf +80% -20%, Cer. Disc, 25 WVDC	1005-5039	Erie
C32	10µf, 10%, TANT, 20 WVDC	1008-0100	Kemet
C33	.05 µf, +80%-20%, Cer. Disc. 25 WVDC	1005-5039	Erie
	RESISTORS		
R1	10K ohms, 5% 1/4w Carbon Comp.	1065-1002	AB
R2	100 ohms, 5% 1/4w Carbon Comp.	1065-0100	AB
R3	100 ohms, 5% 1/4w Carbon Comp.	1065-0100	AB
R4	2.2K ohms, 5% 1/4w Carbon Comp.	1065-2201	AB

A1, FIXED FREQUENCY BOARD, MODEL 723

CKT. REF.	DESCRIPTION		MFG.
	RESISTORS		
R5	4.7K ohms, 5% 1/4w Carbon Comp.	1065-4701	AB
R6	2.2K ohms, 5% 1/4w Carbon Comp.	1065-2201	AB
R7	33K ohms, 5% 1/4w Carbon Comp.	1065-3302	AB
R8	18K ohms, 5% 1/4w Carbon Comp.	1065-1802	AB
R9	100 ohms, 5% 1/4w Carbon Comp.	1065-0100	AB
R11	1K ohms, 5% 1/4w Carbon Comp.	1065-1001	AB
R12	470 ohms, 5% 1/4w Carbon Comp.	1065-0470	AB
R13	470 ohms, 5% 1/4w Carbon Comp.	1065-0470	AB
R14	1M ohms, 5% 1/4w Carbon Comp.	1066-1004	AB
R15	100K ohms, 5% 1/4w Carbon Comp.	1065-1003	AB
R16	100 ohms, 5% 1/4w Carbon Comp.	1065-0100	AB
R17	1K ohms, 5% 1/4w Carbon Comp.	1065-1001	AB
R18	560 ohms, 5% 1/4w Carbon Comp.	1065-0560	AB
R19	1K ohms, 5% 1/4w Carbon Comp.	1065-1001	AB
R20	100 ohms, 5% 1/4w Carbon Comp.	1065-0100	AB
R21	1.5K ohms, 5% 1/4w Carbon Comp.	1065-1501	AB
R22	560 ohms, 5% 1/4w Carbon Comp.	1065-0560	AB
R23	1K ohms, 5% 1/4w Carbon Comp.	1065-1001	AB
R24	2.2K ohms, ±5%, 1/4w Carbon Comp.	1065-2201	AB
R25	100 ohms, ±5%, 1/4w Carbon Comp.	1065-0100	AB
R26	2.2K ohms, ±5%, 1/4w Carbon Comp.	1065-2201	AB
R27	470 ohms, ±5%, 1/4w Carbon Comp.	1065-0470	AB
R28	100K ohms, ±5%, 1/4w Carbon Comp.	1065-1003	AB
	INDUCTORS		
L1	15 µH, RF Choke	1530-0150	Delevan
L2	15 µH, RF Choke	1530-0150	Delevan
L3	Variable, 8t	1550-0011	
L4	15 µH, RF Choke	1530-0150	Delevan
L5	Variable, 8t	1550-0011	
L8	15 µH, RF Choke	1530-0150	Delevan
L9	15 µH, RF Choke	1530-0150	Delevan
L10	15 µH, RF Choke	1530-0150	Delevan
	INTEGRATED CIRCUITS		
Z1	I.C. SP380	1100-0380	Signetics
Z2	I.C. SN7400	1100-7400	National
Z3	I.C. SN7490	1100-7490	National
Z4	I.C. SN7490	1100-7490	National
Z5	I.C. SN7490	1100-7490	National
Z6	I.C. SN7490	1100-7490	National
Z7	I.C. SN7400	1100-7400	National
Z8	I.C. SN7413	1100-7413	National

A1, FIXED FREQUENCY BOARD, MODEL 723

CKT. REF.	DESCRIPTION		MFG.
	TRANSISTORS		
Q1	2N4275	1271-4275	Fairchild
Q2	2N3563	1271-3563	National
Q3	2N4275	1271-4275	Fairchild
Q4	TIS58	1271-0058	TI
Q5	2N3563	1271-3563	National
Q6	2N3563	1271-3563	National
A1	Fixed Frequency Board	1600-0042	



FIXED FREQUENCY BOARD

6608-0310 A1

REVISIONS		
LTR	Description	Date
A	RELEASED TO PRODUCTION	11-6-72
B	REVISED PER ECO # 116	12-27-72
C	REVISED PER ECO # 140	9-11-74

P1

TO +15V BUSS — 16 — L2 15

TO +5V BUSS — 21 — L1 15 — C2 .05 — C3 250

5MHz INPUT 0.35 VPP FROM RP-SW1-2 — 20 — R1 10K — C1 .05 — E1 380

5MHz OUTPUT TO CH-A2-2 — 19 — R9 100 — E1 380

5MHz AMP & PULSE SHAPER — R2 100 — C4 47pF — E2 7400 — R3 100 — C5 47pF — E2 7400 — R4 2.2K — E2 7400 — E2 7400

TO -15V BUSS — 18

GND — 1, 22, 7, 10, 13

10MHz HARMONIC FILTER — C6 .05 — R5 4.7K — C7 .06 — L3 8t — C8 390pF — R6 2.2K — Q1 2N4275 — C9 27pF — R7 33K — L4 15 — C10 .05 — R8 18K — C11 .05 — L5 8t — C12 270pF — C13 430pF — Q2 2N3563

÷5 — C20 .05 — E3 7490 — ÷5, ÷2 — E4 7490 — ÷10 — E5 7490 — ÷2, ÷5 — E6 7490

E7 7400 — R11 1K

SWITCHED +5V TO FP-SW3-6 — 3 — L9 15

COUNTER AMP — C23 .05 — C24 10 — R20 100 — R22 560 — R24 2.2K — E8 7413 — R25 100

COUNTER INPUT FROM FP-SW5-11 — 2 — C22 .05 — R16 100 — Q4 TIS58 — C28 25 — R14 1MEG — R17 1K — R19 1K — Q5 2N3563 — Q6 2N3563 — R23 1K — C32 10 — C33 .06 — R28 100K — C25 .05 — R13 100K — C27 .05 — R18 560 — R21 1.2K — L10

TO -15V BUSS — 6 — L10 15 — C26 .06 — C29 10

200KHz BUFFER & CAL SIGNAL GEN — E7 7400 (Gate) — R13 470 — R26 2.2K — Q3 2N4275 — R12 470 — R27 470

P1

17 — 10MHz OUTPUT 0.4VPP TO CH-A3-19

9 — 1MHz OUTPUT TO FP-SW4-11

11 — 1KHz OUTPUT 3.5VPP TO CH-A7-J1-16

14 — 1KHz RP-J9

8 — CAL SIGNAL OUTPUT 3VPP TO CH-A4-2

12 — 200KHz OUTPUT 3 VPP TO CH-A2-G

15 — 0V = OPERATE, +3V = CALIBRATE FROM FP-SW1-5

4 — COUNTER OUTPUT 3VPP TO FP-SW4-7

COMPONENT DESIGNATOR		
FIRST	LAST	DELETED
C1	C33	C14-19
L1	L10	L6, L7
Q1	Q6	
E1	E8	
R1	R28	R10

BOTTOM VIEW TIS58 (S G D)

SP380A

SN7490N

SN7413: 1A 1, 1B 2, NC 3, 1C 4, 1D 5, 1Y 6, GND 7, VCC 14, 2D 13, 2C 12, NC 11, 2B 10, 2A 9, 2Y 8

SN7400: 1A 1, 1B 2, 1Y 3, 2A 4, 2B 5, 2Y 6, GND 7, VCC 14, 4B 13, 4A 12, 4Y 11, 3B 10, 3A 9, 3Y 8

NOTES; UNLESS OTHERWISE SPECIFIED:
1. RESISTORS - VALUES IN OHMS ±5%, 1/4 WATT.
2. CAPACITORS - VALUES IN MICROFARADS.
3. INDUCTORS - VALUES IN MICROHENRYS ±10%
4. *FACTORY SELECT VALUE. TYPICAL VALUE SHOWN.
5. VOLTAGES ARE DC CONDITIONS.

TFT TIME AND FREQUENCY TECHNOLOGY, INC.

SCALE —	APPROVED BY	DRAWN BY D.S.
DATE 11-21-72		REVISED

FIXED FREQUENCY BOARD-A1

FIG 6-4 — MODEL 723 — DRAWING NUMBER 6601-0990

A2, L. O. BOARD, MODEL 723

CKT. REF.	DESCRIPTION	TFT STOCK NO.	MFG.
	CAPACITOR		
C1	.005 µf, +80%-20% Cer. Disc. 100WVDC	1005-5049	ERIE
C2	.05 µf, +80%-20% Cer. Disc. 25WVDC	1005-5039	ERIE
C3	1 µf, Alum. Elect. 25WVDC	1010-0010	SPRAGUE
C4	47 pf, Durmica, 5% 500WVDC	1001-0470	ELMENCO
C5	47 pf, Durmica, 5% 500WVDC	1001-0470	ELMENCO
C6	.005µf, +80%-20% Cer. Disc. 100WVDC	1005-5049	ERIE
C7	820 pf, Cer. Disc.	1005-5039	ERIE
C8	27 pf, Durmica, 5% 500WVDC	1001-0270	ELMENCO
C9	4.7 pf, +.25 pf Tubular Cer. 500WVDC	1000-0047	ERIE
C10	.005 µf + 80%-20% Cer. Disc. 100WVDC	1005-5049	ERIE
C11	.005 µf + 80%-20% Cer. Disc. 100WVDC	1005-5049	ERIE
C12	18 pf, 5% Durmica, 500WVDC	1001-0180	ELMENCO
C13	12 pf, ±5% Durmica, 500WVDC	1001-0120	ELMENCO
C14	.005 µf, +80%-20% Cer. Disc. 100WVDC	1005-5049	ERIE
C15	.005 µf, +80%-20% Cer. Disc. 100WVDC	1005-5049	ERIE
C16	27 pf, 5%, Durmica, 500WVDC	1001-0270	ELMENCO
C17	3.3 pf, +.25 pf, Tubular Cer. 500WVDC	1000-0033	ERIE
C18	1.5 pf, +.25 pf, Tubular Cer. 500WVDC	1000-0015	ERIE
C19	.005 µf, +80%-20%, Cer. Disc. 100WVDC	1005-5049	ERIE
C20	10µf, Tant, 20WVDC	1008-0100	KEMET
C21	.05 µf, +80%-20%, Cer. Disc. 25WVDC	1005-5039	ERIE
C22	.05 µf, +80%-20% Cer. Disc. 25WVDC	1005-5039	ERIE
C23	30 pf, 5% Durmica, 500WVDC	1001-0300	ELMENCO
C24	.0039 µf, ±10%, Polyfilm 100WVDC	1002-3949	SPRAGUE
C25	390 pf ±5%, Durmica, 500WVDC	1001-0391	ELMENCO
C26	.0082 µf, ±10%, Polyfilm 100WVDC	1002-1829	SPRAGUE
C27	560 pf, ±5% Durmica, 500 WVDC	1001-0561	ELMENCO
C28	.0039 µf, ±10%, Polyfilm 100WVDC	1002-3949	SPRAGUE
C29	10µf, Tant. 20WVDC	1008-0100	KEMET
C30	.15 µf, Polyfilm 100V	1002-1529	
C31	Deleted		
C32	18 pf, ±5%, Durmica, 500WVDC	1001-0180	ELMENCO
C33	5 pf, ±5%, Durmica, 500WVDC	1001-0050	ELMENCO
C34	22pf, ±5%, Durmica, 500WVDC	1001-0220	ELMENCO
C35	28pf, N750	1001-0280	ELMENCO
C36	.05µf, +80%-20%, Cer. Disc. 25WVDC	1005-5039	ERIE

A2, L.O. BOARD, MODEL 723

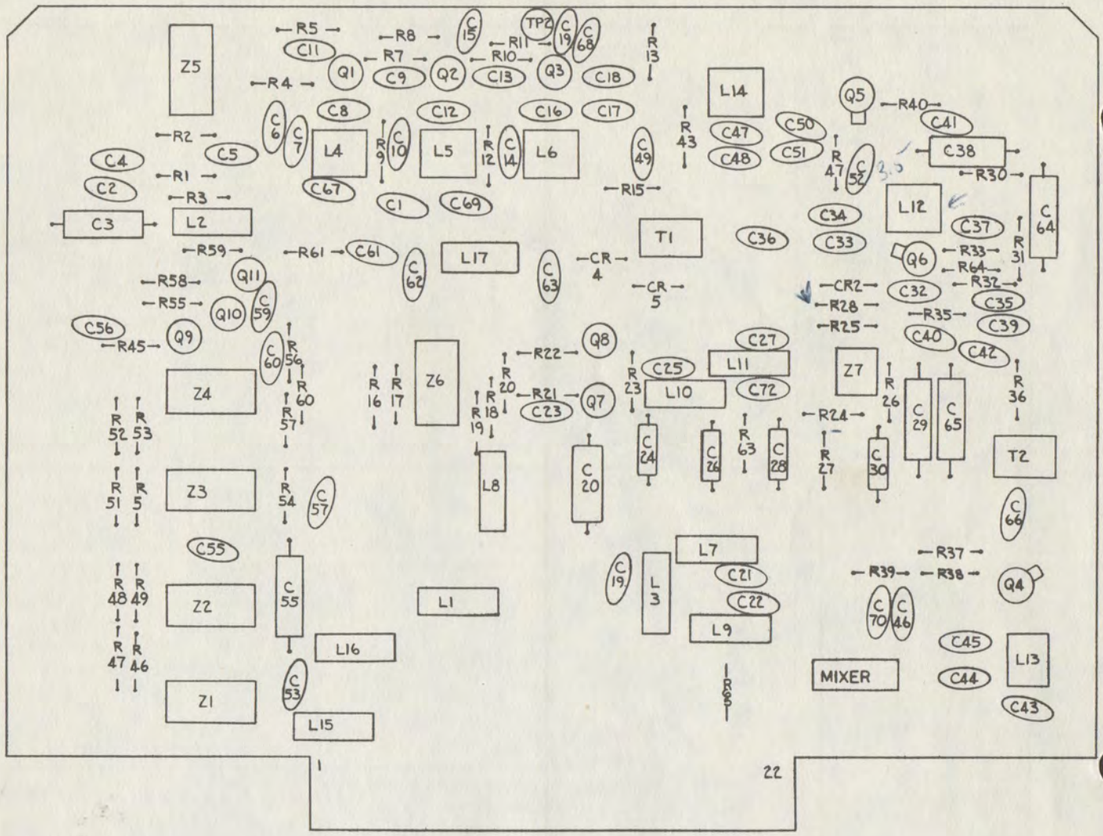
CKT. REF.	DESCRIPTION	TFT STOCK NO.	MFG.
	CAPACITOR		
C37	.005 µf, +80%-20%, Cer. Disc. 100WVDC	1005-4039	ERIE
C38	10 µf, Tant, 20WVDC	1008-0100	KEMET
C39	27 pf, ±5%, Durmica, 500WVDC	1001-0270	ELMENCO
C40	820 pf, +80-20% Ceramic Disc.	1005-0821	ERIE
C41	.005 µf, +80%-20%, Cer. Disc. 100WVDC	1005-4039	SPRAGUE
C42	.005 µf, +80%-20%, Cer. Disc. 100WVDC	1005-4039	ERIE
C43	.01 µf, +80%-20%, Cer. Disc. 100WVDC	1005-1039	ERIE
C44	100 pf, ±5%, Durmica, 500WVDC	1001-0101	ELMENCO
C45	33 pf, ±5%, Durmica, 500WVDC	1001-0330	ELMENCO
C46	.005 µf, +80%-20%, Cer. Disc. 100WVDC	1005-4039	ERIE
C47	.005 µf, +80%-20%, Cer. Disc. 100WVDC	1005-4039	ERIE
C48	18 pf, ±5%, Durmica, 500WVDC	1001-0180	ELMENCO
C49	5 pf, ±5%, Durmica, 500WVDC	1001-0050	ELMENCO
C50	.05 µf, +80%-20%, Cer. Disc. 25WVDC	1005-5039	ERIE
C51	.005 µf, +80%-20%, Cer. Disc. 100WVDC	1005-4039	ERIE
C52	.05 µf, +80%-20%, Cer. Disc. 25WVDC	1005-5039	ERIE
C53	.05 µf, +80%-20%, Cer. Disc. 25WVDC	1005-5039	ERIE
C54	10 µf, Tant. 20WVDC	1008-0100	KEMET
C55	.05 µf, +80%-20%, Cer. Disc. 25WVDC	1005-5039	ERIE
C56	.05 µf, +80%-20%, Cer. Disc. 25WVDC	1005-5039	ERIE
C57	.05 µf, +80%-20%, Cer. Disc. 25WVDC	1005-5039	ERIE
C58	10 µf, Tant	1008-0010	KEMET
C59	.05 µf, +80%-20%, Cer. Disc. 25WVDC	1005-5039	ERIE
C60	.05 µf, +80-20%, Cer. Disc. 25WVDC	1005-5039	ERIE
C61	.05 µf, +80%-20%, Cer. Disc. 25WVDC	1005-5039	ERIE
C62	390pf, ±5% Durmica, 500WVDC	1001-0391	ELMENCO
C63	390pf, ±5% Durmica, 500WVDC	1001-0391	ELMENCO
C64	10µf, Tant, 20WVDC	1008-0100	KEMET
C65	10µf, Tant, 20WVDC	1008-0100	KEMET
C66	820pf +80%-20% Cer. Disc. 500WVDC	1005-0821	ERIE
C67	820pf +80%-20% Cer. Disc. 500WVDC	1005-0821	ERIE
C68	.05 µf +80%-20% Cer. Disc. 25WVDC	1005-5039	ERIE
C69	820pf +80%-20%, Cer. Disc. 500WVDC	1005-0821	ERIE

A2, L.O. BOARD, MODEL 723

CKT. REF.	DESCRIPTION	TFT STOCK NO.	MFG.
	CAPACITOR		
C70	.05 µf, +80%-20%, Cer. Disc. 25WVDC	1005-5039	ERIE
C71	820pf, +80%-20%, Cer. Disc. 500WVDC	1005-0821	ERIE
C72	1000pf, ±5%, Durmica, 500WVDC	1001-0102	ELMENCO
	RESISTORS		
R1	100 ohms, 5%, 1/4w carbon comp.	1065-0100	AB
R2	100 ohms, 5%, 1/4w carbon comp.	1065-0100	AB
R3	2.2K ohms, 5%, 1/4w carbon comp.	1065-2201	AB
R4	2.2K ohms, 5%, 1/4w carbon comp.	1065-2201	AB
R5	2.2K ohms, 5%, 1/4w carbon comp.	1065-2201	AB
R6	Delete		
R7	3.3K ohms, 5% 1/4w carbon comp.	1065-3301	AB
R8	2.2K ohms, 5% 1/4w carbon comp.	1065-2201	AB
R9	3.3K ohms, 5% 1/4w carbon comp.	1065-3301	AB
R10	3.3K ohms, 5% 1/4w carbon comp.	1065-3301	AB
R11	2.2K ohms, 5% 1/4w carbon comp.	1065-2201	AB
R12	3.3K ohms, 5% 1/4w carbon comp.	1065-3301	AB
R13	51 ohms, 5% 1/4w carbon comp.	1065-0051	AB
R14	Delete		
R15	56 ohms, ± 5%, 1/4w carbon comp.	1065-0056	AB
R16	1K ohms, ±5%, 1/4w carbon comp.	1065-1001	AB
R17	1K ohms, ±5%, 1/4w carbon comp.	1065-1001	AB
R18	2.2K ohms, ±5%, 1/4w carbon comp.	1065-2201	AB
R19	1K ohms, ±5%, 1/4w carbon comp.	1065-1001	AB
R20	1K ohms, ±5%, 1/4w carbon comp.	1065-1001	AB
R21	2.2K ohms, ±5%,1/4w carbon comp.	1065-2201	AB
R22	2.2K ohms, ±5%,1/4w carbon comp.	1065-2201	AB
R23	470 ohms, ±5%, 1/4w carbon comp.	1065-0470	AB
R24	2.2K ohms, ±5%,1/4w carbon comp.	1065-2201	AB
R25	12K ohms, ±5%, 1/4w carbon comp.	1065-1202	AB
R26	680 ohms, ±5%, 1/4w carbon comp.	1065-0680	AB
R27	2.4K ohms, ±5%, 1/4w carbon comp.	1065-2401	AB
R28	10K ohms, ±5%, 1/4w carbon comp.	1065-1002	AB
R29	Deleted		
R30	390 ohms, ±5%, 1/4w carbon comp.	1065-0390	AB
R31	1K ohms, ±5%, 1/4w carbon comp.	1065-1001	AB
R32	4.7K ohms, ±5%,1/4w carbon comp.	1065-4701	AB
R33	220 ohms, ±5%, 1/4w carbon comp.	1065-0220	AB
R34	Delete		
R35	180 ohms, ±5%, 1/4w carbon comp.	1065-0180	AB
R36	1K ohms, ±5%, 1/4w carbon comp.	1065-1001	AB
R37	470 ohms, ±5%, 1/4w carbon comp.	1065-0470	AB
R38	680 ohms, ±5%, 1/4w carbon comp.	1065-0680	AB
R39	1.5K ohms, ±5%, 1/4w carbon comp.	1065-1501	AB
R40	1K ohms, ±5%, 1/4w carbon comp.	1065-1001	AB
R41	3.3K ohms, ±5%, 1/4w carbon comp.	1065-3301	AB

A2, L.O. BOARD, MODEL 723

CKT. REF.	DESCRIPTION	TFT STOCK NO.	MFG.
	RESISTORS		
R42	470 ohms, +5%, 1/4w carbon comp.	1065-0470	AB
R43	1K ohms, ±5%, 1/4w carbon comp.	1065-1001	AB
R44	Delete		
R45	2.2K ohms, ±5%, 1/4w carbon comp.	1065-2201	AB
R46	2.2K ohms, ±5%, 1/4w carbon comp.	1065-2201	AB
R47	2.2K ohms, ±5%, 1/4w carbon comp.	1065-2201	AB
R48	2.2K ohms, ±5%, 1/4w carbon comp.	1065-2201	AB
R49	2.2K ohms, ±5%, 1/4w carbon comp.	1065-2201	AB
R50	2.2K ohms, ±5%, 1/4w carbon comp.	1065-2201	AB
R51	2.2K ohms, ±5%, 1/4w carbon comp.	1065-2201	AB
R52	2.2K ohms, ±5%, 1/4w carbon comp.	1065-2201	AB
R53	2.2K ohms, ±5%, 1/4w carbon comp.	1065-2201	AB
R54	2.2K ohms, ±5%, 1/4w carbon comp.	1065-2201	AB
R55	560 ohms, ±5%, 1/4w carbon comp.	1065-0560	AB
R56	2.2K ohms, +5%, 1/4w carbon comp.	1065-2201	AB
R57	1K ohms, ±5%, 1/4w carbon comp.	1065-1001	AB
R58	330 ohms, ±5%, 1/4w carbon comp.	1065-0330	AB
R59	1.8K ohms, ±5%, 1/4w carbon comp.	1065-1801	AB
R60	15K ohms, ±5%, 1/4w carbon comp.	1065-1502	AB
R61	51 ohms, ±5%, 1/4w carbon comp.	1065-0051	AB
R62	100 ohms, ±5%, 1/4w carbon comp.	1065-0100	AB
R63	470 ohms, ±5%, 1/4w carbon comp.	1065-0470	AB
R64	15K ohms, ±5%, 1/4w carbon comp.	1065-1502	AB
R65	5.1K ohms, ±5%, 1/4w carbon comp.	1065-5101	AB
	INDUCTORS		
L1	15 µH, RF coil	1530-0150	DELEVAN
L2	15 µH, RF coil	1530-0150	DELEVAN
L3	15 µH, RF coil	1530-0150	DELEVAN
L4	*1 1/2, 2, or 2 1/2 turn micrometal		
L5	*1 1/2, 2, or 2 1/2 turn micrometal		
L6	*1 1/2, 2, or 2 1/2 turn micrometal		
L7	15 µH, RF coil	1530-0150	DELEVAN
L8	15 µH, RF coil	1530-0150	DELEVAN
L9	15 µHy	1530-0151	
L10	680 µH, RF coil ± 10%	1530-0681	DELEVAN
L11	680 µH, RF coil ±10%	1530-0681	DELEVAN
L12	*2, 2 1/2, or 3 turn micrometal		
L13	*2, 2 1/2, or 3 turn micrometal		
L14	*2, 2 1/2, or 3 turn micrometal		
L15	15 µH, RF coil	1530-0150	DELEVAN
L16	15 µH, RF coil	1530-0150	DELEVAN
L17	.68 µH, RF coil		DELEVAN
	DIODES		
CR1	HP2800	1282-2800	HP
CR2	MV1638	1290-1638	MOTOROLA
CR3	Deleted		



A2, L.O. BOARD, MODEL 723

CKT. REF.	DESCRIPTION	TFT STOCK NO.	MFG.
	DIODES		
CR4	HP2800	1282-2800	HP
CR5	HP2800	1282-2800	HP
	INTEGRATED CIRCUITS		
Z1	SN7410N [5]	1100-7410	NATIONAL
Z2	DM74176N (DM8280) [6]	1100-8280	NATIONAL
Z3	DM74176N (DM8280) [6]	1100-8280	NATIONAL
Z4	SN7472N [3]	1100-7472	NATIONAL
Z5	SN7400N [4]	1100-7400	NATIONAL
Z6	SN7403N [4]	1100-7403	NATIONAL
Z7	LM741C [2]	1100-0741	NATIONAL
	TRANSISTORS		
Q1	2N4275 NPN	1271-4275	FAIRCHILD
Q2	2N5208 PNP	1271-5208	FAIRCHILD
Q3	2N5208 PNP	1271-5208	FAIRCHILD
Q4	2N5179 NPN	1271-5179	FAIRCHILD
Q5	2N5179 NPN	1271-5179	FAIRCHILD
Q6	2N5179 NPN	1271-5179	FAIRCHILD
Q7	2N4121 PNP	1271-4121	FAIRCHILD
Q8	2N4275 NPN	1271-4275	FAIRCHILD
Q9	2N3563 NPN	1271-3563	FAIRCHILD
Q10	2N3563 NPN	1271-3563	FAIRCHILD
Q11	2N3563 NPN	1271-3563	FAIRCHILD
	TRANSFORMER		
T1	Trifilar	1501-0001	
T2	Trifilar	1501-0001	
	MIXER		
	Type R-CDB-119	4500-0001	OLEKTRON
	P.C. BOARD		
	L.O. Board	1600-0047	
	MISC.		
	Shielding Bead	1501-0654	TDK

L.O. BOARD

6608-0250 A2

REVISIONS		
LTR	Description	Date
A	RELEASED TO PRODUCTION	4-26-73
B	REVISED PER ECO 93	10-24-73
C	REVISED PER ECO # 116	12-27-73
D	REVISED PER ECO # 131	5-7-74
E	REVISED PER ECO # 139	9-22-74

90, 95, 100 OR 105 MHz TUNED AMP

200 KHz PHASE DETECTOR

÷N CIRCUIT

÷N DRIVER AMP

L.O. BUFFER

DOUBLE BALANCED MIXER R-CDB-119

L.O. BUFFER

V.C.O.

15 MHz LOWPASS

MIXER

P1

TO -15V BUSS

TO +5V BUSS

5MHz 3.5 PP FROM CH-A1-19

GND

TO +15V BUSS

200KHz 3.5VPP FROM CH-A1-12

TO -15V BUSS

TO FP-SW9-6 (SWITCHED +5V)

RF INPUT FROM CHANNEL FILTER FL2

10.7 MHz OUTPUT TO I.F. BOARD CH-A3-J1

RF INPUT FROM HIGH LEVEL PAD RP-TB1-5

ADJ. L12 FOR FP6

3.5V

COMPONENT DESIGNATOR		
FIRST	LAST	DELETED
C1	C72	C31
CR1	CR5	CR3
L1	L17	
Q1	Q11	
R1	R64	R6, R14, 29 R34, R44
T1	T2	
Z1	Z5	

SN 7400 SN 7403

7410

741

NOTES; UNLESS OTHERWISE SPECIFIED:
1. RESISTORS - VALUES IN OHMS ±5%, 1/4 WATT.
2. CAPACITORS - VALUES IN MICROFARADS.
3. INDUCTORS - VALUES IN MICROHENRYS ±10%
4. *FACTORY SELECT VALUE. TYPICAL VALUE SHOWN.
5. VOLTAGES ARE DC CONDITIONS.

GROUNDING TEST POINTS A1 - D2 PROGRAMS FREQUENCY SYNTHESIZER

TFT TIME AND FREQUENCY TECHNOLOGY, INC.

SCALE	APPROVED BY	DRAWN BY D.S.
DATE 4-26-73		REVISED
L.O. BOARD A2		
FIG. 6-5	MODEL 723	DRAWING NUMBER 6601-0083

A3 IF BOARD, MODEL NO. 723

CKT. REF.	DESCRIPTION		MFG.
	PC B I.F.	1600-0051	
	CAPACITORS		
C1	.05 µf, Disc. Ceram. 25WVDC	1005-5039	Erie
C2	10 µf, TANT, 20 WVDC	1008-0100	Kemet
C3	.05 µf, Disc. Ceram. 25 WVDC	1005-5039	Erie
C4	10 µf, TANT, 20 WVDC	1008-0100	Kemet
C5	39 Pf, Durmica, 5%, 500 WVDC	1001-0390	Elmenco
C6	220 Pf, Durmica, 5%, 500 WVDC	1001-0221	Elmenco
C7	24 Pf, Durmica, 5%, 500 WVDC	1001-0240	Elmenco
C8	15 Pf, Durmica, 5%, 500 WVDC	1001-0150	Elmenco
C9	.05 µf, Disc. Ceramic, 25 WVDC	1005-5039	Erie
C10	.05 µf, Disc. Ceramic, 25 WVDC	1005-5039	Erie
C11	10 µf, TANT, 20 WVDC	1008-0100	Kemet
C12	.05 µf, Disc. Ceram. 25 WVDC	1005-5039	Erie
C13	.05 µf, Disc. Ceram. 25 WVDC	1005-5039	Erie
C14	.05 µf, Disc. Ceram. 25 WVDC	1005-5039	Erie
C15	.05 µf, Disc. Ceram. 25 WVDC	1005-5039	Erie
C16	6.8 pf, Tabular Cer. ± .25 pf. 500 WVDC	1000-0068	Erie
C17	.05 µf, Disc. Ceram. 25 WVDC	1005-5039	Erie
C18	.05 µf, Disc. Ceram. 25 WVDC	1005-5039	Erie
C19	.05 µf, Disc. Ceram. 25 WVDC	1005-5039	Erie
C20	.05 µf, Disc. Ceram. 25 WVDC	1005-5039	Erie
C21	.05 µf, Disc. Ceram. 25 WVDC	1005-5039	Erie
C22	10 µf, TANT, 20 WVDC	1008-0100	Kemet
C23	.05 µf, Disc. Ceram. 25 WVDC	1005-5039	Erie
C24	.05 µf, Disc. Ceram. 25 WVDC	1005-5039	Erie
C25	.05 µf, Disc. Ceram. 25 WVDC	1005-5039	Erie
C26	10 µf, TANT 20 WVDC	1008-0100	Kemet
C27	.05 µf Disc. Ceram. 25 WVDC	1005-5039	Erie
C28	.05 µf Disc. Ceram. 25 WVDC	1005-5039	Erie
C29	.05 µf Disc. Ceram. 25 WVDC	1005-5039	Erie
C30	1 µf, Alum Elect. 25 WVDC	1010-0010	Sprague
C31	2000pf, Durmica, ±5%, 500 WVDC	1001-0202	Elmenco
C32	620 pf, Durmica, ±5%, 500 WVDC	1001-0621	Elmenco
C33	330 pf, Durmica, ±5%, 500 WVDC	1001-0331	Elmenco
C34	.05 µf, Disc. Cer. 25 WVDC	1005-5039	Erie
C35	.05 µf, Disc. Cer. 25 WVDC	1005-5039	Erie
C36	.05 µf, Disc. Cer. 25 WVDC	1005-5039	Erie
C37	27 pf, Durmica, ±5%, 500 WVDC	1001-0270	Elmenco
C38	120 pf, Durmica, ±5%, 500 WVDC	1001-0121	Elmenco
C39	.05 µf, Disc. Ceram. 25 WVDC	1005-5039	Elmenco
C40	.05 µf, Disc. Ceram. 25 WVDC	1005-5039	Elmenco
C41	.05 µf, Disc. Ceram. 25 WVDC	1005-5039	Elmenco
C42	10 µf, TANT, 20 WVDC	1008-0100	Kemet
C43	10 µf, TANT, 20 WVDC	1008-0100	Kemet
C44	10 µf, 35V Tantalum Electrolytic	1008-0100	Kemet
C45	360 pf, Durmica, ±5% 500 WVDC	1001-0361	Elmenco

IF BOARD, MODEL NO. 723

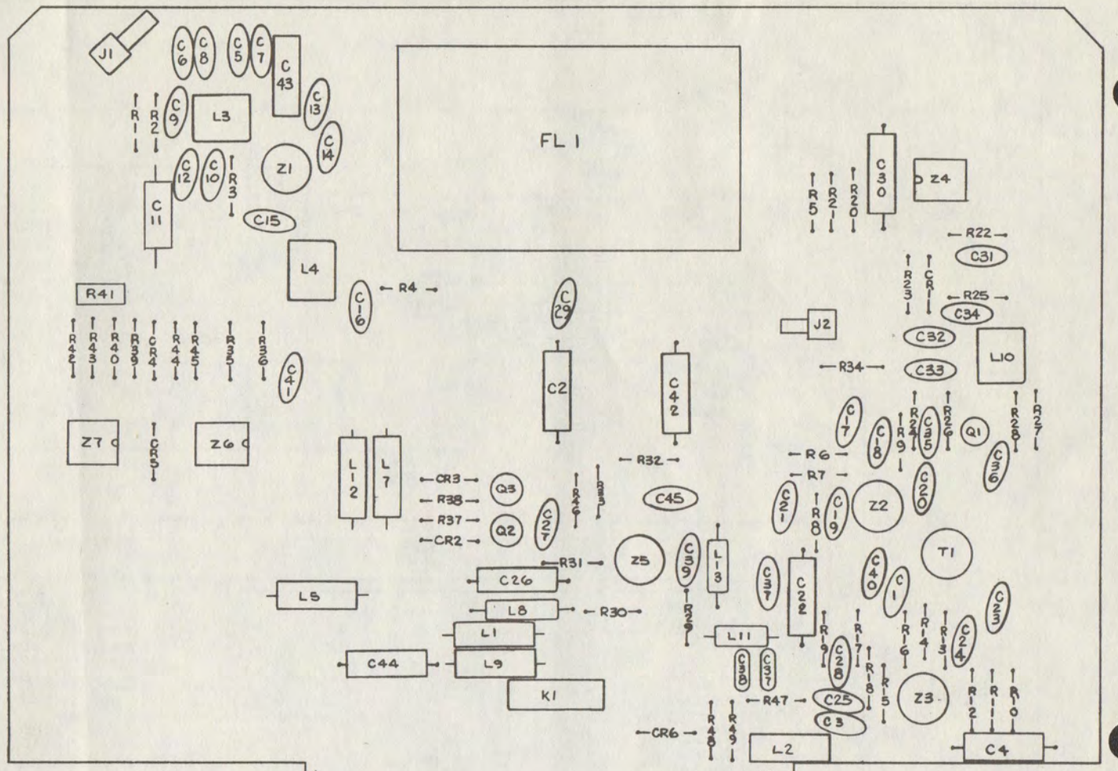
CKT. REF.	DESCRIPTION		MFG.
	DIODES		
CR1	HP 2800	1282-2800	HP
CR2	IN 3064, Silicon	1281-3064	Fairchild
CR3	IN 3064, Silicon	1281-3064	Fairchild
CR4	IN 3064, Silicon	1281-3064	Fairchild
CR5	IN 3064, Si Diode	1281-3064	Fairchild
CR6	HPA 2800	1282-2800	HP
	INTEGRATED CIRCUITS		
Z1	I.C. MC 1550	1100-1550	Motorola
Z2	I.C. MC 1550	1100-1550	Motorola
Z3	I.C. MC 1596G	1100-1547	Motorola
Z4	I.C. LM 741C	1100-0741	Nat'l
Z5	I.C. CA 3028	1100-3028	RCA
Z6	I.C. LM 741C	1100-0741	Nat'l
Z7	I.C. LM 741C	1100-0741	Nat'l
T1	Transformer	1501-0001	Trifilar
	RESISTORS		
R1	12K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-1202	AB
R2	3.3K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-3301	AB
R3	1.2K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-1201	AB
R4	5.6K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-5601	AB
R5	1K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-1001	AB
R6	12K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-1202	AB
R7	3.3K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-3301	AB
R8	1.2K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-1201	AB
R9	330 ohms, Carbon Comp. ±5%, 1/4 Watt	1065-0330	AB
R10	1K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-1001	AB
R11	33K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-3302	AB
R12	33K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-3302	AB
R13	1K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-1001	AB

IF BOARD, MODEL NO. 723

CKT. REF.	DESCRIPTION		MFG.
	RESISTORS		
R14	4.7K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-4701	AB
R15	1K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-1001	AB
R16	1K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-1001	AB
R17	1K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-1001	AB
R18	51 ohms, Carbon Comp. ±5%, 1/4 Watt	1065-0051	AB
R19	1K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-1001	AB
R20	10K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-1002	AB
R21	100 ohms, Carbon Comp. ±5%, 1/4 Watt	1065-0100	AB
R22	10K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-1002	AB
R23	1K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-1001	AB
R24	100 ohms, Carbon Comp. ±5%, 1/4 Watt	1065-0100	AB
R25	1.5K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-1501	AB
R26	1.5K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-1501	AB
R27	10K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-1002	AB
R28	4.7K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-4701	AB
R29	1K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-1001	AB
R30	330 ohms, Carbon Comp. ±5%, 1/4 Watt	1065-0330	AB
R31	680 ohms, Carbon Comp. ±5%, 1/4 Watt	1065-0680	AB
R32	1.2K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-1201	AB
R33	1K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-1001	AB
R34	51 Ω, Carbon Comp. ±5%, 1/4 Watt	1065-0051	AB
R35	12K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-1202	AB
R36	15K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-1502	AB
R37	10K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-1002	AB

IF BOARD, MODEL NO. 723

CKT. REF.	DESCRIPTION		MFG.
	RESISTORS		
R38	10K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-1002	AB
R39	2.7K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-2701	AB
R40	8.2K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-8201	AB
R41	1K Potentiometer	1072-1001	Beckman
R42	680 ohms, Carbon Comp. ±5%, 1/4 Watt	1065-0680	AB
R43	12K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-1202	AB
R44	680 ohms, Carbon Comp. ±5%, 1/4 Watt	1065-0680	AB
R45	2.2K ohms, Carbon Comp. ±5%, 1/4 Watt	1065-2201	AB
R46	1K ohms, Carbon Comp ±5%, 1/4 Watt	1065-1001	AB
R47	22 ohms, ±5% 1/4w Carbon Comp.	1065-0022	AB
R48	22 ohms, ±5% 1/4w Carbon Comp.	1065-0022	AB
R49	47 ohms, ±5% 1/4w Carbon Comp.	1065-0047	AB
	INDUCTORS		
L1	15 µH, RF Coil ±10%	1530-0150	Delevan
L2	15 µH, RF Coil ±10%	1530-0150	Delevan
L3	3 µH, Variable Coil	1577-0001	Delevan
L4	18 µH, Variable Coil	1577-0018	Delevan
L5	15 µH, RF COIL, ±10%	1530-0150	Delevan
L7	15 µH, RF Coil, ±10%	1530-0150	Delevan
L8	15 µH, RF Coil, ±10%	1530-0150	Delevan
L9	15 µH, RF Coil, ±10%	1530-0150	Delevan
L10	1 µH, Variable Coil	1577-0003	Delevan
L11	82 µH, RF Coil	1530-0820	Delevan
L12	15 µH, RF Coil, ±10%	1530-0150	Delevan
L13	180 µH, RF Coil	1530-0180	Delevan
	RELAYS		
K1	Relay Type PRB 3510	1880-0001	Clare
	FILTER		
F1	10.7 MHz, Filter	1052-0001	Filtech
	TRANSISTORS		
Q1	2N 3563, NPN	1271-3563	National
Q2	2N 4275, NPN	1271-5275	National
Q3	2N 4121, PNP	1271-4121	Fairchild



I.F. BOARD A3 6608-0240

NEXT ASSY	USED ON
6608-0240	723
6608-0240	734

REVISIONS		
LTR	Description	Date
A	RELEASED TO PRODUCTION	4-26-73
B	REVISED PER ECO 81	9-4-73
C	REVISED PER ECO 93	10-24-73
D	REVISED PER ECO 108	11-17-73
E	REVISED PER ECO 114	12-18-73
F	REVISED PER ECO 116	12-27-73
G	REVISED PER ECO 151	2-7-74
H	REVISED PER ECO 183	4-16-74

P/O P1
TO -15V BUSS 21
GND 1
L2 15
C3 .05
C4 10

COAXIAL INPUT CONNECTOR
10.7 MHz INPUT FROM MIXER FROM CH-A2-J1 MODEL 723
CH-A12-J2 MODEL 734
J1

1ST. I.F. AMP
C5 39 PF
C7 24 PF
L3 3.0
C6 220 PF
C8 15 PF
C9 .05
R1 12K
R2 3.3K
C10 .05
R3 1.2K
Z1 MC 1550
C13 .05
C43 10
C14 .05
C15 .05
R4 5.6K
L5 15
C11 10
C12 .05

10.7MHz FILTER
C16 6.8 PF
L4 18
C17 .05
R5 1K
R6 12K
L7 15

T1
R9 330
C18 .05
C23 .05
R7 3.3K
C19 .05
Z2 MC 1550
R8 1.2K
C40 .05
C20 .05
C22 10
C21 .05
2 NO. I.F. AMP.

2ND MIXER
Z3 SL7496393
R11 33K
R12 33K
R10 1K
C24 .05
R13 1K
R14 4.7K
R15 1K
R17 1K
R18 51
R19 1K
C28 .05
C25 .05
R47 22
R48 22
R49 47

1 MHZ LOW PASS
L13 180
L11 82
C45 360PF
C38 120PF
C37 27PF
R16 1K

P1
19 INPUT 10 MHz L.O. 0.4VPP FROM CH-A1-17

P/O P1
GND 3
TO +15V BUSS 13
TO +5V BUSS 8
22
7
9
11
15
18
20
GND
TO -15V BUSS 4

L1 15
C1 .05
C2 10
L8 15
C27 .05
C26 10
L9 15
C29 .05
C44 10
L12 15
C41 .05
C42 10

AGC AMP & DETECTOR
Z4 741
R20 10K
CR1 HPA2800
R25 1.5K
C32 620 PF
C33 330 PF
L10 1.0
C34 .05
R27 10K
C30 1.0
C31 2000PF
R21 68
R22 10K
R23 1K
Q1 2N3563
C35 .05
R28 4.7K
R24 100
R26 820
J2 CH-A13-J2 (OPTION)
R34 * SEE NOTE 6
C36 .05

K1
Q2 2N4275
R37 10K
CR2 IN3064
CR3 IN3064
R38 10K
Q3 2N4121
R46 1K

SQUELCH AMP
Z6 741
R35 12K
R36 15K

CARRIER LEVEL METER AMP
Z7 741
R43 12K
R40 8.2K
R39 2.7K
R42 680
R41 1K

CR4 IN3064
R45 2.2K
R44 680
CR5 IN3064

700 KHz LIMITING AMP
C39 .05
R30 330
R31 680
CR6 HPA2800
Z5 CA3028
R29 1K
R33 1K
R32 1.2K

P1
16 TO COUNTER 4VPP TO FP-SW4-9
17 TO DISCRIMINATOR 3VPP TO CH-A4-5
12 RP-J3
14 RP-J4
10
6
0-500 uA CARRIER LEVEL METER FP-M1

COMPONENT DESIGNATOR		
FIRST	LAST	DELETED
C1	C45	
CR1	CR6	
K1	K1	
L1	L13	
Q1	Q4	
R1	R49	
Z1	Z7	

NOTES; UNLESS OTHERWISE SPECIFIED:
1. RESISTORS - VALUES IN OHMS ±5%, 1/4 WATT.
2. CAPACITORS - VALUES IN MICROFARADS.
3. INDUCTORS - VALUES IN MICROHENRYS ±10%
4. *FACTORY SELECT VALUE. TYPICAL VALUE SHOWN.
5. VOLTAGES ARE DC CONDITIONS.
6. WITH NO CARRIER FREQUENCY OPTION R34 SHOULD BE 22 Ω, FOR CARRIER FREQUENCY OPTION R34 SHOULD BE 51 Ω

741: OFFSET NULL 1, INVERT INPUT 2, NON INVERT INPUT 3, V- 4, N.C. 5, V+ 7, OUTPUT 6, OFFSET NULL 8

K1 PRB 3510 TOP VIEW

TFT TIME AND FREQUENCY TECHNOLOGY, INC.

SCALE	APPROVED BY	DRAWN BY D.S.
DATE 4-26-73		REVISED

I.F. BOARD (A3)

FIG. 6-6 — DRAWING NUMBER 6601-0084

A4, DISCRIMINATOR BOARD, MODEL 723

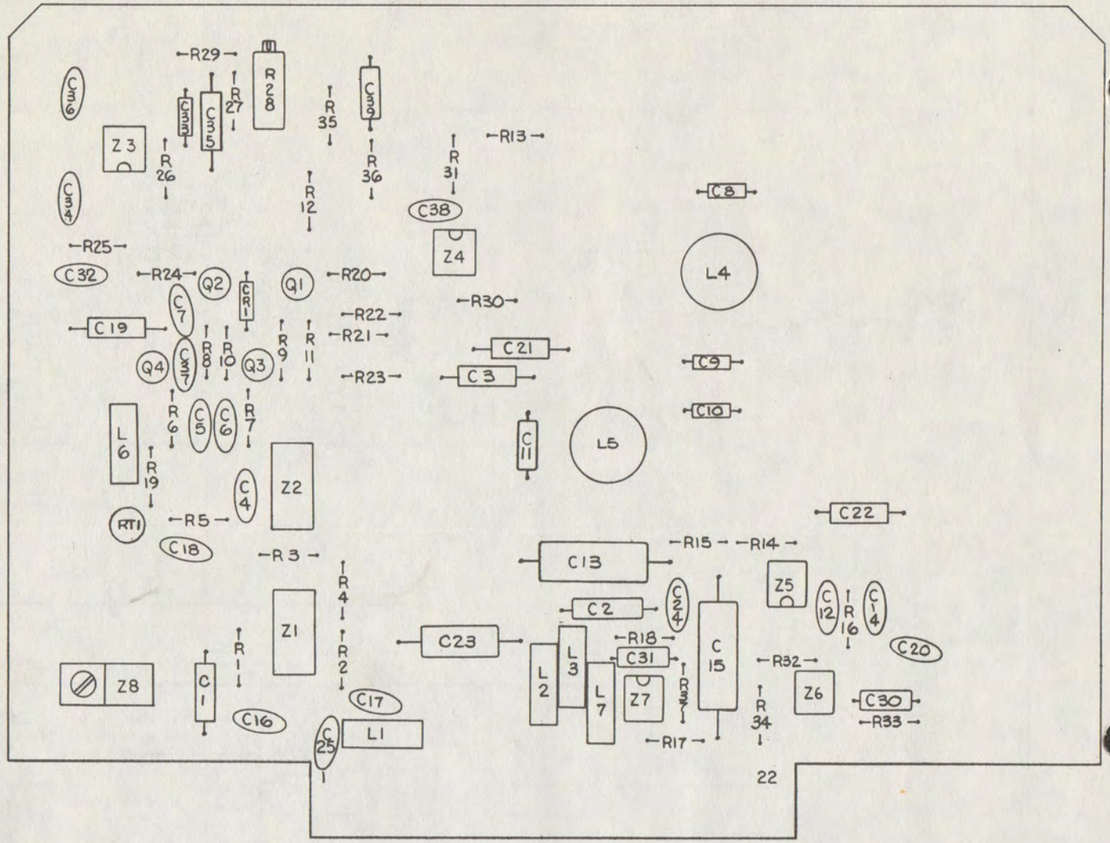
CKT. REF.	DESCRIPTION		MFG.
	CAPACITORS		
C1	10 µf, 10%, TANT, 20 WVDC	1008-0100	Kemet
C2	10 µf, 10%, TANT, 20 WVDC	1008-0100	Kemet
C3	10 µf, 10%, TANT, 20 WVDC	1008-0100	Kemet
C4	270 pf, ±5%, Durmica, 500 WVDC	1001-0271	Elmenco
C5	10 pf, ±5%, Durmica, 500 WVDC	1001-0100	Elmenco
C6	10 pf, ±5%, Durmica, 500 WVDC	1001-0100	Elmenco
C7	.05 µf, +80%-20%-Disc.Cer. 25 WVDC	1005-5039	Erie
C8	5100pf, ±5% Durmica, 500 WVDC		Elmenco
C9	6800pf, ±5%, Durmica, 500 WVDC	1001-0682	Elmenco
C10	2000pf, ±5%, Durmica, 500 WVDC	1001-0202	Elmenco
C11	5100 pf, ±5%, Durmica, 500 WVDC		Elmenco
C12	150 pf, ±5%, Durmica, 500 WVDC	1001-0151	Elmenco
C13	250 µf, Alum Elect 6 WVDC	1010-0251	Sprague
C14	24 pf, ±5%, Durmica, 500 WVDC	1001-0240	Elmenco
C15	100 µf, Alum Elect, 16 WVDC	1010-0101	Sprague
C16	.2 µf, +80%-20% Disc. Cer. 25 WVDC	1005-2029	Erie
C17	.05 µf, +80%-20% Disc. Cer. 25 WVDC	1005-5039	Erie
C18	.05 µf +80%-20% Disc. Cer. 25 WVDC	1005-5039	Erie
C19	10 µf, ±10%, TANT 20 WVDC	1008-0100	Kemet
C20	.05 µf, +80%-20%, Disc.Cer. 25 WVDC	1005-5039	Erie
C21	10 µf, ±10%, TANT, 20 WVDC	1008-0100	Kemet
C22	10 µf, 10%, TANT, 20 WVDC	1008-0100	Kemet
C23	25 µf, Alum Elect. -GWVDC	1010-0250	Sprague
C24	150 pf ± 5% Durmica 5 WVDC	1001-0151	Elmenco
C25	.2 µf ± 80%-20% Disc. Cer. 25 WVDC	1005-2029	Erie
C30	.0033 µf Poly. Film 100 WVDC	1002-3349	Sprague
C31	5pf Tubular	1000-0050	Sprague
C32	.033 µf ± 10% Polyfilm 100 WVDC	1002-3539	Sprague
C33	1000 pf ±5% Durmica 5 WVDC	1001-0102	Elmenco
C34	.15 µf, ± 10%, Polyfilm 100 WVDC	1002-1529	Sprague
C35	10 µf, 10%, TANT 20 WVDC	1008-0100	Kemet
C36	.05 µf, +80%-20%, Disc. Cer. 25 WVDC	1005-5039	Erie
C37	10 pf ±5% Durmica 500 WVDC	1001-0100	Elmenco
C38	51 pf, ±5%, Durmica, 500 WVDC	1001-0510	Elmenco
C39	.0033 µf, ±10% Polyfilm, 100 WVDC	1002-3349	Sprague
	RESISTORS		
R1	51 ohms ± 5%, 1/4w Carbon Comp.	1065-0051	AB
R2	51 ohms ± 5%, 1/4w Carbon Comp.	1065-0051	AB
R3	10K ohms ± 5%, 1/4w Carbon Comp.	1065-1002	AB
R4	10K ohms ± 5%, 1/4w Carbon Comp	1065-1002	AB

A4, DISCRIMINATOR BOARD, MODEL 723

CKT. REF.	DESCRIPTION		MFG.
R5	10K ohms ± 5%, 1/4w Carbon Comp.	1065-1002	AB
R6	4.7K ohms ± 5%, 1/4w Carbon Comp.	1065-4701	AB
R7	4.7K ohms ± 5%, 1/4w Carbon Comp.	1065-4701	AB
R8	470 ohms ± 5%, 1/4w Carbon Comp.	1065-0470	AB
R9	470 ohms ± 5%, 1/4w Carbon Comp.	1065-0470	AB
R10	2.2K ohms ± 5%, 1/4w Carbon Comp.	1065-2201	AB
R11	2.2K ohms ± 5%, 1/4w Carbon Comp.	1065-2201	AB
R12	390 ohms ± 5%, 1/4w Carbon Comp.	1065-0390	AB
R13	12 ohms ± 5%, 1/4w Carbon Comp.	1065-0012	AB
R14	330 ohms ± 5%, 1/4w Carbon Comp.	1065-0330	AB
R15	33 ohms ± 5%, 1/4w Carbon Comp.	1065-0033	AB
R16	3.3K ohms ± 5%, 1/4w Carbon Comp.	1065-3301	AB
R17	12K ohms ± 5%, 1/4w Carbon Comp.	1065-1202	AB
R18	22K ohms ± 5%, 1/4w Carbon Comp.	1065-2202	AB
R19	18 ohms ± 5%, 1/4w Carbon Comp.	1065-0018	AB
R20	470 ohms ± 5%, 1/4w Carbon Comp.	1065-0470	AB
R21	56 ohms ± 5%, 1/4w Carbon Comp.	1065-0056	AB
R22	470 ohms ± 5%, 1/4w Carbon Comp.	1065-0470	AB
R23	56 ohms ± 5%, 1/4w Carbon Comp.	1065-0056	AB
R24	1K ohms ± 5%, 1/4w Carbon Comp.	1065-1001	AB
R25	1K ohms ± 5%, 1/4w Carbon Comp.	1065-1001	AB
R26	1K ohms ± 5%, 1/4w Carbon Comp.	1065-1001	AB
R27	7.5K ohms ± 5%, 1/4w Carbon Comp.	1065-7501	AB
R28	1K ohms Variable	1069-1001	Beckman
R29	1.5K ohms ± 5%, 1/4w Carbon Comp.	1065-1501	AB

A4, DISCRIMINATOR BOARD, MODEL 723

CKT. REF.	DESCRIPTION		MFG.
	RESISTORS		
R30	22K ohms ± 5%, 1/4w Carbon Comp.	1065-2202	AB
R31	120K ohms ± 5%, 1/4w Carbon Comp.	1065-2202	AB
R32	12K ohms ± 5%, 1/4w Carbon Comp.	1065-1202	AB
R33	22K ohms ± 5%, 1/4w Carbon Comp.	1065-2202	AB
R34	560 ohms ± 5%, 1/4w Carbon Comp.	1065-0560	AB
R35	5.6K ohms ± 5%, 1/4w Carbon Comp.	1065-5601	AB
R36	10K ohms ± 5%, 1/4w Carbon Comp.	1065-1002	AB
R37	560 ohms ± 5%, 1/4w Carbon Comp.	1065-0560	AB
RT1	1K Thermistor		
	INDUCTOR		
L1	15 µH, RF Coil	1530-0150	Delevan
L2	15 µH, RF Coil	1530-0150	Delevan
L3	15 µH, RF Coil	1530-0150	Delevan
L4	1000 µH RF Coil	1577-1000	Delevan
L5	1000 µH RF Coil	1577-1000	Delevan
L6	15 µH RF Coil	1530-0150	Delevan
L7	15 µHy RF Choke	1530-0150	Delevan
	DIODES		
CR1	HPA 2800	1282-2800	HP
	INTERGRATED CIRCUITS		
Z1	I.C. SP 380	1100-0380	SIG
Z2	I.C. MC 8601	1100-8601	Motorola
Z3	I.C. LM 741C	1100-0741	National
Z4	I.C. LM 741C	1100-0741	National
Z5	I.C. LM 301A	1100-0301	National
Z6	I.C. LM 741C	1100-0741	National
Z7	I.C. LM 301A	1100-0301	National
Z8	I.C. 7805	1100-7805	
A4	Discriminator Board	1600-0048	



DISCRIMINATOR BOARD

6608-0320 A4

NEXT ASSY	USED ON
6608-0320	723
6608-0320	734

REVISIONS		
LTR	Description	Date
A	REVISED PER ECO # 82	9-4-73
B	REVISED PER ECO # 93	10-24-73
C	REVISED PER ECO # 116	12-27-73
D	REVISED PER ECO # 157	6-27-74

Break Jumper AUDIO to #7 - Low Imp. 60 to Audio Meas. Dist. at Audio

INPUT SELECTOR — ONE SHOT — BUFFER AMP — AUDIO DE-EMPHASIS NETWORK + BUFFER — 95 KHz LOWPASS & BUFFER — 10 KHz LOW PASS & BUFFER

P1

+5V 6 — L1 15 — Z8 7805 (IN 1, COM. 2, OUT 3) — C25 15 — C1 10 — C18 .05

CALIBRATION SIGNAL FROM CH-A1-8

OPERATE/CALIBRATE SIGNAL 0V = OPERATE +3V = CALIBRATE FROM FP-SW1-5

700 KHz, 3V PP FROM CH-A3-17

2 — C16 .2 — R1 51 — R3 10K — Z1 SP380

4 — Z1 SP380

5 — C17 .05 — R2 51 — R4 10K — Z1 SP380 — Z1 SP380

*R19 10 — R5 10K — RT1 1K — C4 270 PF — L6 15 — C19 10

Z2 MC8601 (Q)

C5 10pF — R6 4.7K — Q4 2N4275

C6 10pF — R7 4.7K — Q3 2N4275

R8 470 — R9 470 — C7 .05 — C37 10pF

R10 2.2K — Q2 2N4121 — CR1 HPA2800

R11 2.2K — Q1 2N4275

+15V 11 — L2 15 — C2 10

R33 22K — C30 .0033 — Z6 741 — R32 12K — R17 12K

R34 560 — C31 5PF — R18 22K — C24 150PF — Z7 301 — R37 560

R16 3.3K — C14 24pF — C12 150pF — Z5 301 — C15 100

R12 390 — R13 12 — L4 1000 — L5 1000 — C13 250 — R15 33 — R14 330

C8 5100 PF — C9 6800 PF — C10 2000 PF — C11 5100 PF

C20 .05

1 — 22 — L7 15 — C22 10

-15V 13 — L3 15 — C3 10

R20 470 — R21 56

R22 470 — R23 56

8, 15, 16

R24 1K — R25 1K — R26 1K — C34 .15 — C32 .033 — C33 1000pF — Z3 741 — C35 10 — R27 7.5K — C21 10 — R35 5.6K — R28 1K — R29 1.5K

R30 22K — Z4 741 — R36 10K — C38 51 Pf — R31 120K — C39 .0033

C36 .05 — C23 25

P1

21 — AUDIO OUTPUT WITH DE-EMPHASES 1V RMS/75 KHz DEVIATION TO RP-J8

17 — AUDIO OUTPUT WITHOUT DE-EMPHASES 0.1VRMS/75 KHz DEVIATION TO RP-J2

19 — COMPOSITE SIGNAL TO METER AND PEAK FLASHERS 1V RMS/75 KHz DEVIATION TO FP-SW1-9

9 — MODULATED 700 KHz SIGNAL FOR ACCESSORY TO RP-J11

10 — MODULATED 700 KHz SIGNAL FOR ACCESSORY TO RP-J10

7 — 10 KHz CALIBRATION SIGNAL. 1V RMS FOR 100% CALIBRATION TO FP-SW1-7

741: OFFSET NULL, INVERT INPUT, NON INVERT INPUT, V-, N.C., V+, OUTPUT, OFFSET NULL

301: BALANCE/COMPENSATION INPUT, INPUT, V-, COMP., V+, OUTPUT, BALANCE

SP380: GND, Vcc

COMPONENT DESIGNATOR		
FIRST	LAST	DELETED
C1	C39	C26-C29
CR1	CR1	
Q1	Q4	
R1	R37	
Z1	Z8	
L1	L7	

NOTES; UNLESS OTHERWISE SPECIFIED:
1. RESISTORS - VALUES IN OHMS ±5%, 1/4 WATT.
2. CAPACITORS - VALUES IN MICROFARADS.
3. INDUCTORS - VALUES IN MICROHENRYS ±10%
4. *FACTORY SELECT VALUE, TYPICAL VALUE SHOWN.
5. VOLTAGES ARE DC CONDITIONS.

TFT TIME AND FREQUENCY TECHNOLOGY, INC.

SCALE —	APPROVED BY	DRAWN BY D.S.
DATE 4-30-73		REVISED —

DISCRIMINATOR BOARD-A4

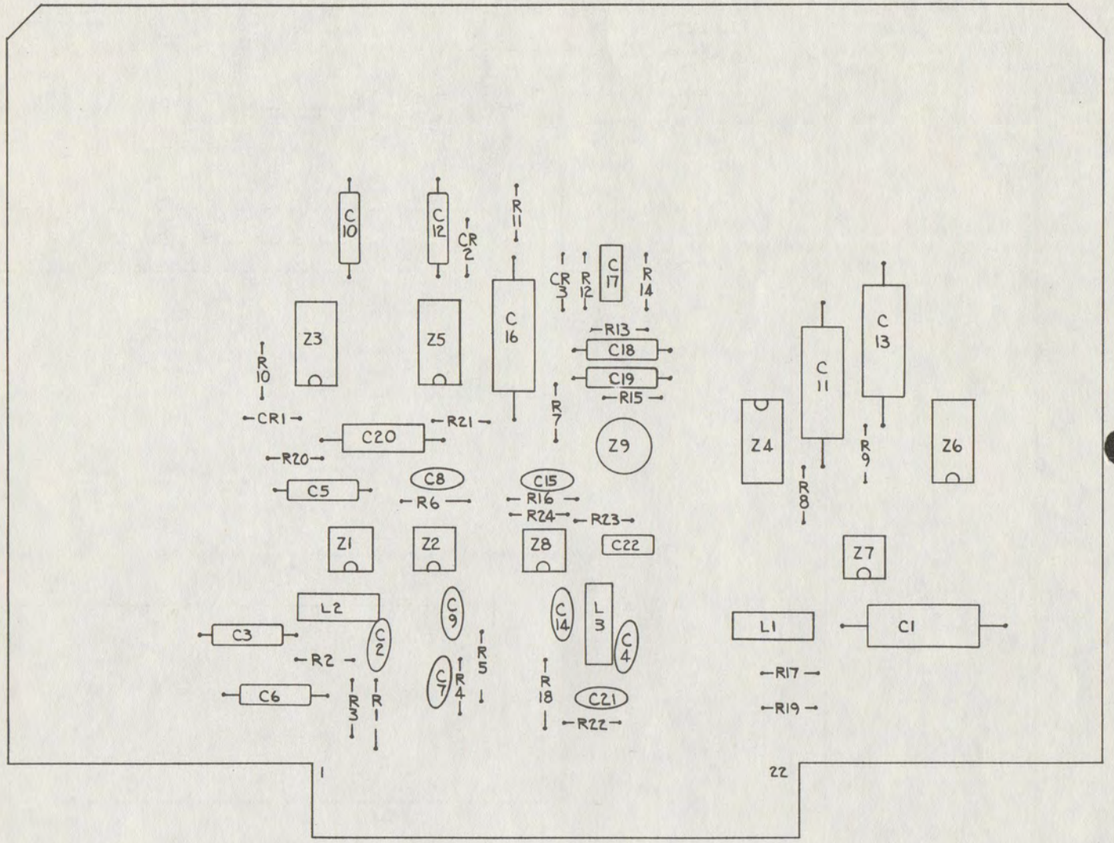
FIG. 6-7 — DRAWING NUMBER 6601-0370

A5 PEAK FLASHER AND METER AMP., MODEL 723

CKT. REF.	DESCRIPTION		MFG.
	CAPACITORS		
C1	250 µf, Alum Elect, 6VDC	1010-0251	Sprague
C2	.05 µf, +80%-20%, Cer. Disc. 25 WVDC	1005-5039	Erie
C3	10 µf, TANT, 10% 20 WVDC	1008-0100	Kemet
C4	.05 µf, +80%-20%, Cer. Disc. 25 WVDC	1005-5039	Erie
C5	10 µf, TANT, 10% 20 WVDC	1008-0100	Kemet
C6	10 µf, TANT, 10% 20 WVDC	1008-0100	Kemet
C7	.05 µf, +80%-20%, Cer. Disc. 25 WVDC	1005-5039	Erie
C8	10PF, 5% Durmica 500 WVDC	1001-0100	Elmenco
C9	150 PF, 5% Durmica 500 WVDC	1001-0151	Elmenco
C10	10 µf, TANT, 10%, 20 WVDC	1008-0100	Kemet
C11	250 µf, Alum Elect, 6WVDC	1010-0251	Kemet
C12	10 µf, TANT, 10%, 20 WVDC	1008-0100	Kemet
C13	250 µf, Alum Elect, 6 WVDC	1010-0251	Kemet
C14	150 PF, 5%, Durmica 500 WVDC	1001-0151	Elmenco
C15	4.7 PF, ±.25 PF, Tubular Cer. 500 WVDC	1000-0047	Erie
C16	250 µf, Alum Elect, 6 WVDC	1010-0251	Sprague
C17	.22 µf, ±10%, Polyfilm 100 WVDC	1002-2224	Sprague
C18	6.8 µf, TANT, 10%, 35 WVDC	1008-0068	Sprague
C19	6.8 µf, TANT, 10%, 35 WVDC	1008-0068	Sprague
C20	25 µf, Alum Elect, 6 WVDC	1010-0250	Sprague
C21	4.7 PF, ±.25 PF, Tubular Cer. 500 WVDC	1000-0047	Erie
C22	.0033 µf, ± 10% Polyfilm 100 WVDC	1002-3349	Sprague
	RESISTORS		
R1	499 ohms, ±1%, Metal Film, 1/8w	1061-0499	Dale
R2	100K ohms, ±5%, 1/4w Carbon Comp.	1065-1003	AB
R3	4.7K ohms, ±5%, 1/4w Carbon Comp.	1065-4701	AB
R4	4.7K ohms, ±5%, 1/4w Carbon Comp.	1065-4701	AB
R5	10K ohms, ±.25% Metal Film 1/8w	1059-1002	Dale
R6	10K ohms, ±.25% Metal Film 1/8w	1059-1002	Dale
R7	560 ohms, ±5% 1/4w Carbon Comp.	1065-0560	AB
R8	12K ohms, ±5%, 1/4w Carbon Comp.	1065-1202	AB
R9	12K ohms, ±5%, 1/4w Carbon Comp.	1065-1202	AB
R10	220 ohms, ±5%, 1/4w Carbon Comp.	1065-0220	AB
R11	10K ohms, ±5%, 1/4w Carbon Comp.	1065-1002	AB
R12	1 Meg ohms, ±5%, 1/4w Carbon Comp.	1065-1004	AB
R13	12K ohms, ±5%, 1/4w Carbon Comp.	1065-1202	AB
R14	2.7K ohms, ±5%, 1/4w Carbon Comp.	1065-2701	AB
R15	12K ohms, ±5%, 1/4w Carbon Comp.	1065-1202	AB
R16	47.5K ohms, ±1%, Metal Film	1065-4702	Dale
R17	150 ohms, ±5%, 1/4w Carbon Comp.	1065-0150	AB
R18	10K ohms, ±1%, Metal Film 1/8w	1061-1002	Dale
R19	150 ohms, ±5% 1/4w, Carbon Comp.	1065-0150	AB

A5 PEAK FLASHER AND METER AMP., MODEL 723

CKT. REF.	DESCRIPTION		MFG.
	RESISTORS		
R20	1K ohms, ±5%, 1/4w Carbon Comp.	1065-1001	AB
R21	1K ohms, ±5% 1/4w Carbon Comp.	1065-1001	AB
R22	470K ohms, ±5% 1/4w Carbon Comp.	1065-4703	AB
R23	680K ohms, ±5% 1/4w Carbon Comp.	1065-6803	AB
R24	270K ohms, ±5% 1/4w Carbon Comp.	1065-6803	AB
	INDUCTORS		
L1	15 µH, RF Coil	1530-0150	Delevan
L2	15 µH, RF Coil	1530-0150	Delevan
L3	15 µH, RF Coil	1530-0150	Delevan
	DIODES		
CR1	IN 4731 Zener	1283-4731	National
CR2	IN 4735 Zener	1283-4735	National
CR3	HP 2800	1282-2800	HP
	INTERGRATED CIRCUITS		
Z1	I.C. LM 741C	1100-0741	National
Z2	I.C. LM 301A	1100-0301	National
Z3	I.C. LM 710C	1100-0710	National
Z4	I.C. SP 380	1100-0380	Sig
Z5	I.C. LM 710	1100-0710	National
Z6	I.C. SN7400	1100-7400	National
Z7	I.C. SN75451P	1100-7551	Motorola
Z8	I.C. LM 301	1100-0301	National
Z9	I.C. LM 302	1100-0302	National
	P.C. Board		
A5	Peak Flasher and Meter Amp	1600-0049	



PEAK FLASHER AND METER AMP. BOARD

6608-0330 A5

USED ON	NEXT ASSY
723A	6608-0330
734	6608-0380

REVISIONS		
LTR	Description	Date
A	RELEASED TO PRODUCTION	4-26-73
B	REVISED PER ECO #93	10-24-73
C	REVISED PER ECO #116	12-27-73
D	REVISED PER ECO #169/170	7-2-74

P1

TO +5V BUSS 17 — L1 15 — C1 250

TO +15V BUSS 4 — L2 15 — C2 .05 — C3 10

THUMBWHEEL SW ≈ +0.7V TO FP-SW11-A 3 — R1 499 1% — C6 10

FLASHER CAL ≈ +.15VDC TO FP-R1-2 2

TO -15V BUSS 13 — L3 15 — C4 .05 — C5 10

FLASHER REF.

R2 100K — R3 4.7K — Z1 741 — CR1 IN4731

C7 .05 — R4 4.7K

FLASHER & METER INPUT ≈ 1V RMS FROM FP-SW3-6 8

GND 7

R5 10K .25% — R21 1K — C8 10pF — R6 10K .25% — C9 150pF — Z2 301

INVERTED AUDIO SIGNAL ≈ 1V RMS TO FP-SW3-4 6

GND 5

INVERTING UNITY GAIN AMP

C20 25 — R20 1K — Z3 710

PEAK FLASHER DETECTORS

R10 220 — C10 10

R8 12K — Z4 380 — C11 250 — Z4 380 — Z6 7400 — Z8 LM251 — R19 150 — P1 20 — "–" FLASHER TO FP-CR11-2

R9 12K — Z4 380 — C13 250 — Z4 380 — Z6 7400 — Z7 LM251 — R17 150 — P1 18 — "+" FLASHER TO FP-CR10-2

TO GND BUSS 1, 22

R7 560 — CR2 IN4735 — C12 10

PULSE STRETCHERS & LAMP DRIVERS

P1 9 — TO FP-SW10-A

TO PIN 3 THIS BOARD — 0 TO 790Ω FRONT PANEL THUMBWHEEL SWITCH

+5V — "–" LED

+5V — "+" LED

P1 19 — TO RP-J12-C REMOTE FLASHER

P1 20 — TO RP-J12-G REMOTE FLASHER

P1 12 — TO CH-A10-6

P1 16 — TO FP-M2 "+"

P1 14 — GND

P1 15 — TO RP-J12-A REMOTE METER

MODULATION METER FP-M2 — 0-400 μA

METER INPUT CH-R2-2 ≈ 0.5V RMS 11

GND 10

R18 10K 1% — R22 470K * — C21 4.7pF *

MODULATION METER AMP — Z8 301 — C14 150pF — C22 .0033 * — R23 680K * — R24 270K * — C15 4.7pF — R16 47.5K 1% — C16 250

MODULATION METER DETECTOR — CR3 HPA2800 — R11 10K — R12 1.0 Meg. — C17 .22

VOLTAGE FOLLOWER — Z9 302 — C18 6.8 — R13 12K — R14 2.7K — R15 12K — C19 6.8

SN7400 — 1A 1B 1Y 2A 2B 2Y GND — 4B 4A 4Y 3B 3A 3Y

710 — NC GND NON INVERTING INPUT INVERTING INPUT NC V- NC — NC NC NC V+ NC OUTPUT NC

SN75451 OR LM251 — 1A 1B 1Y GND — VCC 2B 2A 2Y

SP380A

301 — BALANCE/COMPENSATION INPUT INPUT V- — COMPENSATION V+ OUTPUT BALANCE

741 — OFFSET NULL INVERT INPUT NON-INVERT V- — NC V+ OUTPUT OFFSET NULL

302 — BALANCE NC INPUT V- — V+ OUTPUT BIAS

COMPONENT DESIGNATOR		
FIRST	LAST	DELETED
C1	C22	
CR1	CR3	
L1	L3	
R1	R24	
Z1	Z9	

NOTES; UNLESS OTHERWISE SPECIFIED:
1. RESISTORS - VALUES IN OHMS ±5%, 1/4 WATT.
2. CAPACITORS - VALUES IN MICROFARADS.
3. INDUCTORS - VALUES IN MICROHENRYS ±10%
4. *FACTORY SELECT VALUE. TYPICAL VALUE SHOWN.
5. VOLTAGES ARE DC CONDITIONS.

TFT TIME AND FREQUENCY TECHNOLOGY, INC.

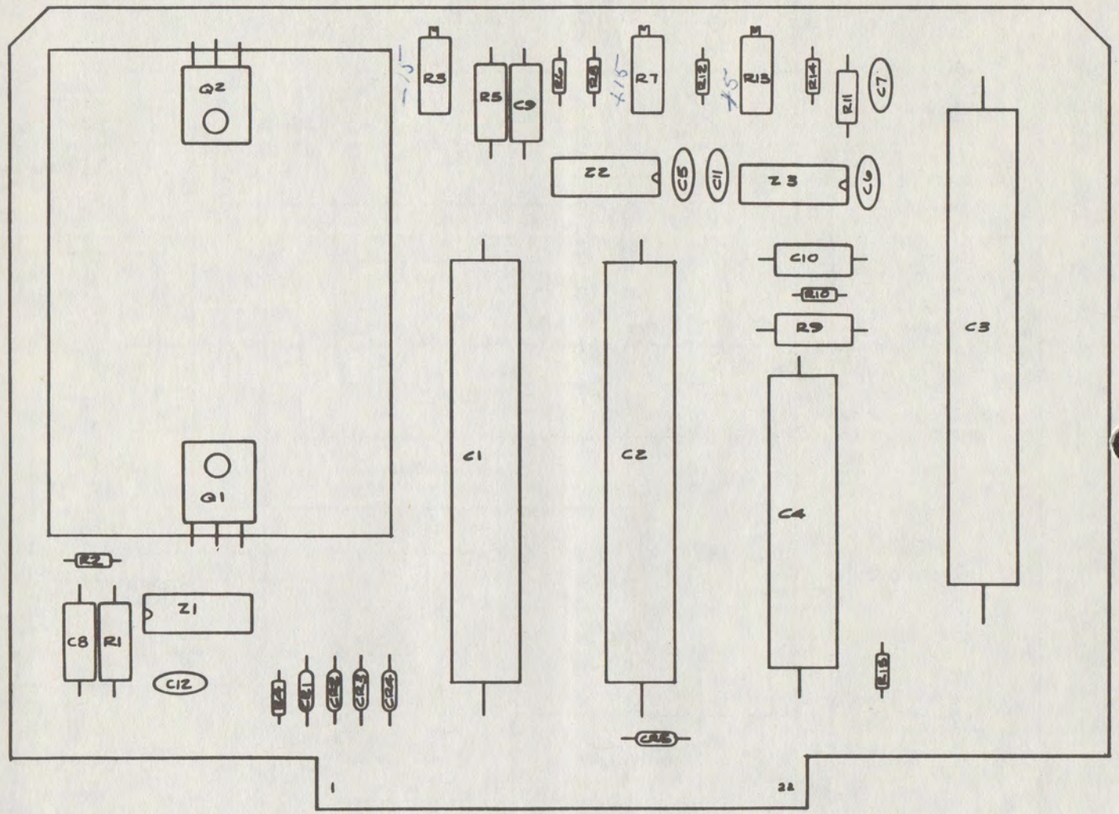
SCALE —	APPROVED BY	DRAWN BY D.S.
DATE 4-26-73		REVISED
PEAK FLASHER & METER AMP. BOARDS		
FIG. 6-8		DRAWING NUMBER 6601-0980

A 6 POWER SUPPLY BOARD

CKT. REF.	DESCRIPTION	TFT STOCK NO.	MFR.
	CAPACITORS		
C1	Electro., 4000 μF ±20%, 25V	1010-0402	Sprague
C2	Electro., 4000 μF ±20%, 25V	1010-0402	Sprague
C3	Electro., 8000 μF ±20%, 15V	1010-0802	Sprague
C4	Electro., 10 μF ±20%, 450V	1010-0100	Sprague
C5	Mica, 470 pF ±5%	1001-0471	Elmenco
C6	Mica, 470 pF ±5%	1001-0471	Elmenco
C7	Cer., .05 μF +80% -20%, 25V	1005-5039	Erie
C8	Tant., 10 μF ±10%, 20V	1008-0100	Kemet
C9	Tant., 10 μF ±10%, 20V	1008-0100	Kemet
C10	Tant., 10μF ±10%, 20V	1008-0100	Kemet
C11	Cer., .01 μF +80% -20%, 25V	1005-1039	Erie
C12	470, 5%, 1/4W	1065-0470	ABR
	RESISTORS		
R1	Wirewound, 1Ω ±5%, 3W	1068-0001	Ohmite
R2	Comp, 3.3K ±5%, 10 turns	1065-3301	Allen-Bradley
R3	Vari., 1K ±10%, 1/4W	1069-1001	Beckman
R4	Comp, 3.3K ±5%, 1/4W	1065-3301	Allen-Bradley
R5	Wirewound, 1Ω ±5%, 3W	1068-0001	Ohmite
R6	Comp, 3.3K ±5%, 1/4W	1065-3301	Allen-Bradley
R7	Vari., 1K ±10%, 10 turns	1069-1001	Beckman
R8	Comp, 3.3K ±5%, 1/4W	1065-0191	Ohmite
R9	Wirewound, 0.1Ω ±5%, 3W	1068-0191	Ohmite
R10	Comp, 680Ω ±5%, 1/4W	1065-0680	Allen-Bradley
R11	Comp, 82Ω ±5%, 1/4W	1065-0082	Allen-Bradley
R12	Comp, 560Ω ±5%, 1/4W	1065-0560	Allen-Bradley
R13	Vari., 1KΩ ±10%, 10 turns	1069-1001	Beckman
R14	Comp, 1.8KΩ, ±5%, 1/4W	1065-1801	Allen-Bradley
R15	100K 5%, 1/4W	1065-1003	ABR
	TRANSISTORS		
Q1	Si, Power NPN, MJE 3055	1272-3055	Motorola
Q2	Si, Power NPN, MJE 3055	1272-3055	Motorola
	INTEGRATED CIRCUITS		
Z1	LM723CN Regulator	1100-0723	National
Z2	LM723CN Regulator	1100-0723	National
Z3	LM723CN Regulator	1100-0723	National

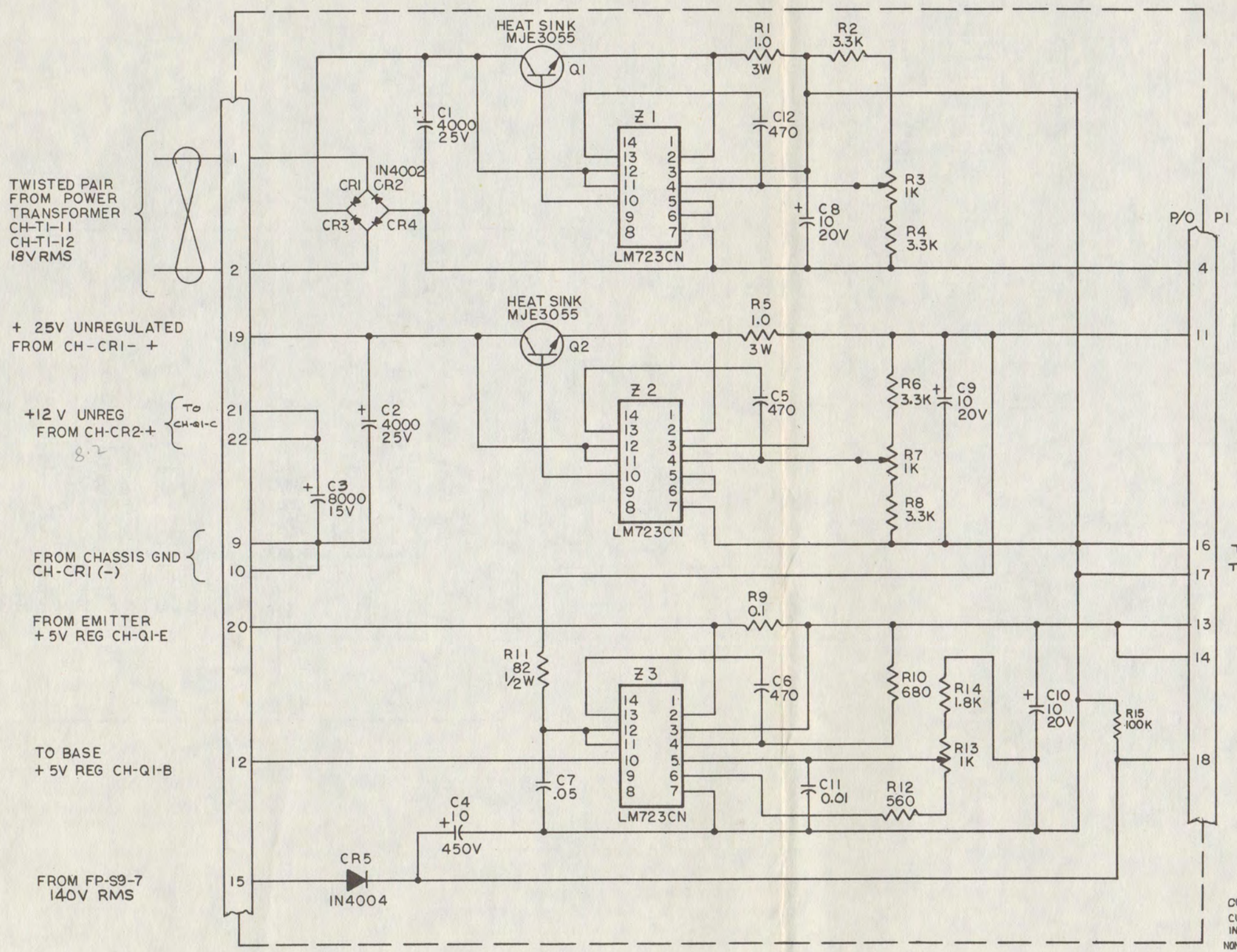
A 6 POWER SUPPLY BOARD

CKT. REF.	DESCRIPTIONS	TFT STOCK NO.	MFR.
	RECTIFIERS		
CR1	1N4002, 1A, 200V PIV	1284-4002	Motorola
CR2	1N4002, 1A, 200V PIV	1284-4002	Motorola
CR3	1N4002, 1A, 200V PIV	1284-4002	Motorola
CR4	1N4002, 1A, 200V, PIV	1284-4002	Motorola
CR5	1N4004, 1A, 400V PIV	1284-4004	Motorola



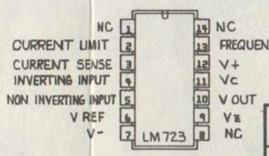
POWER SUPPLY BOARD
A6 6608-0006

REVISIONS		
LTR	Description	Date
A	RELEASED TO PRODUCTION	4-4-73
B	REVISED PER ECO # 116	12-21-73



COMPONENT DESIGNATOR		
FIRST	LAST	DELETED
C1	C12	
CR1	CR5	
Q1	Q2	
R1	R15	
Z1	Z3	

NOTES; UNLESS OTHERWISE SPECIFIED:
1. RESISTORS - VALUES IN OHMS ±5%, 1/4 WATT.
2. CAPACITORS - VALUES IN MICROFARADS.
3. INDUCTORS - VALUES IN MICROHENRYS ±10%
4. *FACTORY SELECT VALUE, TYPICAL VALUE SHOWN.
5. VOLTAGES ARE DC CONDITIONS.



TIME AND FREQUENCY TECHNOLOGY, INC.
SANTA CLARA, CA 95050 (408) 246-6365

SCALE: —
DATE: 12-4-72
APPROVED BY:
DRAWN BY
REVISED

POWER SUPPLY (A6)

FIG. 6-9 MODEL 723 DRAWING NUMBER 6601-0088

A7 COUNTER-DISPLAY BOARD, MODEL 723

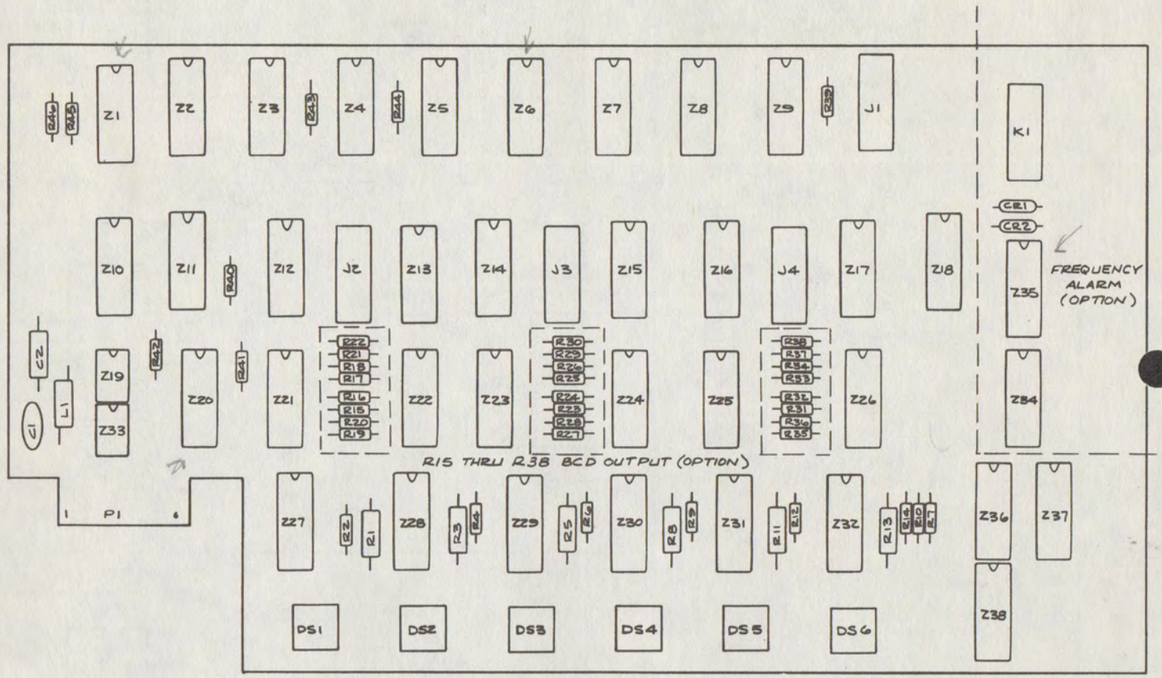
CKT. REF.	DESCRIPTION			TFT STOCK NO.	MFG.
	CAPACITORS				
C1	.05 µf +80-20% 25V Cer. Disc.			1005-5039	ERIE
C2	1 µf 25V Electrolytic			1010-0010	SPRAGUE
C3	22 pf Durmica ± 5%			1001-0220	ELMENCO
	RESISTORS				
R1	15K	10%	1/2w	1067-1502	AB
R2	10MEG	10%	1/4w	1066-1005	AB
R3	15K	10%	1/2w	1067-1502	AB
R4	10MEG	10%	1/4w	1066-1005	AB
R5	15K	10%	1/2w	1067-1502	AB
R6	10MEG	10%	1/4w	1066-1005	AB
R7	150K	5%	1/4w	1065-1503	AB
R8	15K	10%	1/2w	1067-1502	AB
R9	10MEG	10%	1/4w	1066-1005	AB
R10	150K	5%	1/4w	1065-1503	AB
R11	15K	10%	1/2w	1067-1502	AB
R12	10MEG	10%	1/4w	1066-1005	AB
R13	15K	10%	1/2w	1067-1502	AB
R14	10MEG	10%	1/4w	1066-1005	AB
R40	1K	5%	1/4w	1065-1001	AB
R41	100Ω	5%	1/4w	1065-0100	AB
R42	100Ω	5%	1/4w	1065-0100	AB
R43	1K	5%	1/4w	1065-1001	AB
R44	1K	5%	1/4w	1065-1001	AB
R45	1K	5%	1/4w	1065-1001	AB
R46	150Ω	5%	1/4w	1065-0150	AB
R47	2.7KΩ	5%	1/4w	1065-2701	AB
R48	150K	5%	1/4w	1065-1503	AB
R49	1K	5%	1/4w	1065-1001	AB
	COILS				
L1	2 1/2 Turn Choke			1530-0025	
	INTEGRATED CIRCUITS				
Z1	SN 7476			1100-7476	NAT'L
Z2	SN 7400			1100-7400	NAT'L
Z3	SN 7400			1100-7400	NAT'L
Z4	SN 7490			1100-7490	NAT'L
Z5	SN 7490			1100-7490	NAT'L
Z6	SN 7490			1100-7490	NAT'L
Z7	SN 7400			1100-7400	NAT'L
Z8	SN 7490			1100-7490	NAT'L
Z9	SN 7400			1100-7400	NAT'L
Z10	SN 7476			1100-7476	NAT'L
Z11	SN 7400			1100-7400	NAT'L
Z12	SN 74190			1100-7491	TI
Z13	SN 74190			1100-7491	TI

A7, BCD OUTPUT (OPTION), MODEL 723

CKT. REF.	DESCRIPTION			TFT STOCK NO.	MFG.
R15	1K	± 5%	1/4w	1065-1001	AB
R16	1K	± 5%	1/4w	1065-1001	AB
R17	1K	± 5%	1/4w	1065-1001	AB
R18	1K	± 5%	1/4w	1065-1001	AB
R19	1K	± 5%	1/4w	1065-1001	AB
R20	1K	± 5%	1/4w	1065-1001	AB
R21	1K	± 5%	1/4w	1065-1001	AB
R22	1K	± 5%	1/4w	1065-1001	AB
R23	1K	± 5%	1/4w	1065-1001	AB
R24	1K	± 5%	1/4w	1065-1001	AB
R25	1K	± 5%	1/4w	1065-1001	AB
R26	1K	± 5%	1/4w	1065-1001	AB
R27	1K	± 5%	1/4w	1065-1001	AB
R28	1K	± 5%	1/4w	1065-1001	AB
R29	1K	± 5%	1/4w	1065-1001	AB
R30	1K	± 5%	1/4w	1065-1001	AB
R31	1K	± 5%	1/4w	1065-1001	AB
R32	1K	± 5%	1/4w	1065-1001	AB
R33	1K	± 5%	1/4w	1065-1001	AB
R34	1K	± 5%	1/4w	1065-1001	AB
R35	1K	± 5%	1/4w	1065-1001	AB
R36	1K	± 5%	1/4w	1065-1001	AB
R37	1K	± 5%	1/4w	1065-1001	AB
R38	1K	± 5%	1/4w	1065-1001	AB

A7 COUNTER-DISPLAY BOARD, MODEL 723

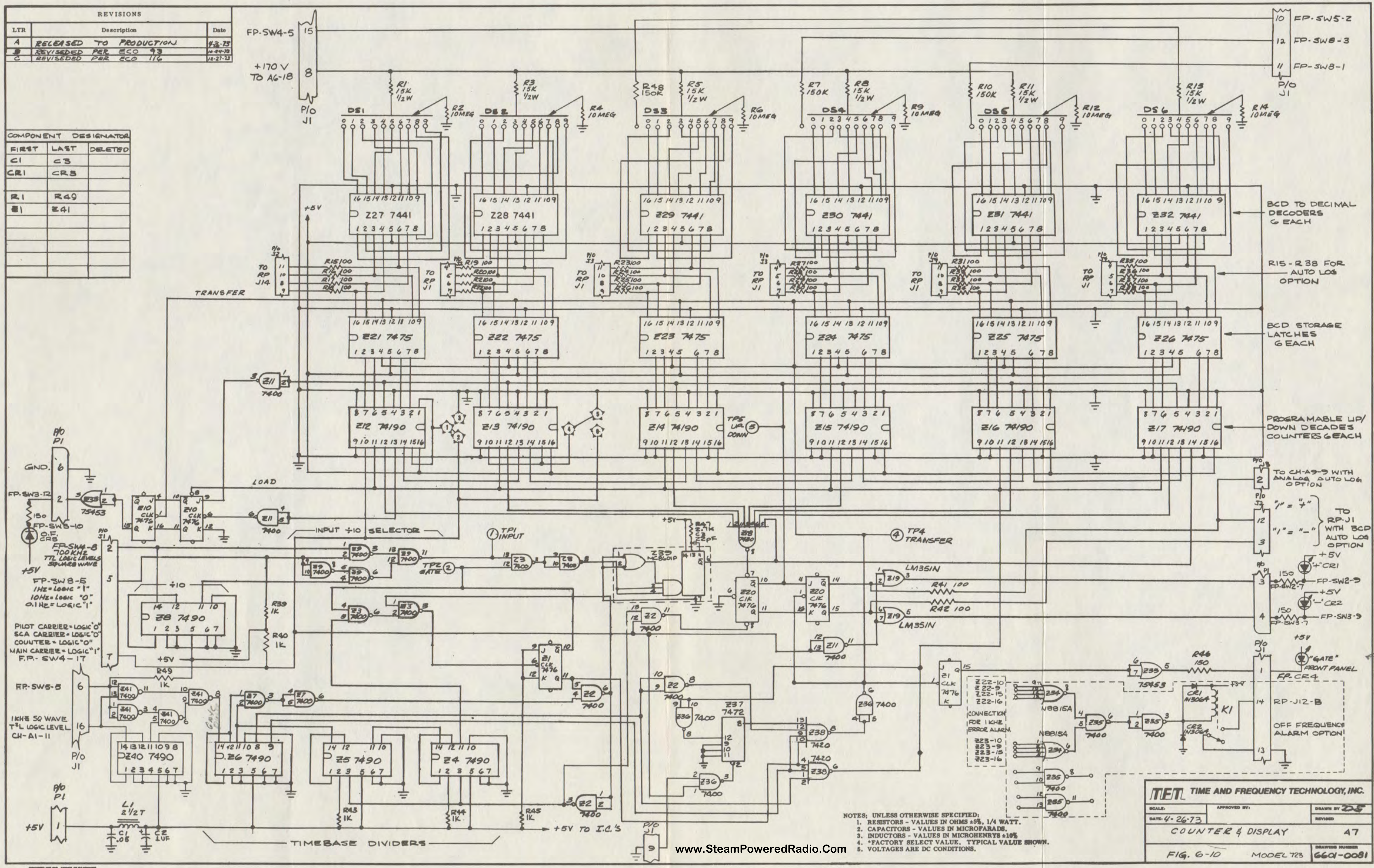
CKT. REF.	DESCRIPTION		TFT STOCK NO.	MFG.
	INTEGRATED CIRCUITS			
Z14	SN 74190		1100-7491	TI
Z15	SN 74190		1100-7491	TI
Z16	SN 74190		1100-7491	TI
Z17	SN 74190		1100-7491	TI
Z18	SN 7430		1100-7430	NAT'L
Z19	SN 75453		1100-7553	NAT'L
Z20	SN 7476		1100-7476	NAT'L
Z21	SN 7475		1100-7475	NAT'L
Z22	SN 7475		1100-7475	NAT'L
Z23	SN 7475		1100-7475	NAT'L
Z24	SN 7475		1100-7475	NAT'L
Z25	SN 7475		1100-7475	NAT'L
Z26	SN 7475		1100-7475	NAT'L
Z27	SN 7441		1100-7441	NAT'L
Z28	SN 7441		1100-7441	NAT'L
Z29	SN 7441		1100-7441	NAT'L
Z30	SN 7441		1100-7441	NAT'L
Z31	SN 7441		1100-7441	NAT'L
Z32	SN 7441		1100-7441	NAT'L
Z33	SN 75453		1100-7553	NAT'L
Z36	SN 7400		1100-7400	NAT'L
Z37	SN 7472		1100-7472	NAT'L
Z38	SN 7420		1100-7400	NAT'L
Z39	MC 8601		1100-8601	NAT'L
Z40	SN 7490		1100-7490	NAT'L
Z41	SN 7400		1100-7400	NAT'L
	MISCELLANEOUS			
	P.C. BOARD		1600-0022	
FREQUENCY ALARM OPTION				
CR1	IN 3064	Sil-Diode - Option	1281-3064	FSC
CR2	IN 3064	Sil-Diode - Option	1281-3064	FSC
K1	Relay - PRB-3510 - Option		1300-0001	CLARE
Z34	SN 7425	Option	1100-7425	NSC
Z35	SN 7400	Option	1100-7400	NSC



COUNTER DISPLAY A7 6608 0160

LTR	Description	Date
A	RELEASED TO PRODUCTION	4-2-73
B	REVISEDED PER ECO 93	10-24-73
C	REVISEDED PER ECO 116	12-27-73

COMPONENT DESIGNATOR		
FIRST	LAST	DELETED
C1	C3	
CR1	CR3	
R1	R49	
Z1	Z41	



NOTES: UNLESS OTHERWISE SPECIFIED:
1. RESISTORS - VALUES IN OHMS ±5%, 1/4 WATT.
2. CAPACITORS - VALUES IN MICROFARADS.
3. INDUCTORS - VALUES IN MICROHENRYS ±10%
4. *FACTORY SELECT VALUE. TYPICAL VALUE SHOWN.
5. VOLTAGES ARE DC CONDITIONS.

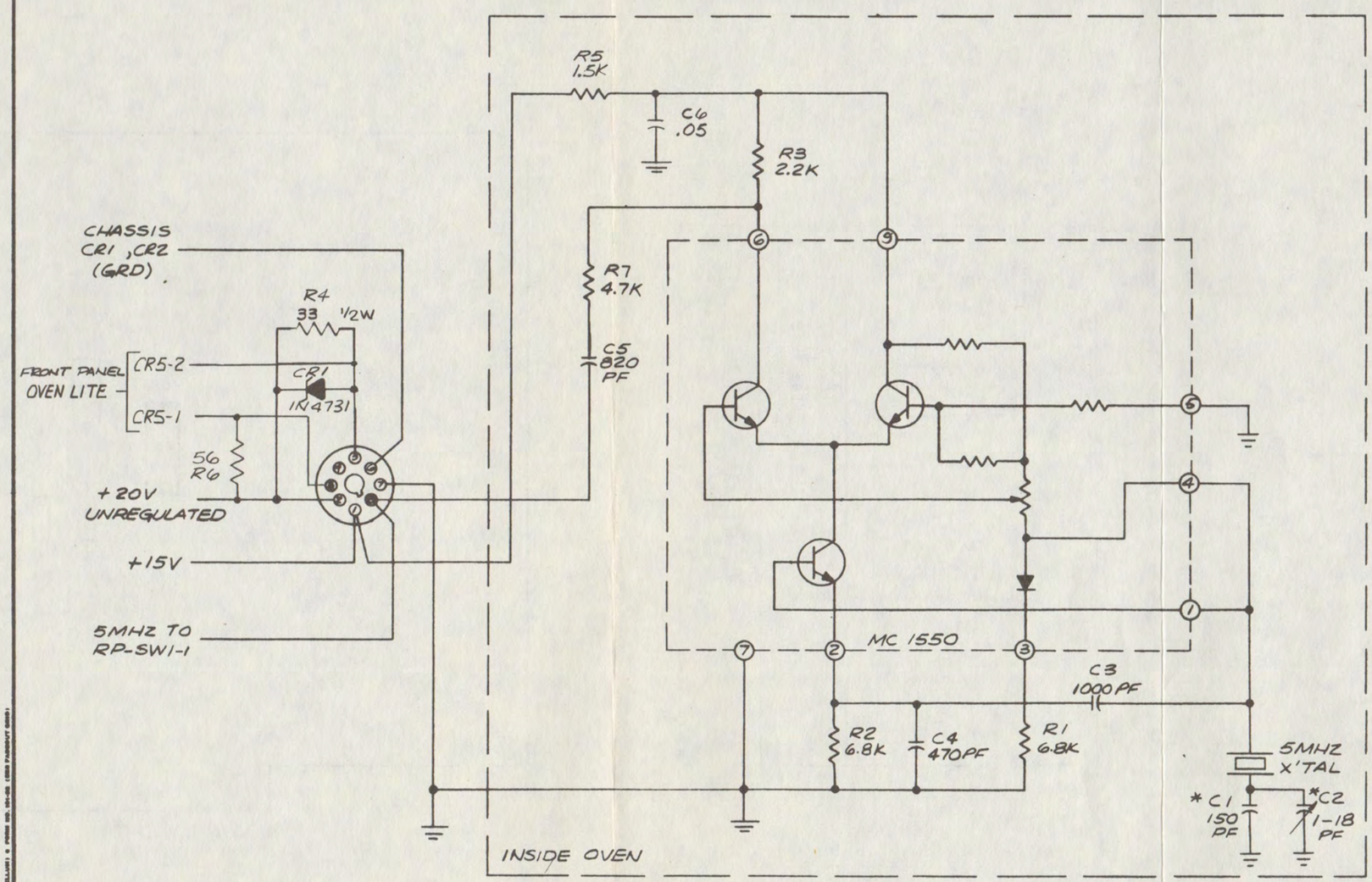
TFT TIME AND FREQUENCY TECHNOLOGY, INC.

DATE: 4-26-73

COUNTER & DISPLAY — A7

FIG. 6-10 — MODEL 723 — 6601-0081

REVISIONS		
LTR	Description	Date
A	RELEASED TO PRODUCTION	4-6-73
B	REVISED PER ECO # 116	12-27-73



NOTES; UNLESS OTHERWISE SPECIFIED:
1. RESISTORS - VALUES IN OHMS ±5%, 1/4 WATT.
2. CAPACITORS - VALUES IN MICROFARADS.
3. INDUCTORS - VALUES IN MICROHENRYS ±10%
4. *FACTORY SELECT VALUE. TYPICAL VALUE SHOWN.
5. VOLTAGES ARE DC CONDITIONS.

COMPONENT DESIGNATOR		
FIRST	LAST	DELETED
C1	C6	
CR1	CR1	
R1	R5	R6 thru R20

TFT TIME AND FREQUENCY TECHNOLOGY, INC.

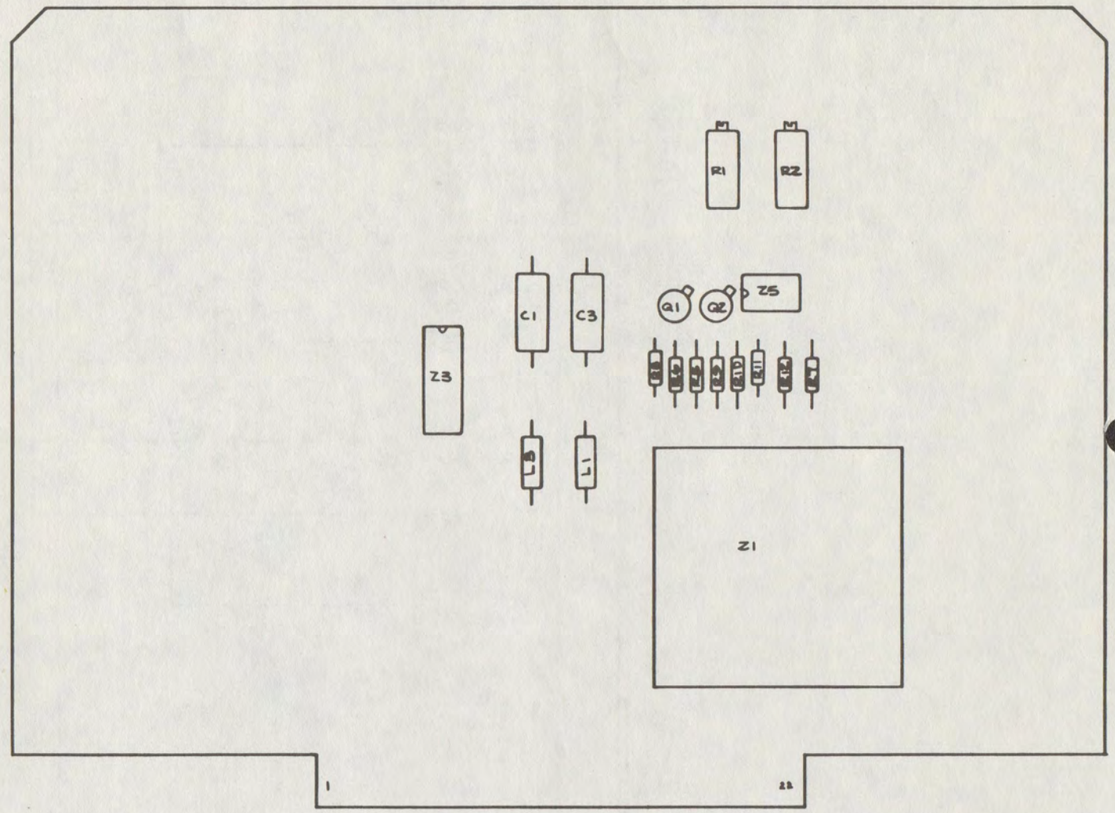
SCALE	APPROVED BY	DRAWN BY
DATE 4-17-72		REVISED

5 MHZ X TAL OSC (A8)

FIG. 6-11 MODEL 723A DRAWING NUMBER 6001-0087

A9 D/A CONVERTER, MODEL 723 (Option)

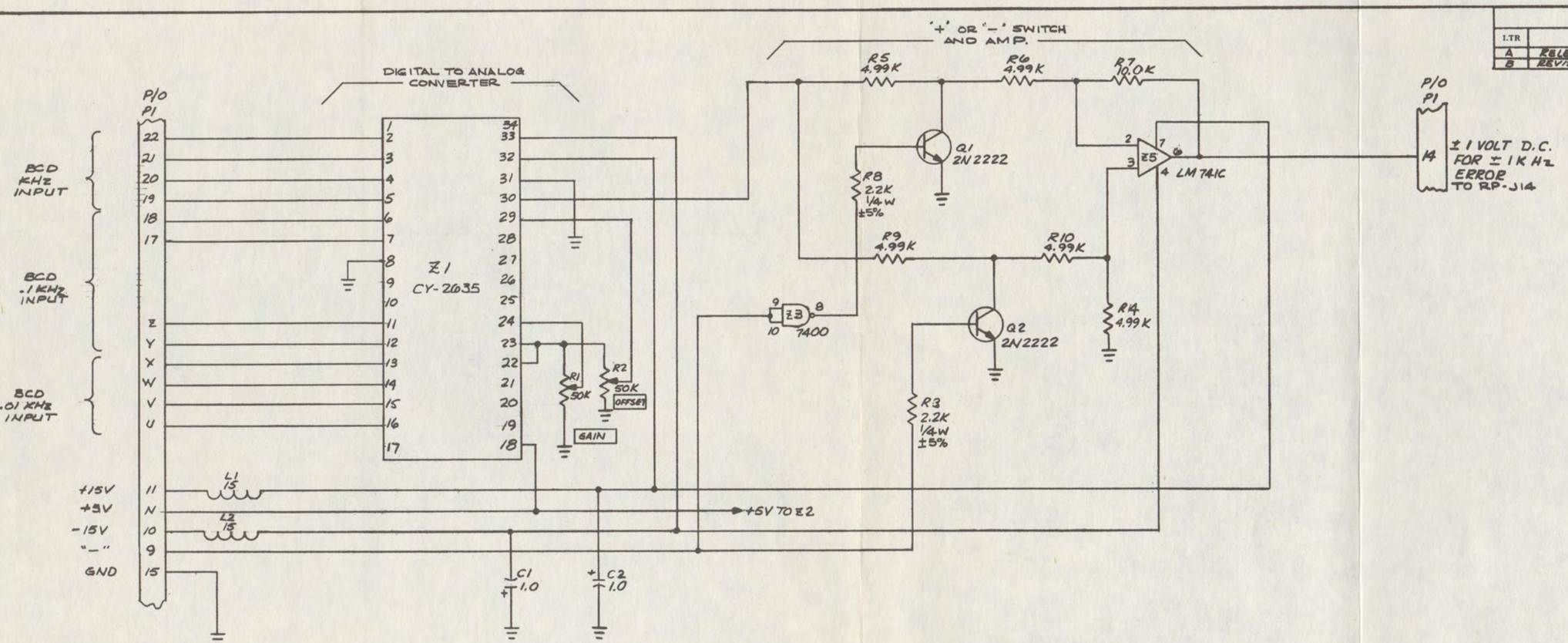
CKT. REF.	DESCRIPTION		MFG.
	CAPACITORS		
C1	1 μf 25V Electrolytic	1010-0010	Sprague
C2	1 μf 25V Electrolytic	1010-0010	Sprague
	RESISTORS		
R1	50K Cermet Potentiometer	1069-5002	Beckman
R2	50K Cermet Pot	1069-5002	Beckman
R5	4.99K ± 1% 1/8w Metal Film	1061-4991	Dale
R6	4.99K ± 1% 1/8w Metal Film	1061-4991	Dale
R7	10.0K ± 1% 1/8w Metal Film	1061-1002	Dale
R8	2.2K ± 5% 1/4w Carbon Comp.	1065-2201	AB
R9	4.99K ± 1% 1/8w Metal Film	1061-4991	Dele
R10	4.99K ± 1% 1/8w Metal Film	1061-4991	Dale
R11	2.2K ± 5% 1/4w Carbon Comp.	1065-2201	AB
R12	4.99K ± 1% 1/8w Carbon Comp.	1061-4991	Dale
	INTERGRATED CIRCUITS		
Z1	I.C. CY-2635	1122-2635	Cycon
Z3	I.C. SN 7400N	1000-7400	NSC
Z5	I.C. LM 741cN	1100-0741	NSC
	INDUCTORS		
L1	15 μHy RF Choke	1530-0150	Delevan
L3	15 μHy RF Choke	1530-0150	Delevan
	TRANSISTORS		
Q1	2N 2222 Si NPN Transistor	1271-2222	NSC
Q2	2N 2222 Si NPN Transistor	1271-2222	NSC
	P.C. Board, Digital to Analog Converter	1600-0034	



D/A CONVERTER 6608-0230

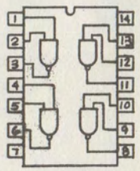
A9

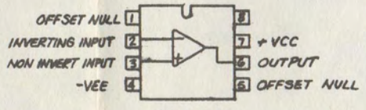
REVISIONS		
LTR	Description	Date
A	RELEASED TO PRODUCTION	4-6-73
B	REVISED PER ECO # 116	12-17-73



P1 SOCKET CONNECTION TABLE			
PIN NO.	CONNECTED TO	PIN NO.	CONNECTED TO
1		A	
2		B	
3		C	
4		D	
5		E	
6		F	
7		H	
8		J	
9	CH-A7-J2-3	K	
10	-15V	L	
11	+15V	M	
12		N	+5V
13		P	
14	TO RP-J14	R	
15	GND	S	
16		T	
17	CH-A7-J3-6	U	CH-A7-J6-10
18	CH-A7-J3-7	V	CH-A7-J4-11
19	CH-A7-J3-10	W	CH-A7-J4-8
20	CH-A7-J3-11	X	CH-A7-J4-9
21	CH-A7-J3-8	Y	CH-A7-J3-5
22	CH-A7-J3-9	Z	CH-A7-J3-4

NOTES; UNLESS OTHERWISE SPECIFIED;
1. RESISTORS - VALUES IN OHMS ±1%, 1/8 WATT.
2. CAPACITORS - VALUES IN MICROFARADS.
3. INDUCTORS - VALUES IN MICROHENRYS ±10%
4. *FACTORY SELECT VALUE. TYPICAL VALUE SHOWN.
5. VOLTAGES ARE DC CONDITIONS.


SN7400



LM741C

COMPONENT DESIGNATOR		
FIRST	LAST	DELETED
C1	C3	
Q1	Q2	
R1	R12	
Z1	Z5	
L1	L3	

TIME AND FREQUENCY TECHNOLOGY, INC.
SANTA CLARA, CA 95050 (408) 249-5305

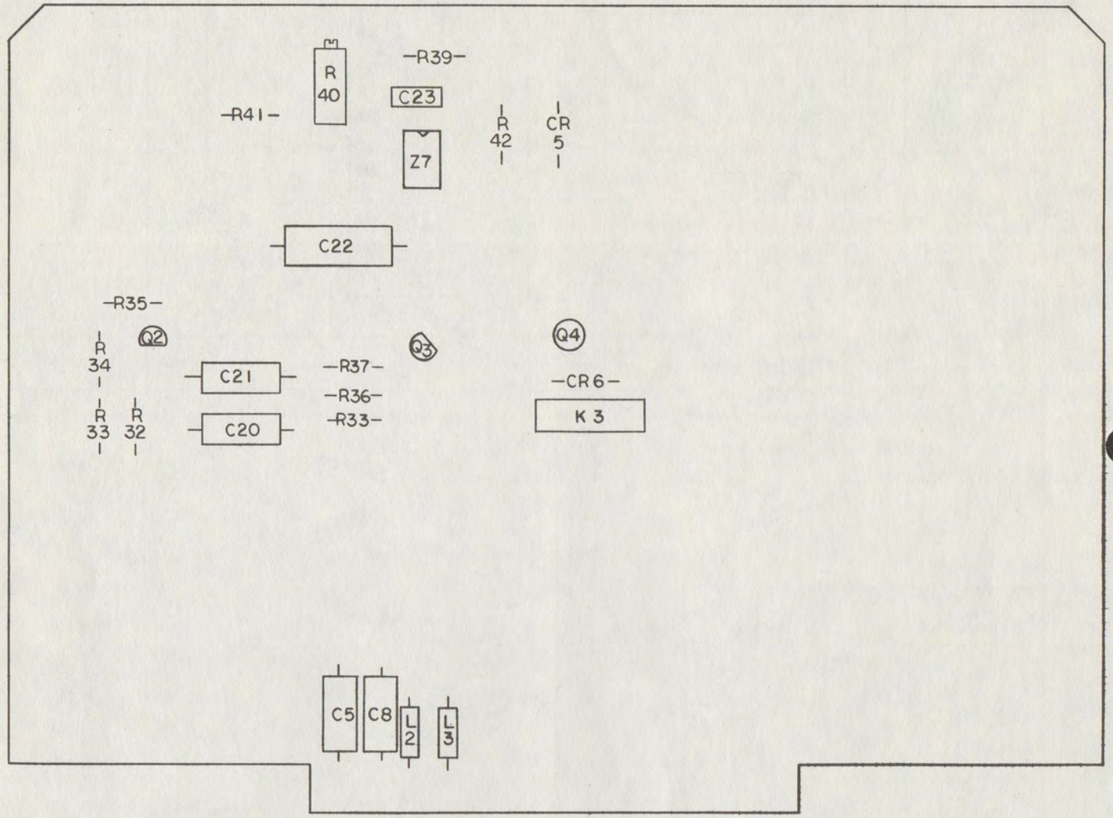
DATE 4-6-73 DRAWN BY RG.

DIGITAL TO ANALOG CONVERTER (A9)

FIG. 6-12 MODEL 728 DRAWING NO. 6601-0089

A10, MODULATION ALARM OPTION MODEL 723

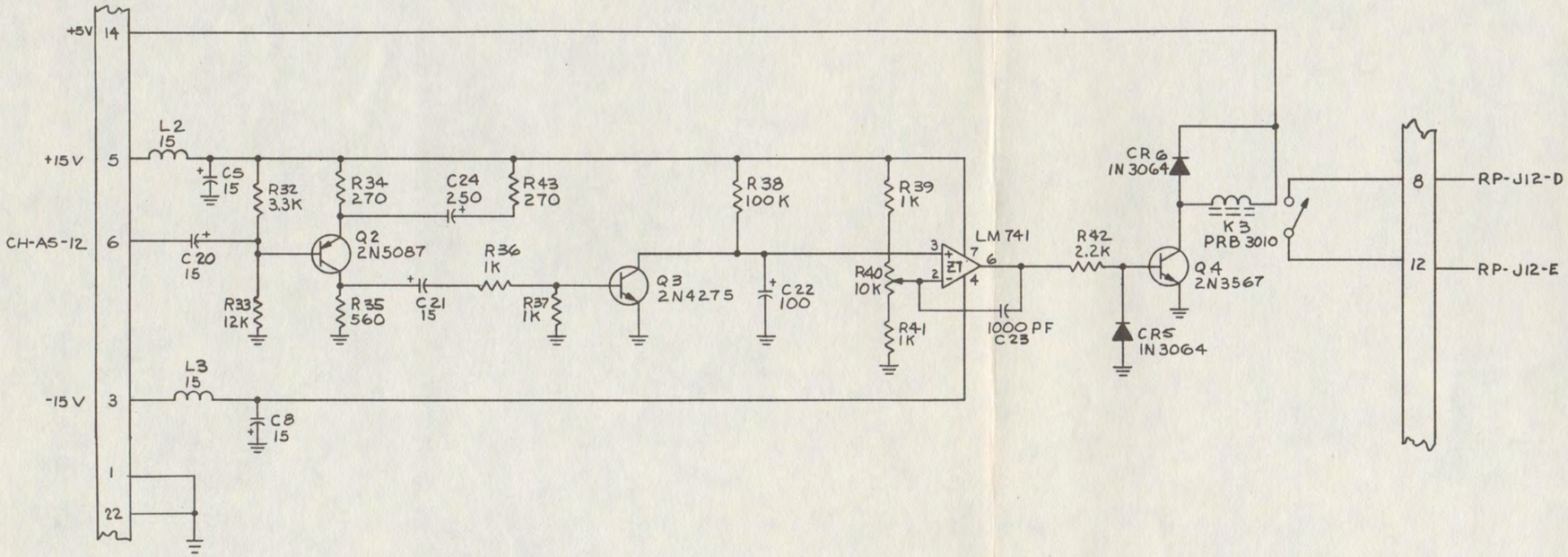
CKT. REF	DESCRIPTION		MFG.
	CAPACITORS		
C5	15µf, 25V ELECTROLYTIC	1010-0150	Sprague
C8	15µf, 25V ELECTROLYTIC	1010-0150	Sprague
C20	15µf, 25V ELECTROLYTIC	1010-0150	Sprague
C21	15µf, 25V ELECTROLYTIC	1010-0150	Sprague
C22	100µf, 16V ELECTROLYTIC	1010-0101	Sprague
C23	1000pf, ±5%V D.M.	1001-0102	Elmenco
	DIODES		
CR5	IN3064 Si Diode	1281-3064	FSC
CR6	IN3064 Si Diode	1281-3064	FSC
	RELAY		
K3	PRB 3510 Relay	1880-0001	Clare
	COIL		
L2	15µH ±20% Molded R.F. Coil	1530-0150	Delevan
L3	15µH ±20% Molded R.F. Coil	1530-0150	Delevan
	TRANSISTORS		
Q2	2N5087 Si PNP Transistor	1271-5087	Motorola
Q2	2N4275 Si NPN Transistor	1271-4275	NSC
Q4	2N3567 Si NPN Transistor	1271-3567	NSC
	RESISTORS		
R32	3.3K ±5% 1/4W Carbon Comp	1065-3301	AB
R33	12K ±5% 1/4W Carbon Comp	1065-1202	AB
R34	270 ohms ±5% 1/4W Carbon Comp	1065-0270	AB
R35	560 ohms ±5% 1/4W Carbon Comp	1065-0560	AB
R36	1K ±5% 1/4W Carbon Comp	1065-1001	AB
R37	1K ±5% 1/4W Carbon Comp	1065-1001	AB
R38	100K ±5% 1/4W Carbon Comp	1065-1003	AB
R39	1K ±5% 1/4W Carbon Comp	1065-1001	AB
R40	10K Potentiometer 20 turn Cermet	1072-1002	Beckman
R41	1K ±5% 1/4W Carbon Comp	1065-1001	AB
R42	2.2K ±5% 1/4W Carbon Comp	1065-2201	AB



MODULATION ALARM
6608-0224 A10

NEXT ASSY	USED ON
6608-0224	723/734

REVISIONS					
SYM	DESCRIPTION	DR	CHK	AUTH	DATE
A	RELEASE TO PRODUCTION	RH			7-2-74



COMPONENT DESIGNATOR		
FIRST	LAST	DELETED
C5	C24	C6,7,C9-19,C23
CR5	CR6	
K3	K3	
L2	L3	
Q2	Q4	
R32	R43	
Z7	Z7	

NOTES; UNLESS OTHERWISE SPECIFIED:
1. RESISTORS - VALUES IN OHMS ±5%, 1/4 WATT.
2. CAPACITORS - VALUES IN MICROFARADS.
3. INDUCTORS - VALUES IN MICROHENRYS ±10%
4. *FACTORY SELECT VALUE. TYPICAL VALUE SHOWN.
5. VOLTAGES ARE DC CONDITIONS.

ITEM NO.	QTY PER ASSY	BN NO.	PART NO.	DESCRIPTION	REF. DES.

LIST OF MATERIALS

REMOVE ALL BURRS AND SHARP EDGES

TOLERANCES UNLESS OTHERWISE SPECIFIED
.XX ± ANGULAR ±
.XXX ±

DO NOT SCALE THIS PRINT

DRAWN BY	R.R.H.	DATE 7-2-74
CHK. BY		
PROJ. ENG.		
MFG. ENG.		
APPD.		
APPD.		
ECO NO.		

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

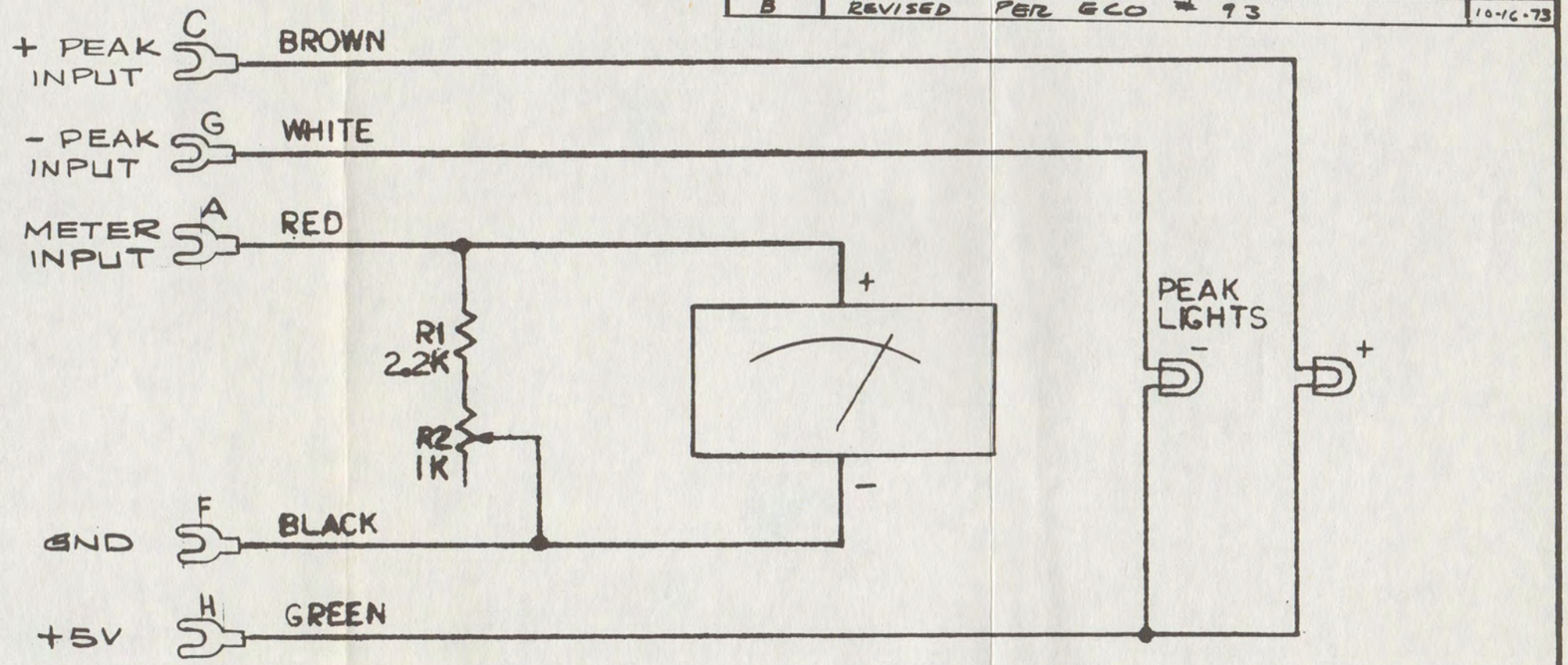
TITLE MODULATION ALARM
MODEL 723 FIGURE 6-13
MODEL 734 FIGURE 6-

SIZE D | DRAWING NO. 6601-0080 | REV. A

SCALE ~ SHT. 1 OF 1

DWG NO. 6601-0080

REVISIONS		
LTR	Description	Date
A	RELEASED TO PRODUCTION	4-6-73
B	REVISED PER ECO # 93	10-16-73



TFT TIME AND FREQUENCY TECHNOLOGY, INC.
3060 SCOTT BLVD., SANTA CLARA, CA 95050 (408) 246-6365

SCALE: NONE	APPROVED BY:	DRAWN BY ECP
DATE: 10 MAY 71		REVISED

MODEL 704B

FIG. 6-14 - MODEL 723, FIG 6-10 MODEL 734

DRAWING NUMBER 6601-0090