Serial No._____

Rev. Level D

Rev. Date 2/80

P.N. 5004-7241

STEREO MONITOR

MODEL 724A

Time & Frequency Technology, Inc.
3090 Oakmead Village Drive
Santa Clara, CA 95051

(408) 727-7272

MODEL 724A
MANUAL REVISION LEVEL B
EFFECTIVE SERIAL NO 240-2

IMPORTANT MANUAL CHANGES

A power transformer, line cord, fuse, and associated wiring have been added to the Model 724A so that it is no longer dependent on the Model 763 for its power. The following drawings are affected, and new copies are attached; Wiring diagram Figure 6.2, Front and rear panel drawings figures 3-1 and 3-2, and Figure 2-2. Other portions of the manual affected are as follows.

1.2 Specifications

Power Requirements

117 VAC ±10%, 15 Watts max.

2.3 Installation Procedures

b. Connect the power cord to a 117VAC power source.

3.2.2 Rear Panel

9. Power Cord and fuse	Main power to the Model 724. If unit is wired for 230V power cord will be so labled. Fuse should be reduced to 1/8 Amp. S.B. when used with 230VAC.

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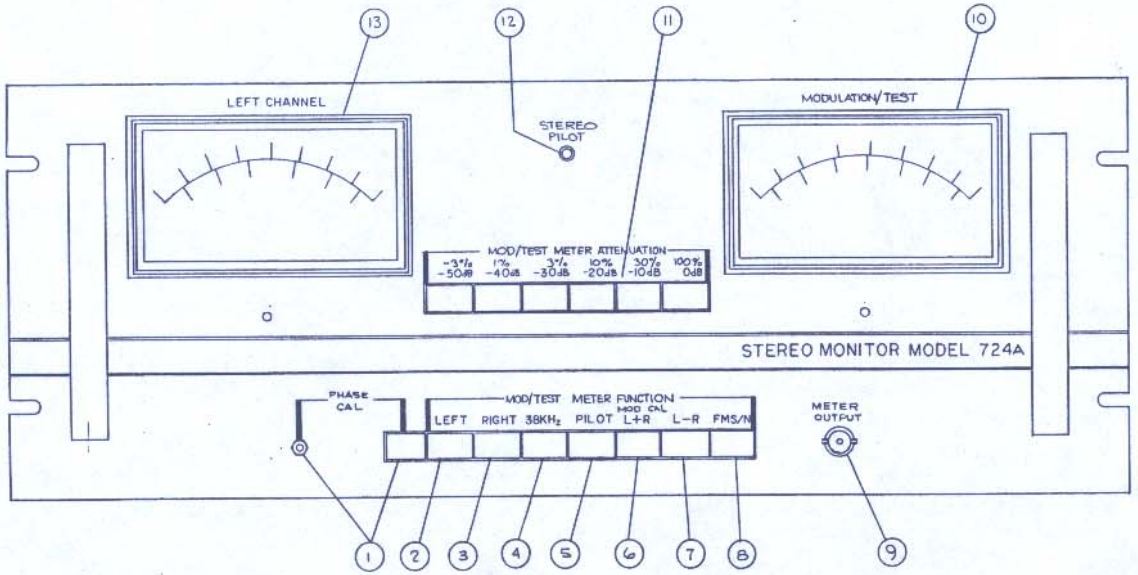


FIGURE 3-1

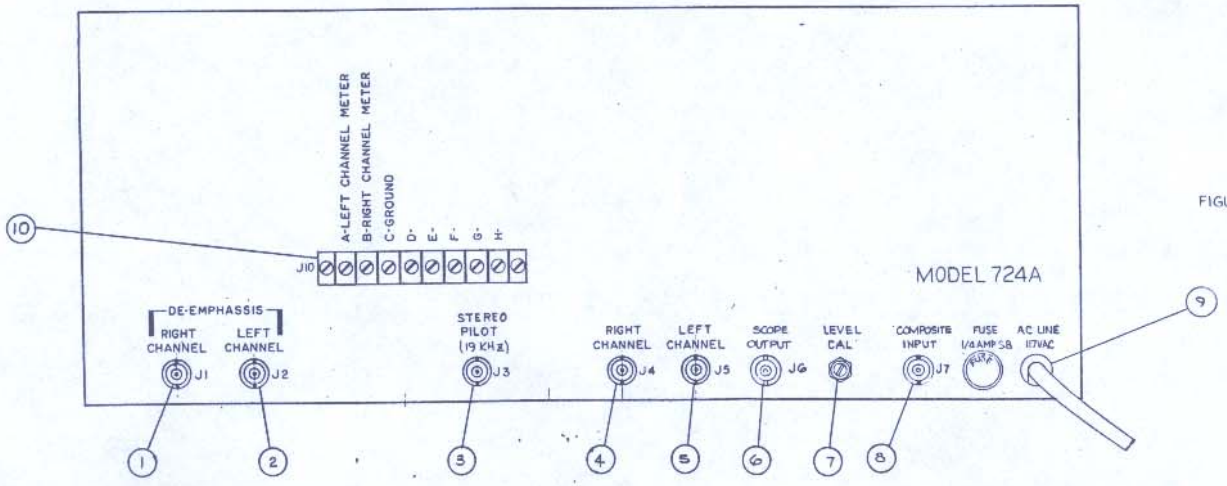


FIGURE 3-2

TFT	TIME AND FREQUENCY SANTA CLARA	
SCALE 1/1	APPROVED BY	DRAWN BY D.S.
DATE 1-19-76	11/8/77	REVISED
PANEL - FRONT & REAR		
MODEL 724A		DRAWING NUMBER 6600-0950

SECTION 4

THEORY OF OPERATION

4.1 General Block Diagram Discussion (Figure 6-1)

Two meters on the front panel of the Model 724A provide monitor and test indications. The LEFT CHANNEL meter reads left-channel modulation percentage. The MODULATION/TEST meter normally reads right-channel modulation percentage, but is also used for all the test functions selectable by the front-panel function switches.

4.1.1 Modulation Monitoring Circuits

On Board A2, the composite signal from the input amplifier is applied to the stereo demodulator, where it is combined with a precision 38-kHz square wave derived from the 19 kHz pilot signal to provide the right-channel and left-channel audio outputs. During normal monitoring, the RIGHT function switch and the 0 dB attenuator switch are depressed. The function switches are mechanically ganged in such a way that when one is closed (depressed) all others are open. The right-channel output of the stereo demodulator is fed through a 15 kHz low-pass filter, the RIGHT function switch, and the selected attenuator to a detector, the DC output of which drives the MODULATION/TEST meter to indicate modulation percentage in the right channel. The right-channel output is also delivered to rear-panel RIGHT CHANNEL connector J4, and through a de-emphasis network to rear-panel DE-EMPHASIS RIGHT CHANNEL connector J1; these two outputs are present regardless of which function switch is depressed.

The left-channel stereo demodulator output is fed through a 15-kHz low-pass filter, amplifiers, detector, and to the LEFT CHANNEL meter. The left-channel output is also delivered to rearpanel LEFT CHANNEL connector J5, and through a de-emphasis network to rear-panel DE-EMPHASIS LEFT CHANNEL connector J2. The left-channel output can also be applied to the MODULATION/TEST meter through the attenuation network by depressing the LEFT function switch.

The precision 38-kHz square wave required by the stereo demodulator is supplied by a phase-locked loop. The 19-kHz pilot signal, extracted from the composite signal by the 19-kHz bandpass filter, is applied to the phase-locked loop as the reference signal. The 76-kHz output of the phase-locked loop is divided by two to provide 38-kHz for the stereo demodulator, and divided again by two to provide a 19-kHz comparison input to the phase-locked loop. Since the phase-locked loop, when properly adjusted, keeps the two 19-kHz inputs locked in phase, the 38-kHz output will also be locked to the 19-kHz reference, as required by the stereo demodulator.

4.1.1 (Continued).

To adjust the phase-locked loop for proper phase lock, the front-panel PHASE CAL switch is depressed. This applies the 19-kHz component of the composite signal to the digital phase detector, where it is compared with the regenerated 19-kHz signal from the phase-locked loop. The output of the digital phase detector is a train of pulses whose width is proportional to the difference in phase between the two 19-kHz singals. A low-pass filter converts the pulses to a DC voltage, the magnitude of which is proportional to the phase difference. This voltage is amplified and applied to the MODULATION/TEST meter. The PHASE CAL Potentiometer in the phase-locked loop is then adjusted for the lowest meter reading, representing the minimum phase difference.

The 19-kHz phase-locked loop output is also furnished to rear-panel STEREO PILOT (19-kHz) connector J3. The output at J3 is fed to the Model 764 counter circuits for measuring the frequency of this regenerated 19-kHz signal.

4.1.2 Measurement Circuits

The measurement circuits consist of filters to extract the desired information from the composite signal, the attenuator network with its selector switches, the MODULATION/TEST meter, and associated amplifiers and function switches.

The main-channel 15-kHz low-pass filter provides the main channel output for FM signal-to-noise measurement, left-plus-right (L+R) main-channel measurement, and MODULATION/TEST meter calibration. When the FM S/N switch is depressed, a de-emphasis network is inserted as required when making signal-to-noise measurements.

The left-minus-right (L-R) stereo-channel (23-53-kHz bandpass) filter provides the stereo-channel output for measurement of the amplitude of that component.

The 38-kHz bandpass filter extracts the pilot signal for measurement of its amplitude, and for input to the phase-locked loop. The pilot signal is also detected to drive the front-panel STEREO PILOT lamp.

4.2 Meter Amplifier and Attenuator Board (A3).

(Circuit Diagram: Figure 6-3)

This board contains the switchable attenuator, detectors for both front-panel meters, and amplifiers to drive the audio outputs.

4.2.1 Attenuator

The 2-volt RMS input at E1 is applied across the attenuator network consisting of R1 through R7. The desired attenuation is selectable in 10-dB steps by front-panel MOD/TEST METER ATTENUATION switches, which tap off at the appropriate point on the voltage-divider network. The attenuation switches are mechanically interconnected so that when one is depressed, all others are released. In addition, separate sections of switches SW4, SW5, and SW6 are wired to feed output buffer amplifier Z7 from the average detector, and separate sections of switches SW1, SW2, and SW3 are wired to feed Z7 from the peak detector. This is because SW1 (0 dB), SW2 (-10 dB), and SW3 (-20 dB) are used to measure signal voltages where peak values are significant, while SW4 (-30 dB), SW5 (-40 dB), and SW6 (-50 dB) are used to measure noise where average values are more significant than peak values. The two detectors are discussed in Section 4.2.2.

4.2.2 Modulation/Test Meter Amplifier

The AC voltage selected by the attenuator is applied to buffer Q1, an emitter follower which presents a high impedance to the attenuator to prevent loading effects. The output of Q1 is amplified by Z9 and Z8, and fed to the average detector (CR3 and operational amplifier Z10) and to the peak detector (CR1 and C13). The output of one of the detectors is selected by the depressed attenuator switch, as described in Section 4.2.1, and fed through DC buffer amplifier Z7 and front-panel PHASE CAL switch A2SW1 to the MODULATION/TEST meter and rear-panel terminal J10-B.

4.2.3 Left-Channel Meter Amplifier

This amplifier consists of operational amplifier Z5, detector CR2/R34/C22, and DC voltage follower Z6. Operational amplifier Z5 provides a gain of 2 for the left-channel signal at its input. Output voltage follower Z6 drives the LEFT CHANNEL meter and also feeds rear-panel terminal J10-A.

4.2.4 Audio Amplifiers

The left-channel audio input is amplified 20 dB by operational amplifier Z4. The output of Z4 drives the left-channel meter amplifier (see Section 4.2.3), furnishes a 2-volt RMS open-circuit voltage to rear-panel connector J5 for a 100% modulated carrier and feeds operation amplifier Z3, which provides unity gain with standard de-emphasis to rear-panel connector J2.

Variable resistor R39 provides a means to adjust the reading on the LEFT CHANNEL meter so that it reads the same as the MODULATION/TEST meter when the front-panel LEFT/MOD/TEST METER FUNCTION switch is depressed.

4.2.4 (Continued).

The right-channel audio circuits, consisting of amplifiers Z2 and A1 and switch Q3, operate similarly to the left-channel circuits.

4.3 (Demodulator and Filter Board (A2)

(Circuit Diagram: Figure 6-4)

This is the main board of the Model 724A. It contains the stereo demodulator with its phase-locked loop; all the filters for extracting the various components of the composite signal; the function switches; the phase calibration circuit; and various buffer amplifiers. The buffers and function switches are described first because they are common to many of the other circuits.

4.3.1 Buffer Amplifiers and Function Switches

Buffer amplifier Q1, which has a gain of 2, feeds stereo demodulator Z1, rear-panel SCOPE OUTPUT connector J6, the phase calibration circuit when front-panel PHASE CAL switch SW1 is depressed, and buffer Q2. Buffer Q2 is an emitter follower which drives the 19-kHz filter directly; and the 38-kHz filter, left-plus-right (L+R) filter FL1, and left-minus-right (L-R) filter FL2 through a buffer consisting of FET amplifier Q3 and emitter follower Q4.

The function switches are SW2 through SW8. The switches are mechanically interconnected so that only one can be depressed at a time. By means of these switches, the output of any one of the filters can be selected as the input to the meter attenuator on Board A3 through buffers Z2 and Z3. Potentiometers R15, R18, R21, R24, R27, and R30 are factory adjusted to provide a 200-millivolt level at pin 3 of Z2 for 100-percent modulation (MODULATION/TEST meter reading of 100%).

To satisfy the requirement that FM Signal-to-noise measurements be made through a 75-microsecond de-emphasis network, depressing FM S/N switch SW8 connects capacitor C30 across the output of L+R filter FL1. This capacitor in conjunction with R91 and associates components provides the required 75-microsecond de-emphasis network.

Operational amplifiers Z2 and Z3 provide a gain of precisely 10 for the filter outputs so that the level at E22 is precisely 2 volts for 100-percent modulation.

4.3.2 19-kHz Filter

This is a three-pole Chebyshev bandpass filter with a 50-

4.3.2 (Continued).

dB bandwidth of less than 8 kHz. It consists of the network between the emitter of Q2 and the base of Q5. The output of the filter is connected through level adjust potentiometer R15 to PILOT function switch SW5. The filter output is also supplied to the phase-locked loop and the 19-kHz detector through emitter follower Q5.

The 19-kHz detector, consisting of amplifier Q6, rectifier CR1, and DC amplifier Q7, lights the front-panel STEREO PILOT LED when there is a pilot carrier present in the composite input.

4.3.3 38-kHz Filter

This is a three-pole Chebyshev bandpass filter with a 70-dB bandwidth of less than 10-kHz. It consists of the network between the emitter of Q4 and the junction of C19 and C20. Its output is delivered to 38-kHz function switch SW4 through level adjust potentiometer R18.

4.3.4 L+R Channel Filter (FL1)

This is a seven-pole, elliptic-function, 15-kHz, low-pass filter. It rejects a 19-kHz frequency by more than 30 dB, and rejects frequencies between 23 and 53 kHz by more than 70 dB. Its output is delivered to both MOD CAL/L+R function switch SW6 and FM S/N function switch SW8 through level adjust potentiometer R21.

For calibrating the Model 724A MODULATION/TEST meter from the Model 763, the front-panel MOD CAL / L+R switch is depressed. The Model 763 furnishes a calibration signal with a frequency deviation of ±75 kHz.

4.3.5 L-R Channel Filter (FL2)

This is a bandpass filter with a pass band of 23 to 53 kHz. It provides more than 35 dB rejection at 19 kHz; more than 46 dB rejection from 59 to 75-kHz; and more than 60 dB rejection from 15-kHz to 50 Hz. Its output is delivered to L-R function switch SW7 through level adjust potentiometer R24.

4.3.6 38-kHz Phase-Locked Loop

The complete phase-locked loop circuit consists of integrated-circuit phase-locked loop Z11, amplifier Q8, flip-flops Z9-15 and Z9-11, and associated circuitry. The 19-kHz pilot carrier from the 19-kHz filter is applied to pin 2 of Z11 as the reference signal. The voltage-controlled oscillator(VCO) contained in Z11 operates at 76 kHz output at Z9-14 is fed to stereo demodulator Z1, and is also divided by

4.3.6 (Continued)

2 in the second Z9 flip-flop to provide the comparison 19-kHz signal for pin 5 of Z11. The regenerated 19-kHz signal is also fed from Z9-10 to rear-panel STEREO PILOT connector J3 so that it can be cabled to the Model 764, where its frequency can be checked on the Model 764 counter. When this loop is properly adjusted, its 38-kHz output will be locked in phase with the 19-kHz pilot carrier, as required by the stereo demodulator. The phase of the 38-kHz carrier can be adjusted over a narrow range by the front-panel PHASE CAL potentiometer.

4.3.7 Stereo Demodulator

Integrated-circuit dual differential amplifiers (Z1) are used as the stereo demodulator. The composite signal input is applied to Z1-3. The required 38-kHz stereo subcarrier comes from the phase-locked loop; thus no turned circuits are required. This provides good stability, and minimum aging phase drift. Potentiometer R39 balances the 38-kHz drive to the stereo demodulator, and is adjusted for minimum 38-kHz feed-through. Variable resistor R48 adjusts the gain balance between the two halves of the demodulator for best overall separation. The left-channel output at Z1-14 and the right-channel output at Z1-1 are delivered to low-pass filters FL3 and FL4, respectively.

4.3.8 Left-Channel Filter (FL3) and Right-Channel Filter (FL4)

There are two seven-pole, elliptic-function, 15-kHz, low-pass filters. Rejection at a frequency of 19-kHz is greater than 60 dB, and at frequencies between 23 and 53-kHz, is greater than 50 dB. The output of FL3 is delivered through level adjust potentiometer R27 to LEFT function switch SW2, and also to the left audio input (A3E7) on Board A3. The output of FL4 is delivered similarly to RIGHT function switch SW3 and the right audio input (A3E4) on Board A3.

4.3.9 Phase Calibration Circuit

When front-panel PHASE CAL switch SW1 is depressed, the composite signal at E1 amplified by Q1 is applied to E7 and the noninverting input of zero crossing detector Z10. Since phase calibration is performed with all modulation removed, the composite signal will consist only of the 19-kHz pilot. The DC voltage at the inverting input of Z10 is factory adjusted by means of R70 so that Z10 operates as a zero-crossing detector and shapes the 19-kHz sine wave into a square wave that is precisely synchronized with the sine wave.

4.3.9 (Continued)

Gates Z5, Z6, Z7 and Z8 comprise a digital phase detector. The regenerated 19-kHz signal from the phase-locked loop is applied from Z9-11 and Z9-10 to the phase detector; the shaped 19-kHz pilot signal from Z10-9 is also applied to the phase detector. The phase detector output at TP3 is a train of pulses whose width is proportional to the difference in phase between the two 19-kHz signals.

The pulses are amplified by Q10 and applied to the low-pass filter consisting of R80 and C69, which produces a DC output proportional to the average pulse width, and therefore proportional to the phase difference between the two 19-kHz signals. This DC voltage is amplified by Z4 and fed to the front-panel MODULATION/TEST meter through terminals 6 and 5 of the PHASE CAL switch. The DC output from Z4-6 is also fed through the PHASE CAL switch to rear-panel terminal J10-B for driving a Model 704C remote meter in the phase calibration mode.

During phase calibration, the phase of the VCO in Z11 is adjusted by the front-panel PHASE CAL control so that the DC output of Z4 is a minimum, indicating the least phase difference between the two 19-kHz signals.

4.4 Power Supply Board (A1)

(Circuit Diagram: Figure 6-5)

This board contains the rectifiers, filters and regulators necessary to provide the +10 V, + 12 V and -12 V used in the Model 724A.

SECTION 5

MAINTENANCE

5.1 General.

Since the Model 724A 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.

5.2 Periodic Maintenance.

The only periodic maintenance required is cleaning. Once a year, or more often in dusty locations, take off the top cover, and blow off dust with compressed air.

5.3 Performance Checks.

The following procedures will enable the technician to determine whether the instrument is operating properly. If the tests indicate substandard operation, it is recommended that the instrument be returned to the factory for adjustment or repair. Internal adjustments, particularly adjustments of the filters, should not be made in the field.

5.3.1 Calibration Accuracy Check.

a. On the Model 763 front panel, depress either the METER (+) or METER (-) switch (not the METER CAL switch).

b. Connect a 1-kHz output from an audio generator into the Model 724A rear-panel COMPOSITE INPUT connector J7.

c. On the front-panel, depress the MOD CAL L+R function switch and the 0 dB attenuation switch.

d. Adjust the level of the 1-kHz signal for a reading of 100% on the MODULATION/TEST meter. The LEFT CHANNEL meter should also read 100% $\pm$2%.

e. Depress the LEFT and RIGHT function switches, one at a time. The MODULATION/TEST meter reading should remain at 100 $\pm$2%.

5.3.1 (Continued)

f. Depress the MOD CAL L+R switch. Reduce the level of the 1-kHz input by 10 dB and depress the -10 dB attenuation switch. The MODULATION/TEST meter should again read 100%. Decrease the input level and attenuation in 10-dB steps through the attenuator range. The MODULATION/TEST meter should read 100% for each step.

g. Depress the 0 dB attenuation switch, and readjust the signal generator output level for a 100% reading on the MODULATION/TEST meter. Without changing level, increase the input frequency to 2 kHz. Depress the FM S/N button. The MODULATION/TEST meter should read -3±0.5 dB.

h. Increase the input frequency to 19,000 ±5Hz. Depress the PILOT function switch. The MODULATION/TEST meter should read 100 ±2%.

i. Increase the input frequency to 38,000 ±10 Hz. Depress the 38 kHz function switch. The MODULATION TEST meter should read 100 ±2%.

j. Without changing the input frequency or level, press the L-R function switch. The MODULATION/TEST meter should read 100 ±2%.

5.3.2 Amplitude Response Check.

a. With the audio generator connected as in the preceding section, adjust it for an output of 1 kHz at a level to produce a MODULATION/TEST meter reading of 100% with the 0 dB attenuator switch and the LEFT function switch depressed.

b. Vary the input frequency from 50 Hz to 15 kHz. The MODULATION/TEST meter reading should remain 100 ±4%. Repeat this check with the RIGHT switch depressed, and then with the MOD CAL L+R switch depressed. The meter reading should remain 100 ±4%.

c. Depresss the L-R function switch. Adjust the input frequency to 38 kHz and the input level for a 100% reading on the MODULATION/TEST meter. Vary the input frequency from 23 kHz to 53 kHz. The meter reading should remain 100 ±4%.

5.3.3 Stereo Pilot Indicator Check.

a. With the audio generator connected as in the preceding sections, adjust its frequency to 19 kHz.

b. Depress the PILOT function switch and the -20 dB attenuation switch.

c. Adjust the generator level for a -6 dB reading on the MODULATION/TEST meter. This is equivalent to 5% total modulation.

d. The STEREO PILOT lamp should be on.

e. Remove the 19 kHz input signal. The STEREO PILOT lamp should go off.

5.3.4 Output Check

a. Depress the MOD CAL L+R function switch and the 0 dB attenuation switch.

b. With the audio generator connected as before, adjust its frequency to 400 Hz and its output level for a 100% reading on the MODULATION/TEST meter.

c. Connect an AC voltmeter in turn to all four rear-panel audio outputs (J1, J2, J4, and J5). The reading for each output should be 2 $\pm$0.25 V RMS (open circuit).

d. Connect the AC voltmeter to the rear-panel SCOPE OUTPUT connector. The reading should be 1 $\pm$0.25 V RMS (open circuit).

e. Increase the input frequency to 2 kHz. The DE-EMPHASIS RIGHT CHANNEL and DE-EMPHASIS LEFT CHANNEL (J1 and J2) outputs should drop 3.0 $\pm$0.5 dB. The two outputs without de-emphasis (J4 and J5) and the SCOPE OUTPUT (J6) should remain the same as in steps c and d above within $\pm$4%.

f. Change the input frequency to 19 kHz and depress the -20 dB attenuation switch. Adjust the audio generator level for a full scale (10% Modulation) reading on the meter, with the PILOT function switch depressed.

5.3.4 (Continued).

g. Connect an oscilloscope to rear-panel STEREO PILOT (19 kHz) connector J3. The oscilloscope display should be a square wave with an amplitude greater than 0.5 V peak-to-peak.

5.3.5 Stereo Separation Check.

a. Connect the composite output of a stereo generator to rear-panel COMPOSITE INPUT connector J7.

b. Depress the PILOT function switch and the -20 dB attenuation switch.

c. Adjust the rear-panel LEVEL CAL potentiometer for a 100% reading on the MODULATION/TEST meter (10% pilot carrier level).

d. Depress the PHASE CAL potentiometer for a minimum reading on the MODULATION/TEST meter. (The minimum reading will not necessarily be zero).

f. Depress the RIGHT function switch and the 0 dB attenuation switch.

g. Modulate the right channel only of the stereo generator with a 1-kHz signal.

h. Adjust the level of the 1-kHz modulation for a 90% reading on the MODULATION/TEST meter.

i. Depress the LEFT function switch and the -40 dB attenuation switch. The reading on the MODULATION/TEST meter should be at least 5 dB below that in step h. (This represents 45 dB separation).

j. On the stereo generator, change the modulation to the left channel and check the right channel on the MODULATION/TEST meter. The right channel should be at least 45 dB below 90%.

k. Vary the stereo generator modulation frequency from 50 Hz to 15 kHz for steps i and j. (Note: It is important that the stereo generator separation be greater than 45 dB at the frequency extremes. Refer to the stereo generator instruction manual for the method of checking this). The reading on the MODULATION/TEST meter should remain as in steps i and j over the frequency range of 50 Hz to 15 kHz.

5.3.6 Crosstalk and Distortion Check.

Crosstalk Into L+R Channel

a. Connect the output of an audio signal generator into rear-panel COMPOSITE INPUT connector J7.

b. Set the generator frequency to 23 kHz.

c. On the Model 724A front panel depress the L-R function switch and the 0 dB attenuation switch.

d. Adjust the generator output level for a 100% reading on the MODULATION/TEST meter.

e. Depress the MOD CAL L+R function switch and the -50 dB attenuation switch.

f. The MODULATION/TEST meter should read less than -10 dB. On the Meter with the -50 dB button depressed (-50 dB).

g. Sweep the audio frequency from 23 kHz to 75 kHz. The reading on the MODULATION/TEST meter should remain below -10 dB.

Crosstalk Into L-R Channel

a. Depress the L-R function switch and the -20 dB attenuation switch.

b. Set the generator frequency to 38 kHz.

c. Reduce the signal generator output level for a 100% reading on the MODULATION/TEST meter (10% carrier modulation).

d. Increase the generator frequency to 59 kHz, and depress the - 50dB attenuation switch. The MODULATION/TEST meter reading should be below -16 dB. (-66 dB)

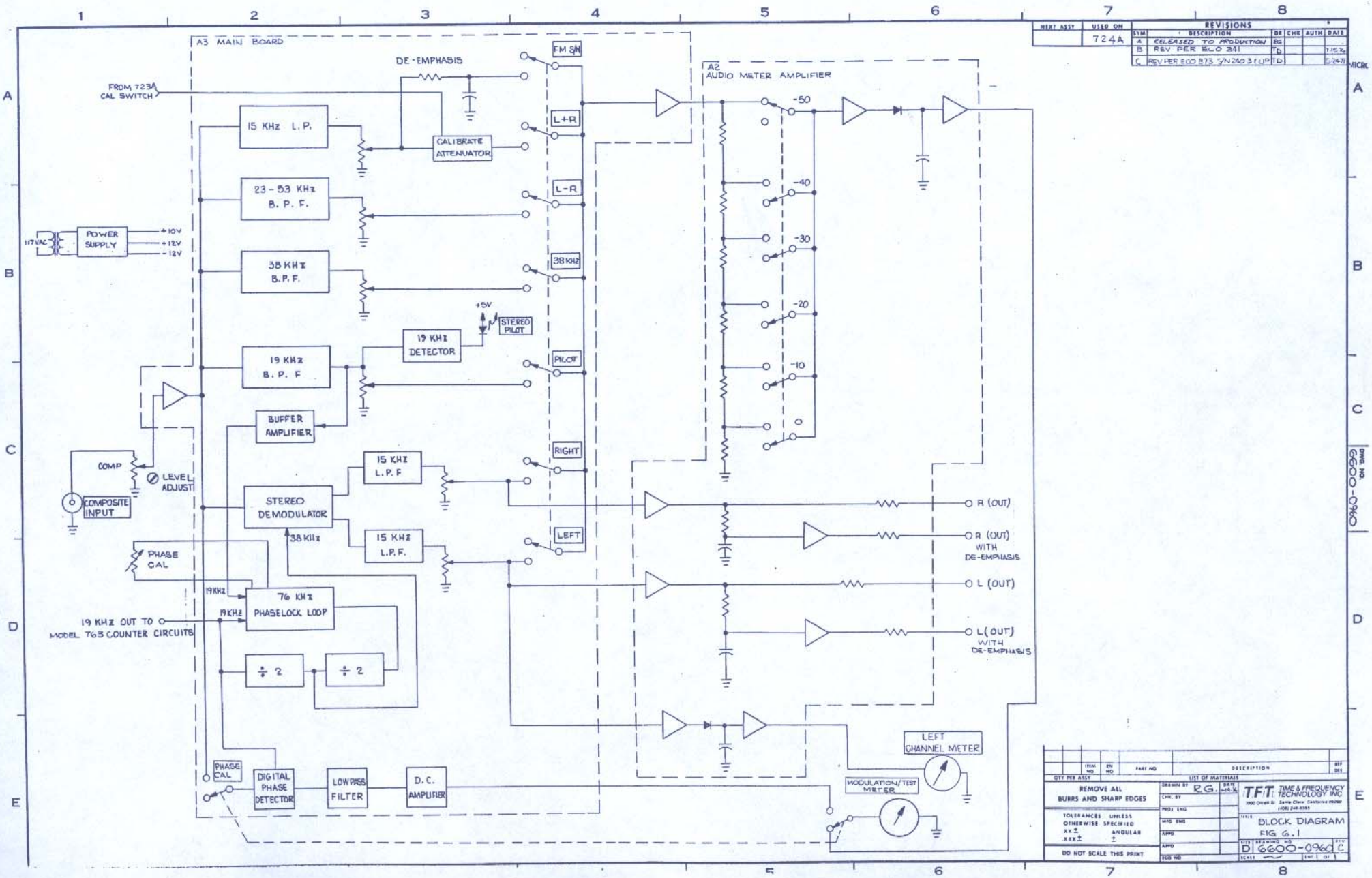
e. Increase the generator frequency to 75 kHz. The MODULATION/TEST meter reading should remain below -16 dB (-66 dB)

f. Set the generator frequency to 38 kHz.

g. Depress the 0 dB attenuation switch, and adjust the generator output level for 100% on the MODULATION/TEST meter.

5.3.6 (Continued).

h. Reduce the generator frequency to 15 kHz and depress the -50 dB switch. The MODULATION/TEST meter should read more than - 10 dB down. (-60 dB) (Note: The signal generator used in this test must have a total harmonic distortion of less than 0.1%; i.e., the second and third harmonics must be more than 60 dB down).



NEXT ASS'Y	USED ON
	724A

REVISIONS

SYM	DESCRIPTION	DR	CHK	AUTH	DATE
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C	REV PER ECO 373, S/N 240 & UP	TD			2-24-77

ITEM NO	QTY	PART NO	DESCRIPTION	ASS'Y SYM

QTY PER ASS'Y — LIST OF MATERIALS

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TOLERANCES UNLESS OTHERWISE SPECIFIED
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XXX ±
ANGULAR ±

DO NOT SCALE THIS PRINT

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CHK. BY
PROJ. ENG.
MFG. ENG.
APPD.
APPD.
ECO NO.

TFT TIME & FREQUENCY TECHNOLOGY, INC.
3000 Oakmead Village Drive, Santa Clara, California 95051
(408) 246-9285

TITLE BLOCK DIAGRAM FIG 6.1

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SCALE | SHT 1 OF 1

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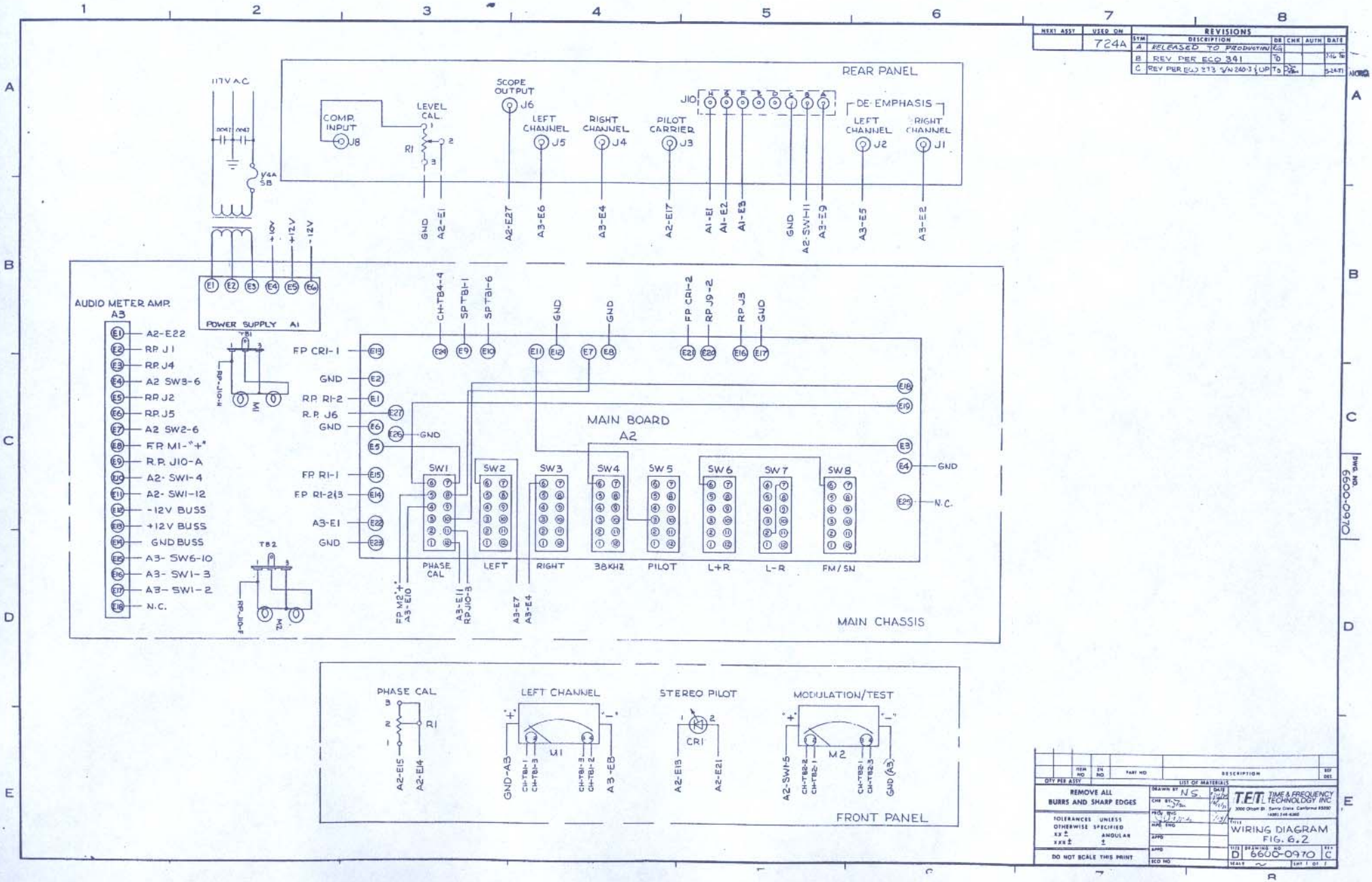

NEXT ASSY	USED ON
	724A

REVISIONS					
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B	REV PER ECO 341	TD			
C	REV PER ECO 273 S/N 240-3 & UP	TD			8-24-71

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XXX ± ±

DO NOT SCALE THIS PRINT

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MFG ENG
APPD
APPD
ECO NO

T.F.T. TIME & FREQUENCY TECHNOLOGY INC.
3000 Ohport St. Santa Clara, California 95050
(408) 246-6360

TITLE WIRING DIAGRAM FIG. 6.2

SIZE D DRAWING NO 6600-0970 REV C
SCALE ~ SHT 1 OF 1

DWG NO 6600-0970

DWG. NO. 6608-0430 SH 1 REV

REVISIONS

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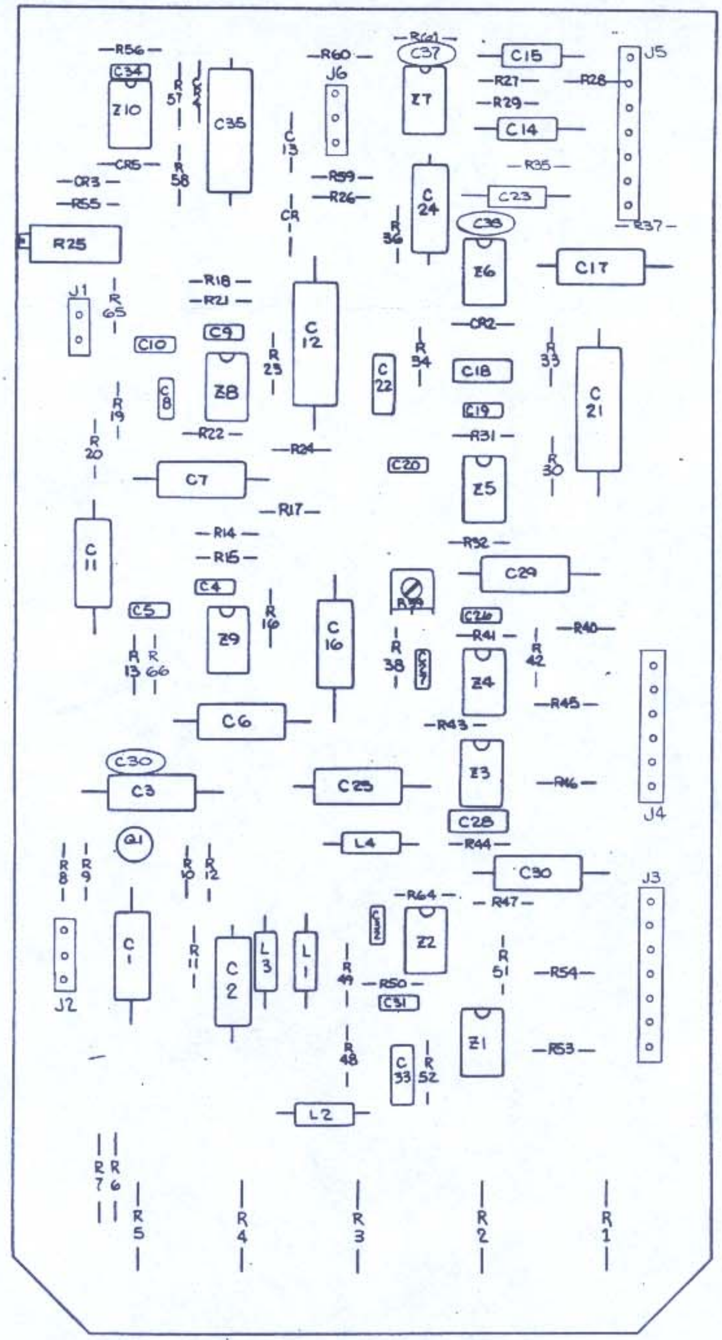

AUDIO METER AMPLIFIER A3 6608-0430

PARTS LIST

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DRAWN 5-29-79

TIME & FREQUENCY TECHNOLOGY INC.

P.C BD ASSY AUDIO METER AMPLIFIER (A3) FIG 6.3

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APPLICATION

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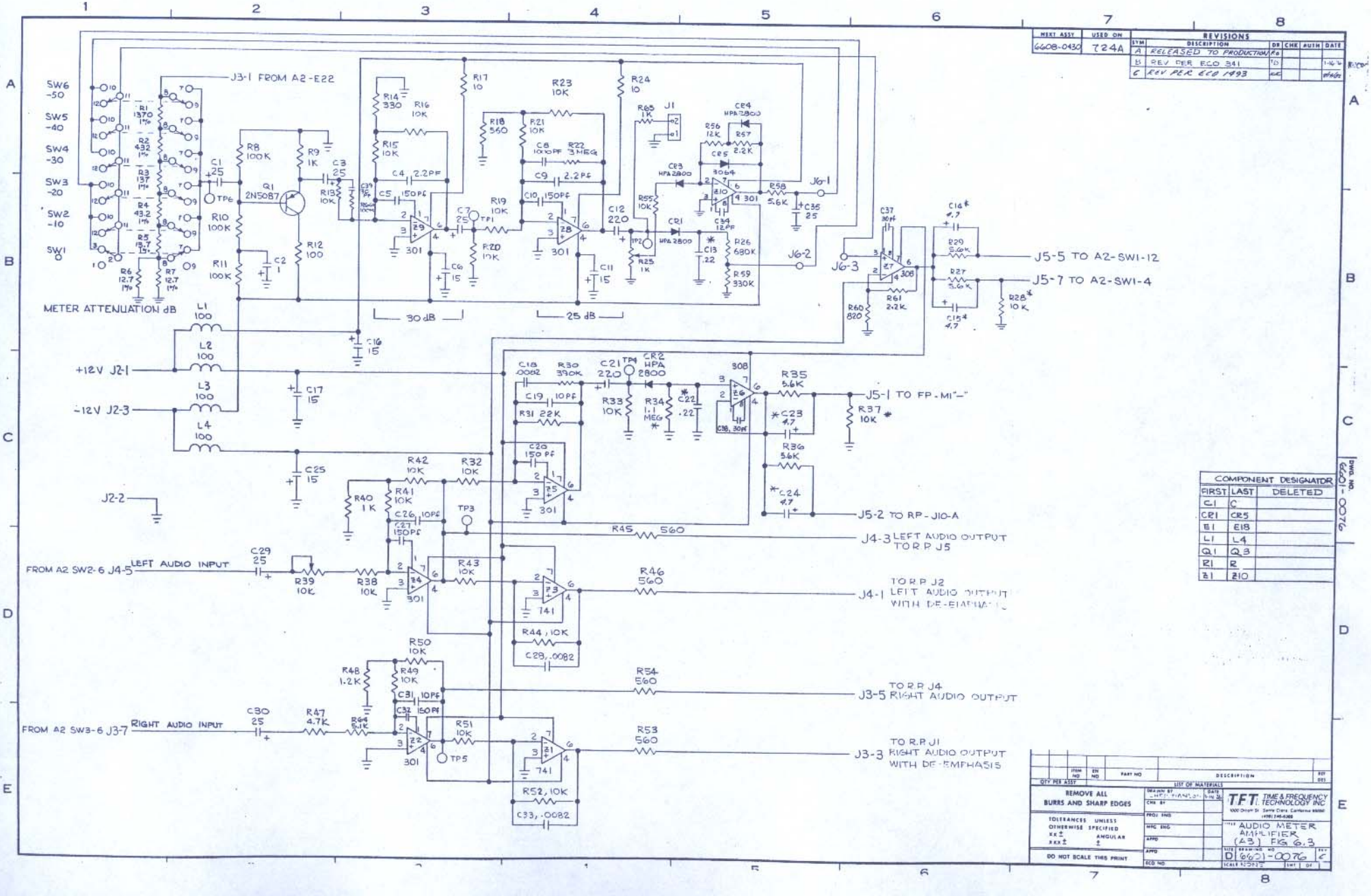
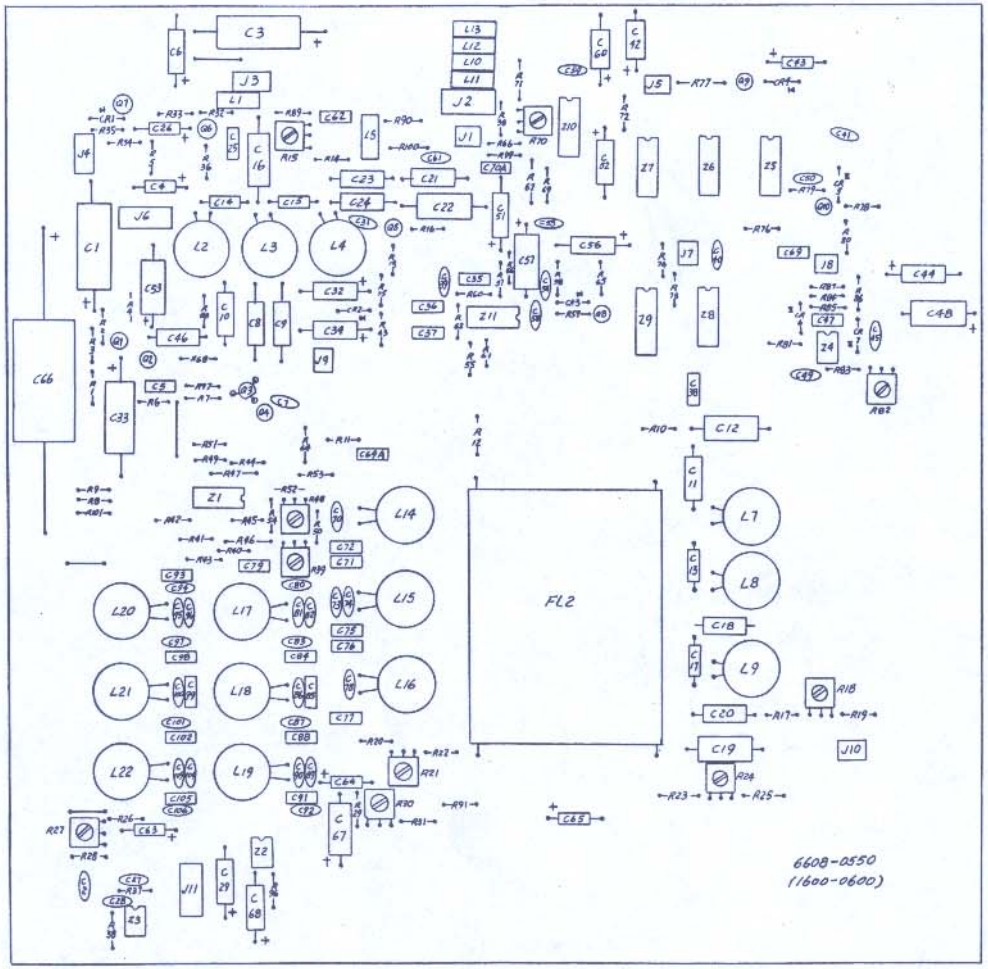

NEXT ASSY
6608-0430
USED ON
T24A
REVISIONS
DESCRIPTION
A RELEASED TO PRODUCTION
B REV PER ECO 341
C REV PER ECO 1993
SW6 -50
SW5 -40
SW4 -30
SW3 -20
SW2 -10
SW1
J3-1 FROM A2-E22
METER ATTENUATION dB
30 dB
25 dB
+12V J2-1
-12V J2-3
J2-2
J5-5 TO A2-SW1-12
J5-7 TO A2-SW1-4
J5-1 TO FP-MI"-"
J5-2 TO RP-J10-A
J4-3 LEFT AUDIO OUTPUT TO R.P J5
FROM A2 SW2-6 J4-5 LEFT AUDIO INPUT
J4-1 TO R.P J2 LEFT AUDIO OUTPUT WITH DE-EMPHASIS
FROM A2 SW3-6 J3-7 RIGHT AUDIO INPUT
J3-5 TO R.P J4 RIGHT AUDIO OUTPUT
J3-3 TO R.P J1 RIGHT AUDIO OUTPUT WITH DE-EMPHASIS
COMPONENT DESIGNATOR
FIRST LAST DELETED
C1 C
CR1 CR5
E1 E18
L1 L4
Q1 Q3
R1 R
S1 S10
REMOVE ALL BURRS AND SHARP EDGES
DO NOT SCALE THIS PRINT
TFT TIME & FREQUENCY TECHNOLOGY INC
AUDIO METER AMPLIFIER (A3) FIG 6.3
D 6608-0076
DWG NO 6608-0076

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED
	C	REV E REDRAWN PER ECO 1090	3-24-80	
	D	REVISED PER ECO 1319	11/22/81	
	E	REVISED PER ECO 1383	6/8/82	
	F	REVISED PER ECO 1462	3/5/82	



REF: SEE SCHEMATIC 6601-0075
6601-0210
6601-0220
6601-1290

QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION
PARTS LIST				

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±
MATERIAL ~
FINISH ~
CONTRACT NO.
APPROVALS / DATE
DRAWN Donna Chen 3-24-80
CHECKED 4w/80
ISSUED

TIME & FREQUENCY TECHNOLOGY INC.

PCB ASSY
A2 DEMODULATOR / FILTER BD

SIZE C | FSCM NO. | DWG. NO. 6608-0550 | REV. F
SCALE 2:1 | SHEET

NEXT ASSY	USED ON
	724A

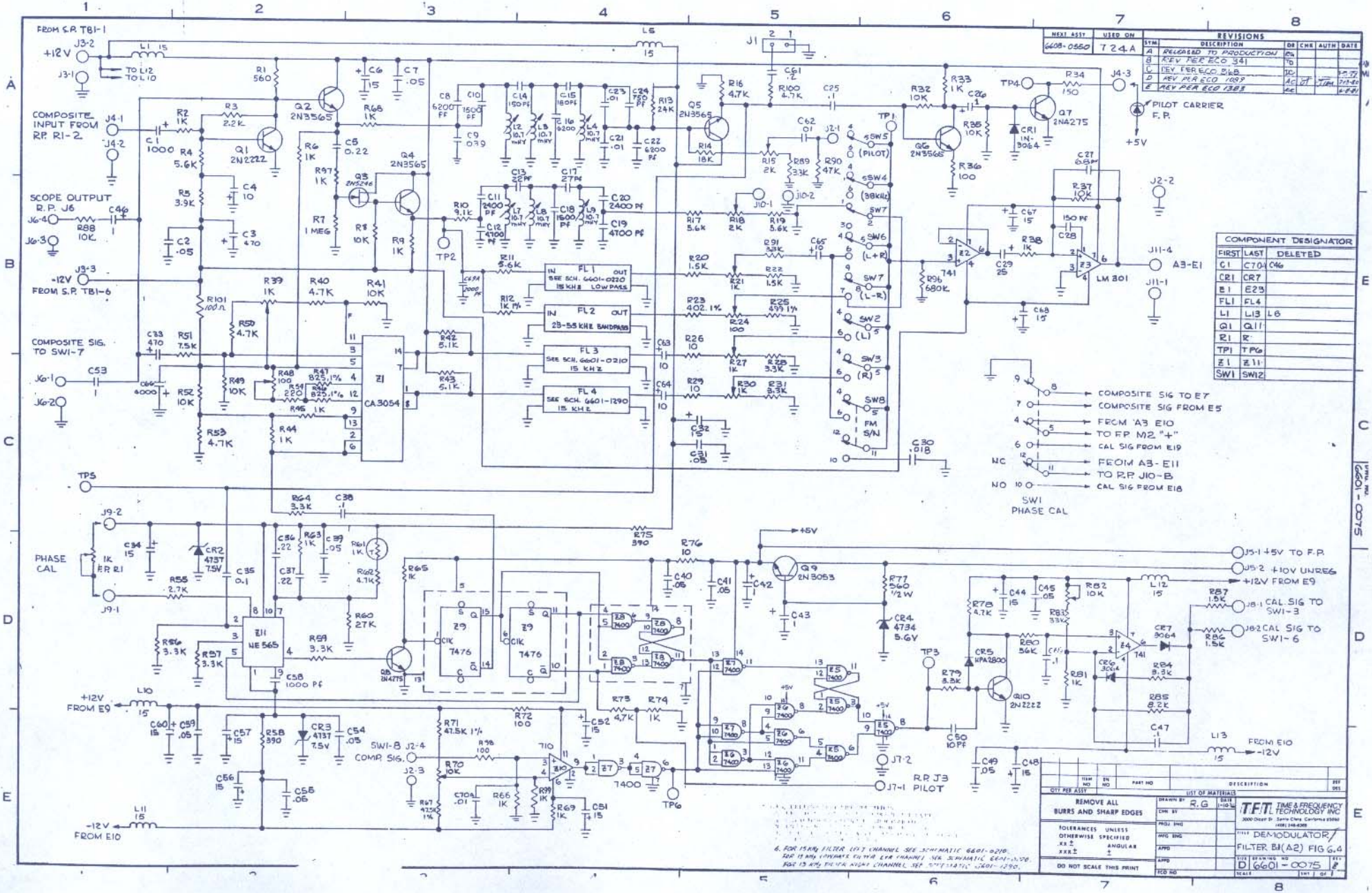
APPLICATION | DO NOT SCALE DRAWING

DWG. NO. 0550-6608 | REV. F | SH 1

Insert Parts List Here for

Demodulator/Filter Bd

(7 pages)


FROM S.P. TB1-1
+12V
J3-2
J3-1
L1 15
TO L12
TO L10
COMPOSITE INPUT FROM R.P. R1-2
J4-1
J4-2
C1 1000
R4 5.6K
R88 10K
SCOPE OUTPUT R.P. J6
J6-4
J6-3
C46
C2 .05
C3 470
-12V
FROM S.P. TB1-6
J3-3
COMPOSITE SIG. TO SW1-7
J6-1
J6-2
C53 1
R101 100Ω
R51 7.5K
R52 10K
R53 4.7K
R49 10K
R50 4.7K
R39 1K
R40 4.7K
R41 10K
R44 1K
R45 1K
R47 B25.1%
R48 100
R54 220
R46 B25.1%
C33 470
C66 4000
Z1 CA3054
R42 5.1K
R43 5.1K
C63 10
C64 10
C32 15
C31 .05
R11 5.6K
C65A 2000 pf
R12 1K 1%
FL1 IN OUT SEE SCH. 6601-0220 15 KHz LOWPASS
FL2 IN OUT 25-55 KHz BANDPASS
FL3 SEE SCH. 6601-0210 15 KHz
FL4 SEE SCH. 6601-1290 15 KHz
R20 1.5K
R21 1K
R22 1.5K
R23 402.1%
R24 100
R25 499.1%
R26 10
R27 1K
R28 3.3K
R29 10
R30 1K
R31 3.3K
C30 .018
TP5
J9-2
J9-1
PHASE CAL
C34 15
CR2 4737 7.5V
C35 0.1
R55 2.7K
R56 3.3K
R57 3.3K
C58 1000 pF
C36 .22
C37 .22
R63 1K
C39 .05
R61 1K
R62 4.7K
R60 27K
R64 3.3K
C38 .1
R59 3.3K
Z11 NE 565
Z9 7476
Q8 2N4275
R65 1K
R75 390
R76 10
+5V
Q9 2N3053
C40 .05
C41 .05
C42 1
C43 1
R77 560 1/2W
CR4 4734 5.6V
J5-1 +5V TO F.P.
J5-2 +10V UNREG
+12V FROM E9
J8-1 CAL SIG TO SW1-3
J8-2 CAL SIG TO SW1-6
R87 1.5K
R86 1.5K
R78 4.7K
C44 15
C45 .05
R82 10K
R83 33K
L12 15
R80 56K
R81 1K
CR5 HPA2800
CR7 3064
CR6 3064
R84 8.2K
R85 8.2K
C47 .1
L13
FROM E10
-12V
TP3
R79 8.2K
Q10 2N2222
C50 10PF
J7-2
J7-1
R.P. J3 PILOT
C49 .05
C48 15
+12V FROM E9
L10 15
C60 15
C59 .05
C57 15
R58 390
CR3 4737 7.5V
C54 .05
C56 15
C55 .06
-12V FROM E10
L11 15
R71 47.5K 1%
R72 100
R73 4.7K
R74 1K
C52 15
SW1-B J2-4
COMP. SIG.
J2-3
R70 10K
R67 49.5K 1%
R68 1K
C70A .01
R66 1K
R69 1K
C51 15
R98 100
T10
7400
TP6
L5 15
L6 15
J1
C61 .2
R100 4.7K
C25 .1
R16 4.7K
Q5 2N3565
R14 18K
R15 2K
R89 33K
R90 47K
C62 .01
J2-1
J10-1
J10-2
TP1
SW5 (PILOT)
SW4 (38KHz)
SW7
SW6 (L+R)
SW7 (L-R)
SW2 (L)
SW3 (R)
SW8 FM S/N
R17 5.6K
R18 2K
R19 5.6K
C65 10
R91 33K
R22 1.5K
R96 680K
741
LM 301
C67 15
C68 15
C27 .68PF
R37 10K
150 PF
C28
R38 1K
C29 25
J11-4
A3-E1
J11-1
R32 10K
R33 1K
C26 1
TP4
R34 150
J4-3
PILOT CARRIER F.P.
+5V
Q6 2N3565
R35 10K
R36 100
Q7 2N4275
CR1 IN-3064
J2-2
SWI PHASE CAL
COMPOSITE SIG TO E7
COMPOSITE SIG FROM E5
FROM A3 E10
TO F.P. M2 "+"
CAL SIG FROM E19
FROM A3-E11
TO P.P. J10-B
CAL SIG FROM E18
NC
NO
COMPONENT DESIGNATOR
FIRST LAST DELETED
C1 C70 C46
CR1 CR7
E1 E23
FL1 FL4
L1 L13 L6
Q1 Q11
R1 R
TP1 TP6
Z1 Z11
SW1 SW12
NEXT ASSY 6608-0550
USED ON 724A
REVISIONS
SYM DESCRIPTION DR CHK AUTH DATE
A RELEASED TO PRODUCTION
B REV PER ECO 341
C REV PER ECO 348
D REV PER ECO 1089
E REV PER ECO 1383
6. FOR 15 KHz FILTER LEFT CHANNEL SEE SCHEMATIC 6601-0210. FOR 15 KHz LOWPASS FILTER EVR CHANNEL SEE SCHEMATIC 6601-1290. FOR 15 KHz FILTER RIGHT CHANNEL SEE SCHEMATIC 6601-1290.
REMOVE ALL BURRS AND SHARP EDGES
TOLERANCES UNLESS OTHERWISE SPECIFIED
DO NOT SCALE THIS PRINT
DRAWN BY R.G
DATE 1-10-84
T.F.T. TIME & FREQUENCY TECHNOLOGY INC.
3000 Oscott St. Santa Clara, California 95050
(408) 246-8300
TITLE DEMODULATOR/ FILTER BD (A2) FIG 6.4
SIZE D DRAWING NO 6601-0075 REV E
SCALE SHT 1 OF 1
6601-0075 REV E

Insert Parts List Here for

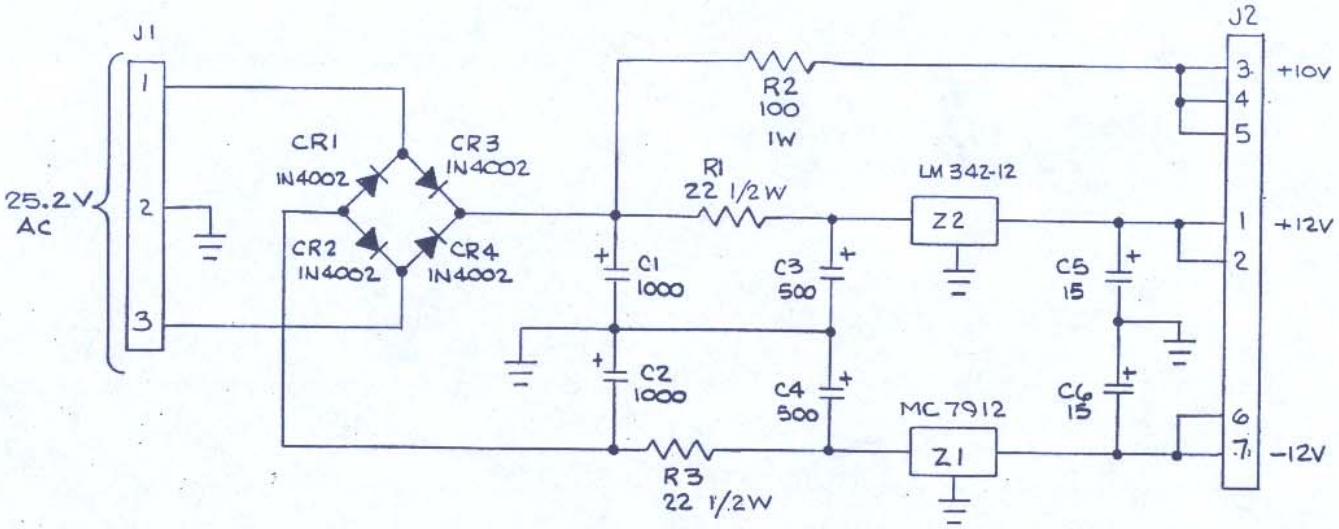
15 KHZ Filters

(3 pages)

DWG. NO. 6601-1560

NEXT ASSY	USED ON
6608-1070	724 A

REVISIONS					
SYM	DESCRIPTION	DR	CHK	AUTH	DATE
B	REV PER ECO 341	TD			7-14-76



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.	EN NO.	PART NO.	DESCRIPTION	REF. DES.
QTY PER ASSY		LIST OF MATERIALS		

REMOVE ALL BURRS AND SHARP EDGES

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

DO NOT SCALE THIS PRINT

		DATE
DRAWN BY	R.G	1-9-76
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 POWER SUPPLY
FIGURE 6.5

SIZE	DRAWING NO.	REV.
B	6601-1560	B

SCALE ~ SHT. 1 OF 1

Insert Here:

Power Supply bd layout and parts list

(3 pages)