

P/N 5004-0923 Rev B
REV. DATE: NOVEMBER 12, 1993
EFFECTIVITY: FROM S/N 1020207

OPERATION AND MAINTENANCE MANUAL
MODEL 923
AM MODULATION MONITOR



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Section I

GENERAL INFORMATION

1.1 EQUIPMENT DESCRIPTION

The TFT Model 923 AM Modulation Monitor is intended for continuous modulation monitoring of an AM transmitter operating in the 500 kHz to 40 MHz frequency range to enable the station to comply with the requirements of Section 73.56 of FCC Rules and Regulations. The Monitor requires a minimum 1-volt rms RF input from the monitored transmitter. No tuning is required at the Monitor.

Features include:

- Flasher to indicate 125% positive modulation peaks.
- Adjustable flashers to indicate positive modulation peaks from 50% to 150% .
- Adjustable attenuator for reading residual noise and low modulation percentages on modulation meters.
- Linear phase filter design, eliminating overshoot on complex audio waveforms.
- Wide audio bandwidth, allowing distortion measurements on high frequency modulation.
- Internal calibration circuit which digitally synthesizes a modulated carrier for both +125% and -100% modulation to check the modulation meter and peak flashers.

An optional, tunable RF Preselector can be installed in the Monitor for off-the-air monitoring of signals in the 500 to 1990kHz range. Figure 1.1-1 is a basic block diagram of the equipment.

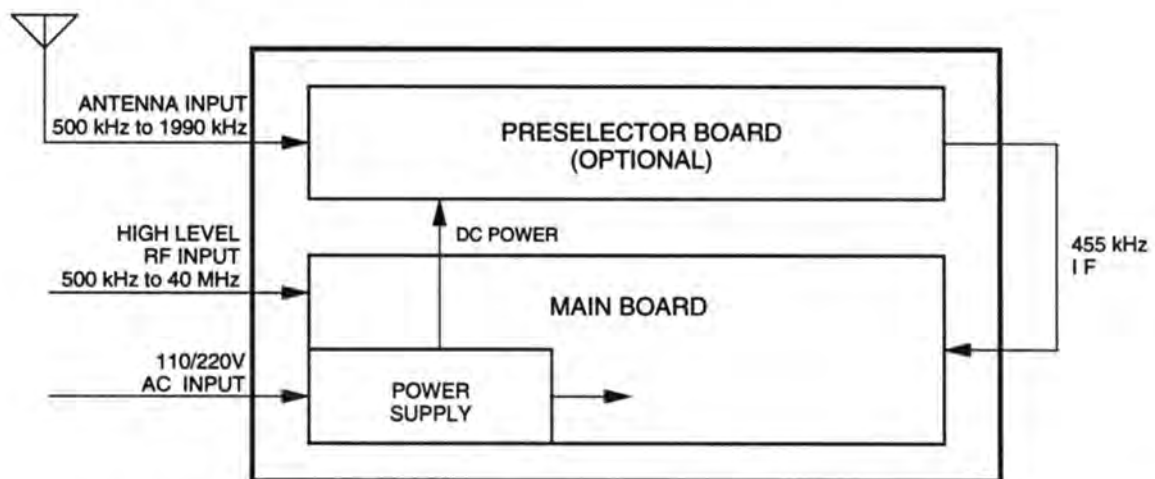


Figure 1.1-1. TFT Model 923 AM Modulation Monitor - Basic Block Diagram

1.2 SPECIFICATIONS

RF INPUT, WIDE BAND DEMODULATOR

Frequency Range	500 kHz to 40 MHz
High-Level RF Input	1 V to 5 Vrms
Impedance	50 ohms

MODULATION METER/TEST/RIGHT

Meter Range	0 to 133% with "dB" scale for measurement of positive modulation or the right channel.
Attenuator Range	0 to -50 dB in 10 dB steps
Accuracy	$\pm 2.0\%$ at 100% modulation, sinusoidal test tone 400 Hz
Frequency Response	50 Hz to 15 kHz $\pm 2.0\%$, 30 Hz to 25 kHz, $\pm 5.0\%$

MODULATION METER/LEFT

Meter Range	0 to 133% and "dB" scale for monitoring negative modulation or the left channel
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PEAK MODULATION INDICATORS

125% Peak Indicator	Internally set to flash when modulation exceeds +125%
Variable Peak Indicator	Set by the front panel 3-digit switch in 1% steps from 50% to 150% on both positive and negative peaks
Accuracy (400 Hz Tone)	2% at 98% modulation
Frequency Response (high level RF input)	$\pm 3\%$, 50 Hz to 15 kHz at 98% modulation
Response Time Accuracy	Approximately 10 cycles of 10 kHz

MODULATION CALIBRATOR

Type: Built-in modulation calibrator generates a "-" 100%, "+" 125% AM modulated carrier which is switched into the detector input by the front panel "CAL" button

Accuracy $\pm 1.0\%$

Audio Outputs, Rear Panel

Impedance 600 ohms. balanced, 5k ohms unbalanced

Balanced Output Level 0 dBm (.775 Vrms)

Unbalanced Output Level 5 Vrms

THD 0.15% typical, 0.25% max at 99% modulation, 400 Hz tone

Signal-to-noise Ratio > 75 dB Below 100%
(high level RF input)

Transient Response < 1.0% overshoot
(high level RF input)

Baseband Frequency Response ± 0.5 dB, 20 Hz to 25 Hz

ALARM OUTPUT

Relay contact closures for activation of an external alarm upon loss of modulation or carrier.

PHYSICAL AND ENVIRONMENTAL

Size 19" W x 5 1/4" H x 14" D

Weight 25 lbs. shipping weight

Power: 115/230 VAC, 50/60 Hz, 30 watts maximum

Operating Temperature 0° to 50°C

1.3 WARRANTY

TFT 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 non-conforming 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 (30) days of the warranty period will be paid both ways by the SELLER.

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

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

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

1.4 CLAIMS 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.

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Section II

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 923 is factory wired to operate from either a 117-volt or a 230-volt AC source. The line frequency must be 50/60 Hz. Maximum power required is 30 watts.

2.3 INSTALLATION

- a. Mount the instrument in the equipment rack.
- b. Plug the line cord into an appropriate power source (see Section 2.2 above)
- c. Turn the front panel level INPUT LEVEL control (Figure 3.3-1, Item 3) fully counterclockwise.

CAUTION

Do not connect the cable to rear panel HIGH LEVEL RF INPUT connector until the INPUT LEVEL control is turned fully counterclockwise. Also, make sure that the RF input from the transmitter is no more than 5V rms before connecting the cable to the HIGH LEVEL RF INPUT connector.

- d. Connect the cable from the high-level modulated sampling point on the transmitter, or from the antenna common point sampling loop, to the rear-panel HIGH LEVEL RF INPUT connector.
- e. Connect all other rear-panel terminals that are used. Refer to Section 3.3.2 for descriptions of the use of the various outputs.
- f. Turn the INPUT LEVEL control clockwise until the INPUT LEVEL "SET" LED is on.

Section III OPERATION

3.1 GENERAL INFORMATION

The Model 923 AM Modulation Monitor displays the modulation percentage of the carrier being monitored. Both positive and negative modulations can be selected for monitoring. A front panel LED flashes when the modulation percentage exceeds 125 percent on positive peaks. A pair of front-panel LEDs flashes when the modulation percentage exceeds a preset limit. Both positive and negative peaks can be monitored at the same time.

The Monitor can also be used to measure residual noise on the carrier and modulation percentage of low-level modulation.

3.2 TURN-ON AND WARM-UP

The monitor contains no on-off switch, and is on whenever it is plugged into an appropriate power source. Since the instrument is completely solid-state, a warm-up of no more than 5 minutes is sufficient for it to achieve its rated accuracy.

3.3 CONTROLS, INDICATORS AND CONNECTORS

Front and rear panel controls, indicators and connectors are shown in Figures 3.3-1 and -2. The functions of these items are listed in Tables 3.3-1 and -2.

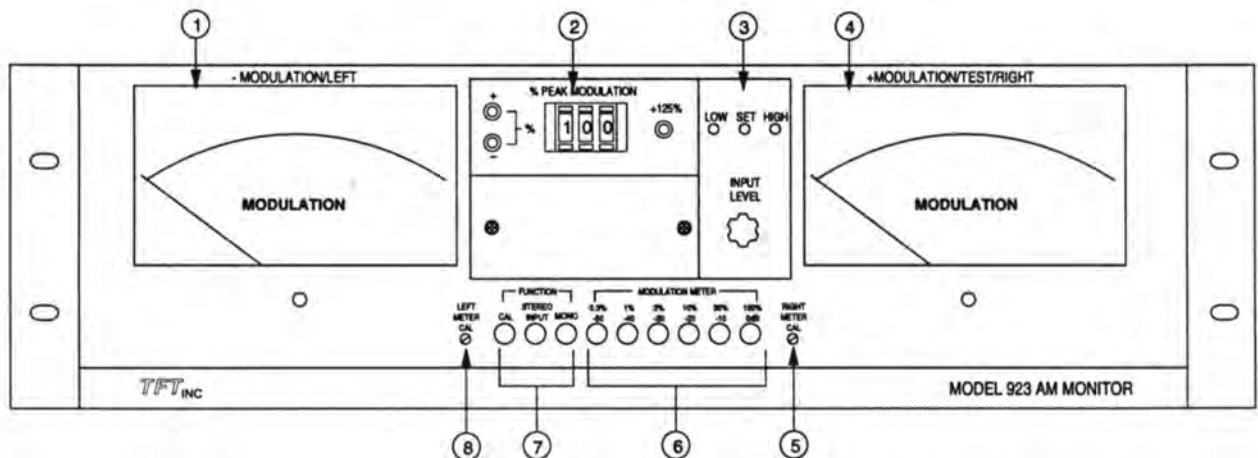


Figure 3.3-1. Front Panel Controls and Indicators

Table 3.3-1. Front Panel Controls and Indicators

ITEM	NAME	FUNCTION														
1	-MODULATION/LEFT	Analog meter. Indicates negative modulation percentage of carrier being monitored as described in Section 3.4.														
2	% PEAK MODULATION	<p>3-digit pushwheel switch and 3 LEDs. Used to indicate that a modulation peak has exceeded a reference level selected via the MODULATION METER switches (Item 6).</p> <p>The LEDs can respond to fast transients and peaks that the MODULATION meters cannot.</p> <p>The pushwheel switches should be set to the desired modulation reference modulation percentage. The ± % LED pair will then flash when modulation peaks exceed the selected reference.</p> <p>The + 125% LED will flash when modulation exceeds 125% regardless of the setting of the pushwheel switches.</p>														
3	INPUT LEVEL	<p>Three LED indicators and one potentiometer control. Used to adjust the carrier input level from the transmitter as described in Section 2.3. The indicator can also be used to observe changes in carrier power during modulation. SET LED lights when input signal level is correct. LOW LED lights when input level is too low. HIGH LED lights when input level is too high.</p>														
4	+ MODULATION/TEST/ RIGHT	<p>Analog meter. Indicates positive modulation percentage of carrier being monitored as described in Section 3.4. The scale to be read depends on which MODULATION METER attenuation switch (Item 6) is depressed, as follows:</p> <table border="0"> <thead> <tr> <th>Modulation Meter Switch</th> <th>Applicable Meter Scale</th> </tr> </thead> <tbody> <tr> <td>100% (0 dB)</td> <td>Top scale</td> </tr> <tr> <td>30% (-10)</td> <td>Middle scale</td> </tr> <tr> <td>10% (-20)</td> <td>Top scale + 10</td> </tr> <tr> <td>3% (-30)</td> <td>Middle scale + 10</td> </tr> <tr> <td>1% (-40)</td> <td>Top scale + 100</td> </tr> <tr> <td>0.3% (-50)</td> <td>Middle scale + 100</td> </tr> </tbody> </table> <p>The + MODULATION meter is also use to indicate residual noise, as described in Sec.3.6. Residual noise in dB referenced to 100% modulation is the sum of the reading on the lower meter scale and the dB label on the depressed MODULATION METER switch.</p>	Modulation Meter Switch	Applicable Meter Scale	100% (0 dB)	Top scale	30% (-10)	Middle scale	10% (-20)	Top scale + 10	3% (-30)	Middle scale + 10	1% (-40)	Top scale + 100	0.3% (-50)	Middle scale + 100
Modulation Meter Switch	Applicable Meter Scale															
100% (0 dB)	Top scale															
30% (-10)	Middle scale															
10% (-20)	Top scale + 10															
3% (-30)	Middle scale + 10															
1% (-40)	Top scale + 100															
0.3% (-50)	Middle scale + 100															

Table 3.3-2. Front Panel Controls and Indicators (Continued)

ITEM	NAME	FUNCTION
5	RIGHT METER CAL	Screwdriver-adjust potentiometer. Used for calibrating +MODULATION meter as described in Section 3.4.
6	MODULATION METER	Set of six interlocked pushbutton switches. Each switch selects an attenuator to set the scale of the +MODULATION/TEST/RIGHT meter (Item 4)
7	FUNCTION	Two interlocked pushbutton switches (MONO and STEREO INPUT) and one alternate-action pushbutton switch (CAL) used as follows: <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;">MONO</div> <div>Used for monitoring AM Monaural broadcast programs only.</div> </div> <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;">STEREO INPUT</div> <div>Reserved for future use.</div> </div> <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;">CAL</div> <div>On-off control of modulation calibrator. Use of the calibrator is explained in Section 3.5.</div> </div>
8	LEFT METER CAL	Screwdriver-adjust potentiometer. Used for calibrating -MODULATION meter as described in Section 3.4.

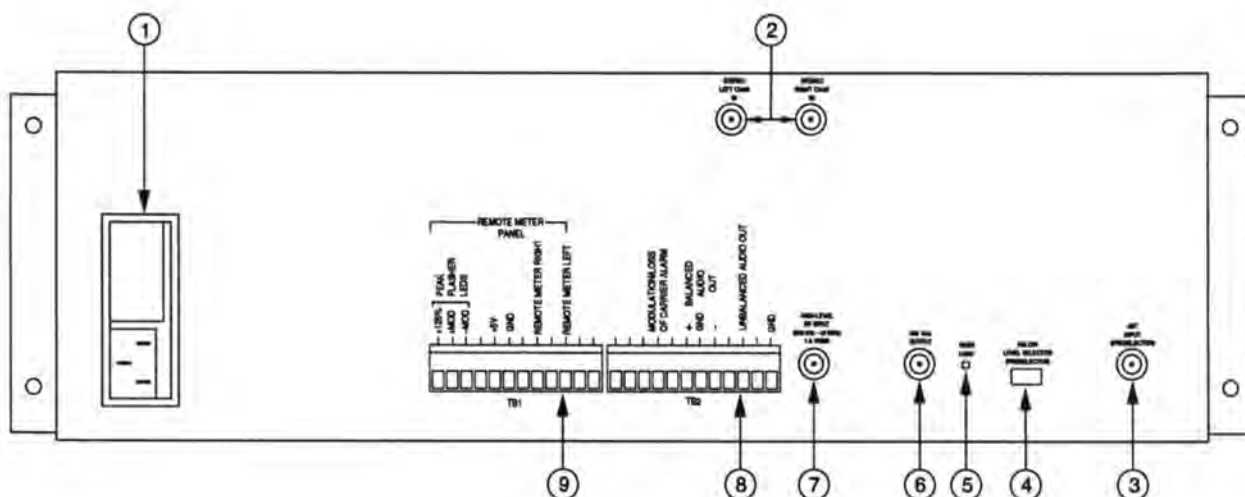


Figure 3.3-2. Rear Panel Controls, Indicators and Connectors

Table 3.3-2. Rear Panel Controls, Indicators and Connectors

ITEM	NAME	FUNCTION
1	(none)	Houses the power fuse, power line noise filters and input voltage selector for 115 or 230VAC.
2	STEREO LEFT CHAN IN RIGHT CHAN IN	Two BNC input connectors reserved for future usage.
3	ANT INPUT (PRESELECTOR)	BNC Connector. Used to connect an antenna to the RF Preselector when this option is installed.
4	HI/LOW LEVEL SELECTOR (PRESELECTOR)	2-position slide switch. Effective only with RF Preselector is installed. In the HI position, a 20 dB attenuator is inserted in the input line. LOW position is for RF input levels of 0.1 to 10 mVrms. HI position is for RF input levels of 10 to 50 mVrms.
5	OVERLOAD	LED. Effective only when RF Preselector is installed. Lights when RF input is too high for proper operation. The RF input level can be reduced by 20 dB by changing position of the HI/LOW Selector (Item 4) to HIGH
6	455 kHz OUTPUT	BNC connector. Used to connect RF Preselector output to Model 923 RF input.
7	HI-LEVEL RF INPUT 500 kHz - 40 MHz 1-5 VRMS	BNC Connector: Provides a means for introducing transmitter carrier through a 50-ohm cable. Maximum voltage is 5 Vrms.
8	TB2	Terminal Board. This board carries the following output terminals: Loss of Carrier Alarm. Terminals (Pin 4 and Pin 5). When RF input drops below a preset level, this pair of terminals provides contact closures that can handle up to 2 amperes at up to 28 VDC. Modulation Alarm. Terminals (Pin 4 and Pin 5). When the modulation on the monitored carrier drops below 10% for a preset time period, this pair of terminals provides contact closures that can handle up to 2 amperes at up to 28 VDC. Balanced Audio Output. Terminals (Pin 6 through 8). These terminals provide 2.2 Vp-p modified 75 μ sec AM Standard de-emphasized, balanced audio output across a 600-ohm load. Unbalanced Audio Output. Terminals (Pin 10 and Pin 11). This pair of terminals provides 14 Vp-p, modified 75 μ sec AM Standard de-emphasized unbalanced audio output across a 5 k-ohm load.
9	TB1	Terminal Board. Provides flashers and metering data for future Remote Meter Panel.

3.4 MODULATION MEASUREMENT USING MODULATION METER

The + and - MODULATION Meters give a quasi-peak indication of positive and negative peak modulations, respectively. For maximum accuracy, the Modulation meters calibration should be checked regularly and adjusted if necessary. The meters are calibrated by depressing the CAL FUNCTION and the MODULATION METER 100% pushbuttons. If the MODULATION meter reading is not exactly 100%, adjust the LEFT METER CAL (Figure 3.3-1, Item 8) until it is. If the MODULATION meter reading is not exactly 125%, adjust the RIGHT METER CAL.

3.5 MEASUREMENT OF MODULATION USING PEAK INDICATORS

The peak flasher are intended to catch fast transients and peaks that the meter cannot respond to. The +125% flasher operates regardless of the settings of other front-panel switches, and indicates when the positive modulation peaks exceed 125%.

To use variable PEAK flashers, set the pushwheel switches to the desired modulation percentage. The variable Peak flasher will then indicate when the modulation exceeds to the preset value in the selected direction.

Accuracy of the peak flashers should be checked regularly, as follows. Depress the FUNCTION CAL button; the +125% flasher should light regardless of the pushwheel settings. With the FUNCTION CAL switch depressed and the pushwheel switches reading 100, the PEAK flasher should be on, at 101% it should be off.

3.6 MEASUREMENT OF RESIDUAL NOISE

Residual noise on the transmitter carrier of up to 40 kHz can be read to an accuracy of 1 dB, and noise of up to 70 kHz can be read to 2 dB. Thus residual sideband measurements can be made on transmitters using newer modulated techniques that might produce unwanted high-frequency spurs.

To read residual noise, turn off the transmitter modulation. Starting with 0 dB MODULATION METER switch, depress each switch in turn until a reading is obtained on the +MODULATION meter. The residual noise in dB below 100% modulation is the algebraic sum of the lower-scale meter reading on the +MODULATION meter and the value of the MODULATION METER switch depressed. Residual noise measurements should be made with monitor reading positive peaks.

An alternate method of using measuring residual noise that does not require turning off transmitter modulation is to depress the MODULATION METER switch that has been found to give a suitable meter reading for the expected value of residual noise. Although the meter will read off-scale during normal modulation, it will not be damaged; and residual noise can be read on the meter during lulls in the program.

3.7 DISTORTION MEASUREMENTS

Connect the distortion analyzer input to the rear-panel UNBALANCED AUDIO OUT at TB2, and tune the analyzer to the fundamental frequency of the audio used to modulate the transmitter. Residual distortion in the Monitor is typically 0.15 percent at 99 percent modulation.

3.8 CARRIER POWER ALARM

The MODULATION/LOSS OF CARRIER ALARM terminals (pins 4 and 5 of TB1) short circuit when the carrier level drops below a preset level. This level is internally adjustable between 0% and 20% below normal level, and is factory set at 10% below normal. There is no front panel control for this feature.

It is emphasized that the CARRIER ALARM terminals are DPDT gold alloy relay contacts. The voltage at the terminals must not exceed +30 volts and the current through the terminals must not exceed 2 amperes.

3.9 MODULATION ALARM

The rear panel MODULATION/LOSS OF CARRIER ALARM terminals (pins 4 and 5 of TB1) short circuit when the modulation on the monitored carrier drops below 10% for a preset period of time. This period is internally adjustable between 2 and 30 seconds. There is no front-panel control for this feature.

Section IV

THEORY OF OPERATION

4.1 Block Diagram Description

The modulated carrier to be monitored is brought in through the RF INPUT connector and is adjusted by means of the CARRIER LEVEL potentiometer to 1V rms at the input to the AM detector. This corresponds to the level at which the CARRIER LEVEL "SET" LED is lit. The AM detector is a full-wave rectifier which cancels out the carrier frequency. This provides a wider bandwidth through the lowpass filter to the metering circuit without allowing the carrier to be passed.

The output of the AM detector is a DC voltage, which is proportional to the input carrier level and the audio modulation riding on the DC. This composite signal is fed through the linear phase lowpass filter which eliminates the carrier and its harmonics and does not produce overshoot on square-wave audio or complex music waveforms. The DC out of the filter is amplified to drive the CARRIER LEVEL LEDs. This circuit is factory adjusted so that a 1-volt rms input to the AM detector turns on the SET LED. The amplified DC is also used to activate an external carrier power alarm by providing a relay contact closure when the DC level out of the lowpass filter drops 10% below normal level.

The audio out of the lowpass filter is applied to a voltage-controlled attenuator to keep the modulation meters and flashers calibrated as the RF level varies within $\pm 30\%$ of the normal level. The attenuator is in a loop with a buffer amplifier and comparator. The buffered DC voltage out of the attenuator is compared with a reference DC voltage, and any difference is applied to the attenuator to correct its DC output. Holding the DC level constant maintains the calibration of the meter and flasher circuits.

The audio output from the buffer amplifier is fed to switch SW1-C to measure positive modulation peaks, and it is also inverted and applied to switch SW1-B to measure negative modulation peaks. Either of these can be selected by the switches for driving the *MODULATION meters through the meter amplifiers, attenuator circuits, and meter detectors. The adjustable attenuator makes it possible to read audio voltages down to 70 dB below 100% modulation, for measurement of residual noise and hum without an external voltmeter.

The positive and negative modulations are also applied to the Pulsewidth Differential Detector (PMDD). When the front-panel switches are set to from 50% to 150%, they control a DC reference voltage to the detector. This voltage is compared with the + and - modulation audio peaks in the PMDD peak comparator. When the audio peaks reach the value of the reference DC voltage, pulses are generated in the comparator and sent to the PMDD peak flasher (which is a programmed microprocessor), against a pulsewidth duration, Tx, set by a thumbwheel switch. If the incoming pulse is greater than Tx, a 1.5-second high output is generated by the microprocessor to activate a corresponding LED on the front panel. The push-wheel switches can be set in 1% steps from 50% to 150% on both positive and negative peaks.

The +125% peak modulation detector is factory set for 125% on positive peaks only, but can be internally adjustable from 115% to 125%.

The audio from the buffer amplifier is amplified and fed to two standard audio outputs; one (UNBALANCED AUDIO OUT) is 5 volts rms into 5000 ohms, and the other (BALANCED AUDIO OUT) is 0 dBm into 600 ohms.

The calibration circuit consists of a 500 kHz oscillator which simulates a carrier. Modulations of -100% and +125% are digitally generated, and the modulated carrier is fed into the AM detector when the front-panel CAL function switch is depressed. Since the modulation percentage of the calibration signal is precisely determined by the digital circuitry and is independent of the carrier level and carrier frequency, the MODULATION meters and the peak flashers can be calibrated regardless of the reading on the INPUT LEVEL LEDs.

4.2 AM Detector, Lowpass Filter, and Summing Amplifier (Figure 6-5)

The detector circuit consists of input transformer T2 and diodes CR3 and CR5 in a full-wave rectifier circuit. The diodes are biased to reduce distortion which may occur when modulation approaches 100%. This bias is factory adjusted by means of potentiometer R77, and should not be readjusted in the field unless an AM Generator with distortion less than 0.1% at 99% modulation is available.

U8, U9 and associated components constitute an active, linear phase, Gaussian, lowpass filter. The 3-dB cutoff is at 80 kHz, making it possible to measure all sidebands out to 70 or 80 kHz. The bias on the AM detector diodes adds a DC component to the audio out of the lowpass filter that is not due to the carrier level. To compensate for this, the same bias that is applied to

the detector diodes is also applied to diodes CR6 and CR7. Thus the common-mode input of U10 has the same value as that at the inverting input of U10; and the DC level out of U10 is proportional to carrier level only. Riding on this DC level is an AC voltage proportional to the modulation on the carrier.

4.3 Audio Attenuator (Figure 6-5)

The composite signal out of summing amplifier U10 drives voltage follower U11 through the voltage divider network consisting of R55, the photo-resistor in optical coupler U17 and R72. Lowpass filter R57/C39 passes only the DC component of the composite signal to the non-inverting input of comparator U11. When this DC voltage is different from the reference voltage set by R61, U11 produces an output which is applied to emitter follower Q9. Current change through the LED of U17 changes the resistance of U17 to apply a change in U11 input voltage which restores the DC output of U11 to its original value. This action ensures that the modulation amplitudes to be measured will not be affected by small changes in the level of the carrier fed into the Monitor.

The level-stabilized composite signal from voltage follower U11 is routed to the meter attenuator/amp U14A via switch SW1C to drive the +MODULATION meter. The U11 output is also inverted by U12 and sent to U15 via switch SW1B to drive the -MODULATION meter. The outputs of U11 and U12 also drive the PMDD (Pulse Modulation Duration Differentiator) circuit.

4.4 Carrier Level LED Drivers (Figure 6-5)

Op amp U10B doubles the DC voltage component of the composite signal from summing amplifier U10A to drive the Carrier level detector U25. DC voltages set by R129 and R132 provide the reference voltages for HI and LOW LEDs respectively. When the DC component of the composite signal from U10B is within the window of the above reference voltages, the SET LED will light.

4.5 Audio Amplifiers (Figure 6-5)

The level-stabilized audio signal from U11 is sent to U7A where it is de-emphasized according to the Modified 75 microsecond AM standard de-emphasis curve set up by National Radio Systems Committee (NRSC). The de-emphasized audio signal from U7A is sent to U7B to provide 14V p-p unbalanced output. The balanced output is provided by U7A and U13B.

4.6 Modulation Meter Amplifiers (Figure 6-5)

The amplified, level-stabilized audio signal from U14A is fed through attenuator R84, R85,

R86, R87 or R88 depending on which Modulation Meter Switch is depressed to the right meter amplifier, consisting of op amps U14A and U18.

The output of this amplifier is rectified by meter detector CR11 to drive the +MODULATION meter through operational amplifier U19, which acts as a buffer and current driver. C82, R114 and R115, together with the meter characteristics, determine the meter fall time, which is between 500 and 800 milliseconds. Meter deflection, rise time, and overshoot are determined by C85, R118, and R120. The values of these components are factory selected for a rise time of 90% of 40 to 90 milliseconds, and an overshoot of less than 7%.

The inverted, level-stabilized audio signal from U12 is fed to the left meter amplifier, U15 via switch SW1/B. The output of U15 is rectified by CR12 to drive the -MODULATION meter through op amp U16. C52, R96 and R98, together with the left meter characteristics, determine the meter fall time. The meter deflection, rise time and overshoot are determined by C56, R102 and R105.

With the CAL function switch and the +MODULATION meter 100% switches depressed, the gain of amplifier U18 is adjusted by R122 to give the +MODULATION meter reading of 125%. The gain of amplifier U15 is adjusted by R1 to give the -MODULATION meter reading of 100%.

4.7 Peak Flashers (Figure 6-5)

Input for the +125% peak mod flasher is the amplified, level-stabilized audio signal from U27A. This is applied to the non-inverting input of comparator U28A. When a modulation peak exceeds the voltage to which calibrating potentiometer R140 is set, a positive pulse is produced at the output of U28A. R140 is normally set to produce an output when positive modulation peaks reach or exceed 125%. The pulse generated by U28A is then sent to U31 against a pulse width duration, Tx, set by the thumbwheel switch SW2. Usually, Tx is set by factory to 0.1 millisecond. If the incoming pulse is greater than 0.1 millisecond, a 1.5 second high output is generated by U31 and sent to Q16 to activate the front panel +125% PEAK MODULATION LED.

The amplified, level-stabilized + and - modulation signals from U27A and U27B are sent to PMDD peak comparators U28B and U28D respectively. These signals are compared in U28B and U28D with a reference DC voltage supplied by U29, U33, U32, and U31. Its value is controlled by push-wheel switches on the front panel according to Table 1 in Figure 6-5, Sheet 2.

The reference DC voltage is then compared in U28B and U28D with the + and - modulation audio

signals respectively. When the modulation amplitude exceeds the reference voltage, U28B and U28D will produce output pulses. These pulses are then sent to U31 against Tx. If the incoming pulses are greater than 0.1 millisecond, 1.5 second high outputs are generated by U31 and sent to Q17 and Q18 to activate the + and - % PEAK MODULATION LEDs respectively.

4.8 Calibration Signal Generator (Figure 6-5)

The purpose of the calibration signal generator is to produce a signal that simulates an RF carrier precisely modulated 125% positively and 100% negatively. Q4 and Q5 form a 0.6 MHz free-running multivibrator. Flip-flop U3B divides the frequency by 2 to give a 300 kHz input to pin 1 of NAND gate U1. The circuitry consisting of divider chain U4/U5, gate U2, and flip-flop U3A, driven by the output of U3B, produces an asymmetrical output. This output is applied to pin 2 of U1; thus the gated output at pin 3 of U1 is a 300 kHz signal gated alternately on and off. This provides the required +125%, -100% modulation. Calibration accuracy is not dependent on accuracy of the oscillator frequency, but only on the accuracy of the digital divider circuit that generates the asymmetrical waveform.

The output of U1C is amplified to approximately 1 volt rms by the push-pull circuit consisting of Q1, Q2, Q3 and T1. When the CAL function switch is depressed, this calibration signal replaces the monitored signal as the input to the AM detector.

4.9 Power Supplies (Figure 6-5)

The 26-volt center tapped secondary of the power transformer is connected to bridge rectifier U20. U20 supplies a positive output to regulator U22 which provides a +12 volt output. U20 also provides a negative output to regulator U23 which provides a -12 volt output. There are no adjustments on the power supplies.

The 13-volt AC output from the transformer also furnishes current for two pairs of 12-volt modulation meter lamps.

Another center -tapped secondary of the power transformer is connected to two full-wave rectifiers, CR13 and CR14. Together they supply a positive output to regulator U21, which provides a +5 volt output.

Section V

MAINTENANCE

5.1 GENERAL INFORMATION

Since the Model 923 is an all solid-state instrument, very little maintenance is required. The Model 923 should be installed a sufficient distance from high heat-producing instruments to insure an ambient operating temperature below $+50^{\circ}\text{C}$ ($+122^{\circ}\text{F}$). Access to the unit is via the top panel which is held in by seven sheet metal screws. The printed circuit board is removed by following steps a through d below. Re-assembly is by reverse order.

- a. Remove top cover by removing the seven sheet metal screws that secure it to the unit.
- b. Remove the front panel assembly, four 6-32 screws and handles, and disconnect cable plugs from the PC board.
- c. Remove nine 6-40 screws.
- d. Remove the board from the hold-downs by lifting the board.

5.2 PERIODIC MAINTENANCE

The only periodic maintenance that should be required is to remove excess dust accumulation on an annual basis. This is done by removing the seven sheet metal screws holding the top cover, and blowing the dust out with compressed air.

5.3 METER LAMP REPLACEMENT

Access to the meter lamps is through the top panel after removing the seven sheet metal screws securing the top panel.

5.4 CALIBRATION PROCEDURES

The following calibration procedures are intended for the person having a RF generator capable of very low distortion amplitude modulation and whose level can be accurately controlled. A high input impedance digital voltmeter and an oscilloscope are also necessary.

5.4.1 Audio Attenuator Circuit

Connect the input of a digital voltmeter to the wiper of R61 and adjust R61 for 0.500 VDC. Connect a 1 V rms RF signal at the desired frequency to the RF input and turn the RF

level control until the SET LED is on. Measure the D.C. Voltage at TP5, which should be 2.0 Volts ± 0.1 Volts. Measure the D.C. voltage at TP4, which should be 0.500V ± 0.010 Volts D.C. Changing the RF input by ± 3 dB without re-adjusting the RF level ADJ will temporarily change this voltage, but it should return to 0.500V within 5 seconds. If this occurs, the audio attenuator circuitry is working properly.

5.4.2 Carrier Level Indicators

With a 1 Vrms RF Carrier present at the input to the Model 923 adjust the INPUT LEVEL control so that the INPUT LEVEL "SET" LED is on.

5.4.3 Peak Flashers

Amplitude modulate the RF generator to 98% using a 400 Hz audio signal. Set the pushwheel switches on the Model 923 to 98%. The + and - PEAK MODULATION indicators should be ON. Adjust R145 and R151 for proper operation. Reduce the modulation to 95% and the + and - % PEAK MODULATION indicators should be OFF. Press the CAL FUNCTION button and set the pushwheel switches to 100%. Both of + and - % PEAK MODULATION indicators and the "125%" indicator should be ON. Slowly vary R140 (+125% PEAK ADJ) to make sure the "125%" indicator is just coming ON.

5.4.4 Modulation Meter

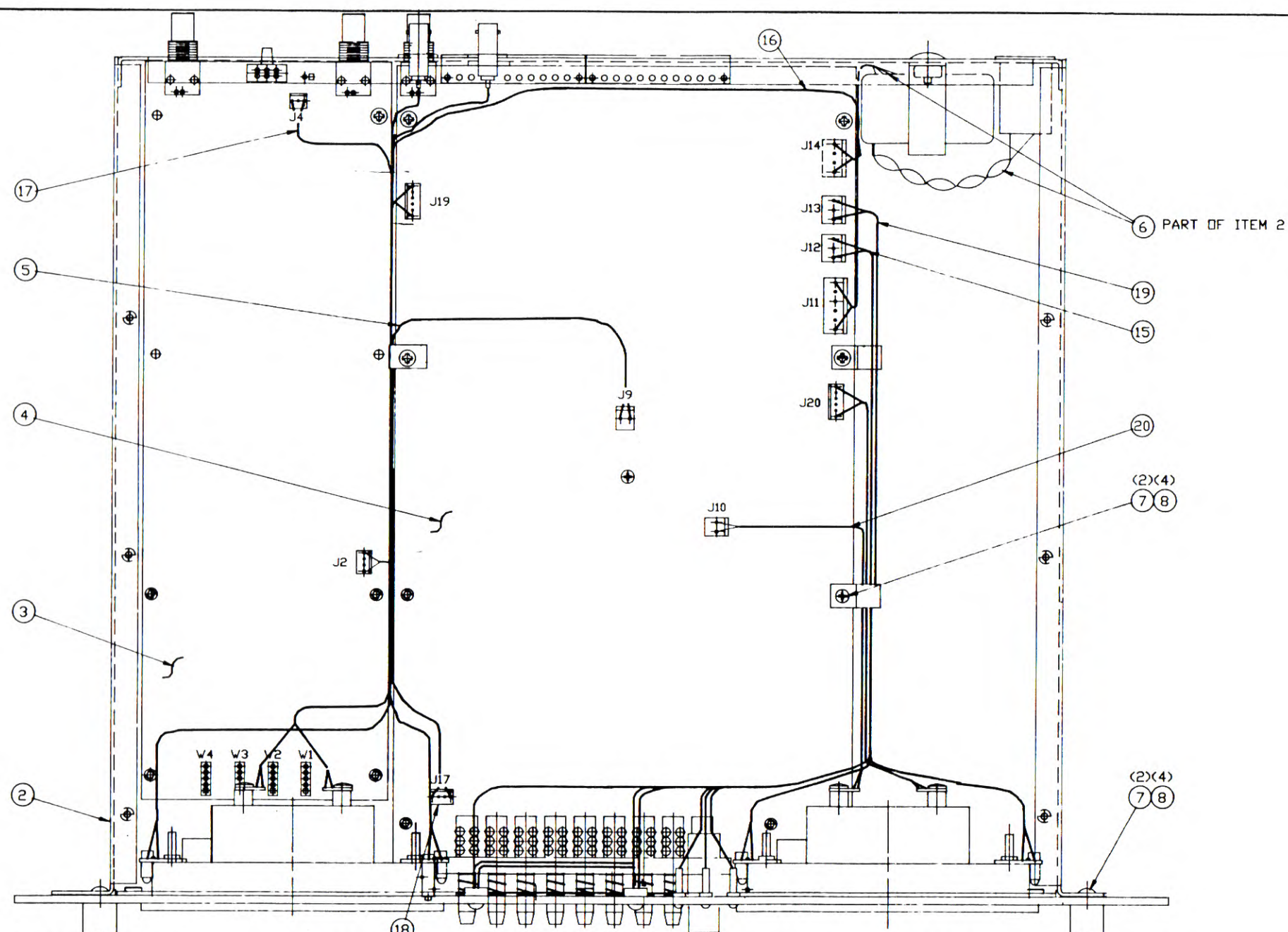
Amplitude modulate the RF generator to 100% with a 400 Hz audio signal. Both the - MODULATION and + MODULATION meters on the 923 should read 100% with the 0 dB (100%) attenuator button depressed. Adjust the METER CAL controls if necessary. Press the CAL FUNCTION button. The -MODULATION meter should read 100% $\pm 1\%$ and the +MODULATION meter should read 125% $\pm 2\%$.

5.4.5 Carrier Power Alarm

With the carrier level indicator at the SET mark, the loss of carrier alarm output, the circuit between pin 4 and pin 5 of TB2 on the rear panel, should be OFF (open). Decrease the RF level 10%, and the output should be ON (shorted). Adjust R28 for the -10%.

5.4.6 Modulation Alarm

With 10% modulation or less the modulation alarm output, circuit between pin 4 and 5 of TB2 on the rear panel should be ON (shorted). R20 controls the delay between loss of modulation and the alarm going ON.

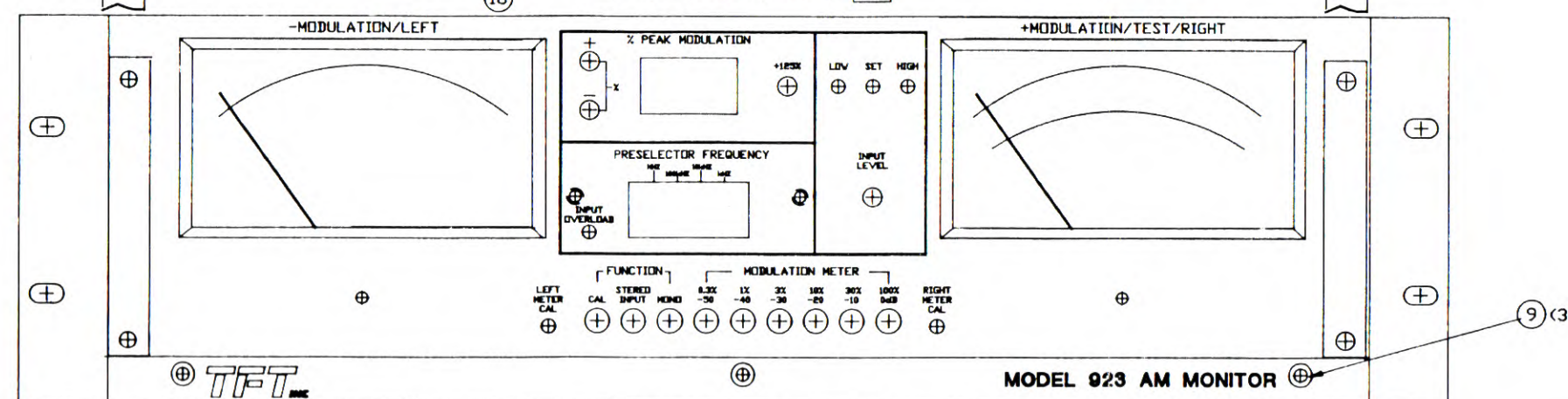


REVISIONS				
REV	DESCRIPTION	DR	DATE	APPD
A	RELEASE TO PROD	K. K.	4-27-93	
B	UPDATE CABLE ROUTING	K. K.	7-13-93	<i>J. Suer</i>

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FIG. 6-1

20	1	4750-0912	MAIN BD J10 TO RIGHT METER
19	1	4750-0914	MAIN BD J13 TO RIGHT MTR LIGHTS
18	1	4750-0915	MAIN BD J17 TO BNC'S (RP)
17	DPT	4750-0918	PRESELECTOR BD J4 TO OVERLOAD LED
16	DPT	4750-0919	MAIN BD J14 TO PRESELECTOR BD J2
15	1	4750-0913	MAIN BD J12 TO LEFT METER LIGHTS
14	-	-	-
13	-	-	-
12	3	2140-0005	TY-WRAP
11	3	2140-0006	MOUNTING TAB, NYLON
10	17	2106-0002	6-32 x 1/4 LG PH SCREW
9	3	2106-0016	6-32 x 1/2 LG OVAL HD SCR BLK
8	4	2110-0011	10-32 x 5/8 LG PH SCREW
7	2	2160-0012	3 1/2 MTR CTR HANDLE
6	REF	5102-3882	POWER XMFR ASSY
5	1	4750-0911	MAIN BD J9 TO LEFT METER
4	1	6608-3946	MAIN PCB ASSY
3	DPT	6608-3945	PRESELECTOR PCB ASSY
2	1	5102-3881	CHASSIS ASSY
1	1	5102-3880	FRONT PANEL ASSY
ITEM QTY		PART NO.	DESCRIPTION



923	5116-0923	DATE	4/27/93
MODEL	NEXT ASSY	DATE	7/15/93
APPLICATION	SA	SCALE	1/4
APPROVALS		DATE	4/27/93
DESIGNED	K. K.		
CHECKED	<i>J. Suer</i>		
TPT		3990 DOWHEAD VILLAGE DR. SANTA CLARA, CA 95050 (408)787-7878 FAX 950-998-0004	
AM MONITOR		MODEL ASSY	
5102-3879		REV NO 5102-3879	
D		SHEET 1 OF 1	

REVISIONS				
REV	DESCRIPTION	DR	DATE	APPD
A	RELEASE TO PROD		1-25-93	<i>Norm 7/2/93</i>

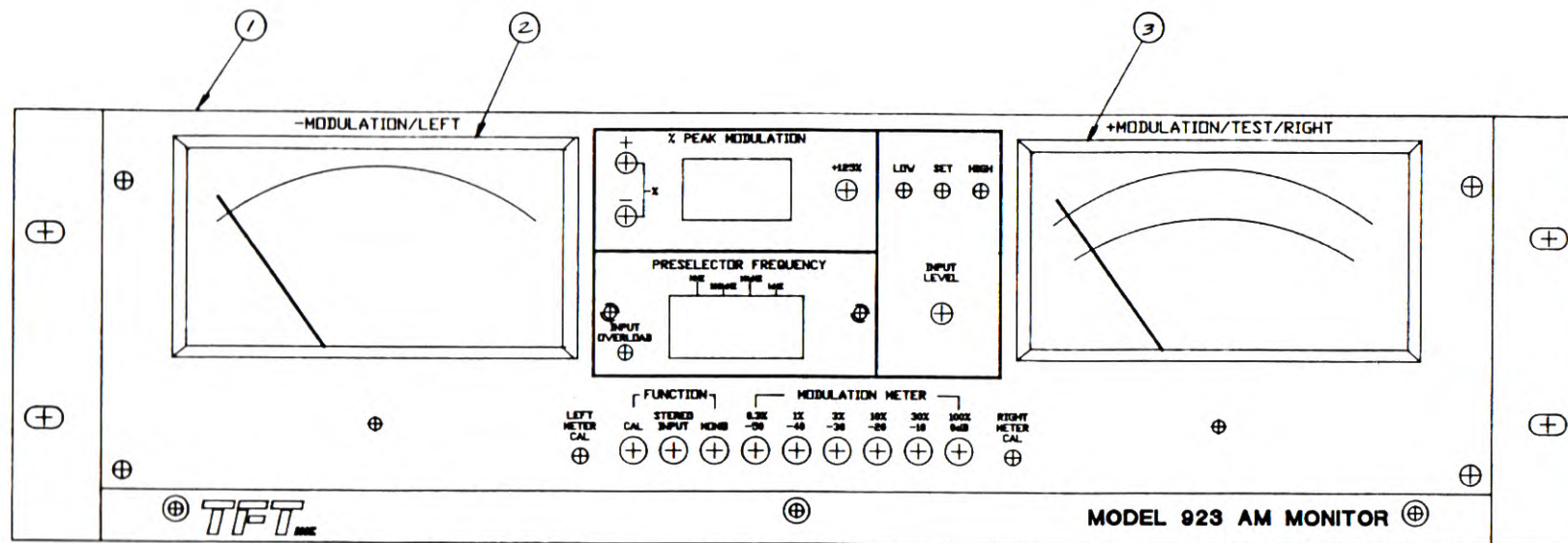
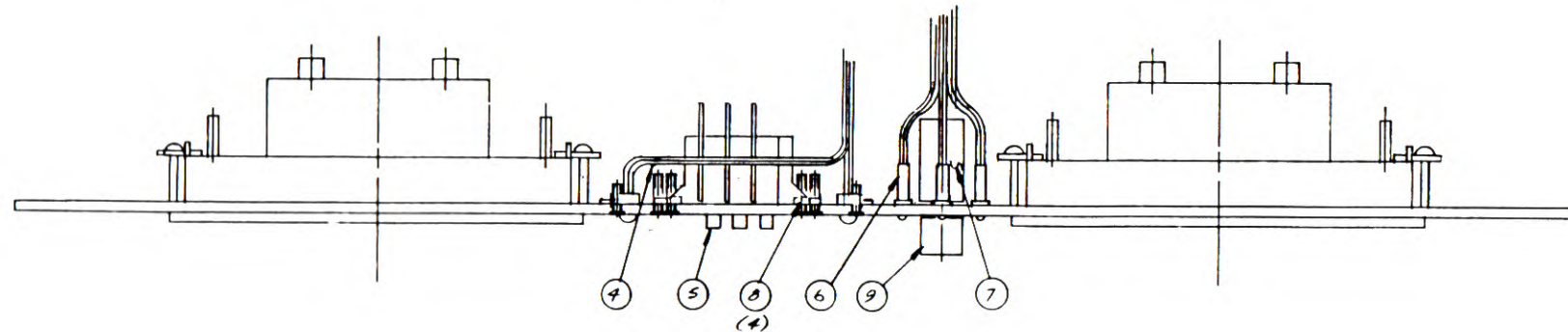


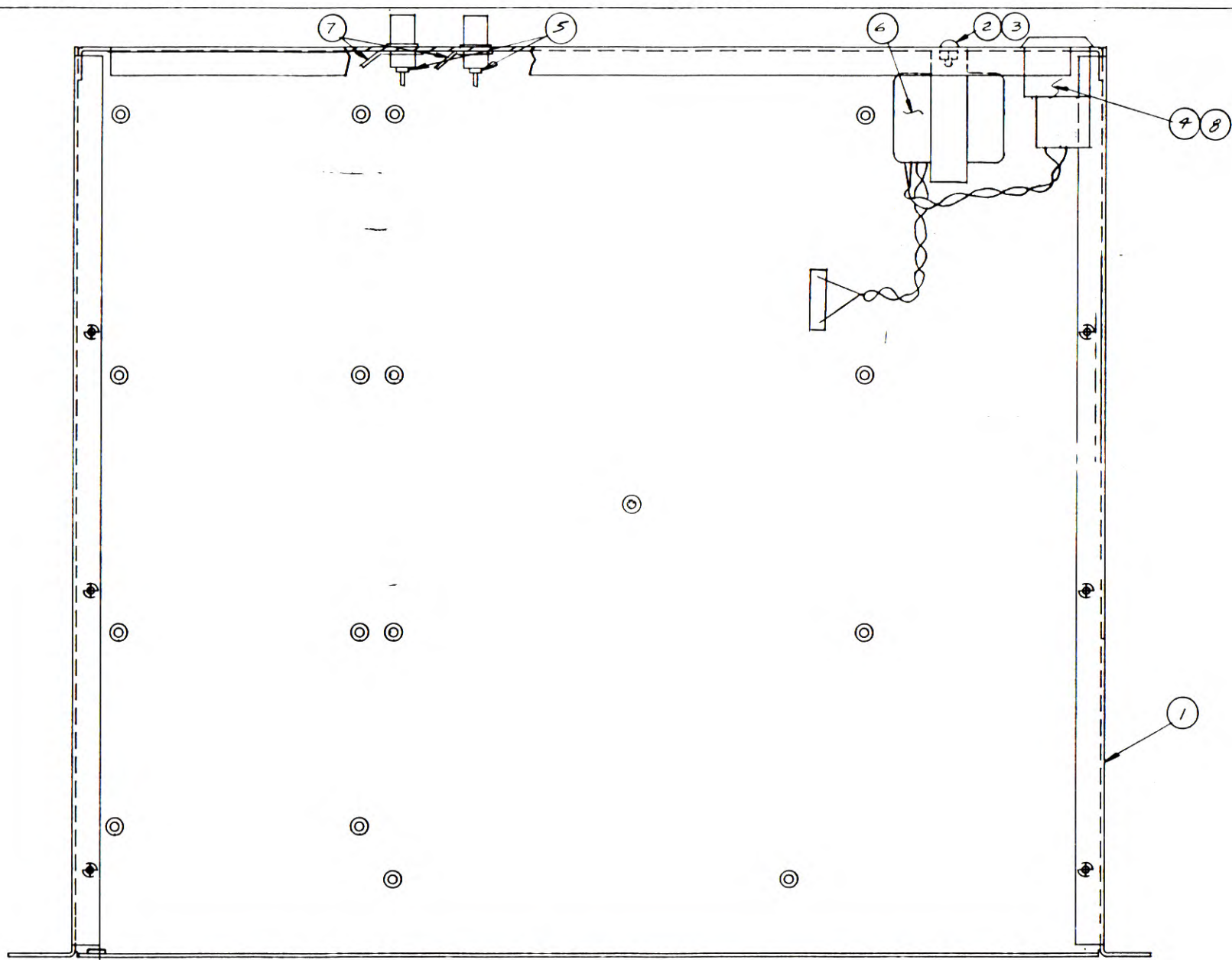
FIG. 6-2

ITEM	QNTY	PART NO.	DESCRIPTION
9	1	2370-0174	KNOB 1/2" BUSHING
8	4	2111-0003	4-KB HEX NUT
7	1	4750-0910	MAIN BD J2 TO INPUT LEVEL ADJ ATTEN
6	1	4750-0916	MAIN BD J19 TO INPUT LEVEL LEADS (FP)
5	1	5102-3883	3 POS PUSHWHEEL SWITCH ASSY
4	1	4750-0917	MAIN BD J20 TO PEAK MOD LEADS (FP)
3	1	1400-7049	METER + MODULATION/TEST/RIGHT
2	1	1400-4203	METER - MODULATION/LEFT
1	1	2000-1050	FRONT PANEL

SPECIFICATIONS UNLESS OTHERWISE SPECIFIED		APPROVALS	DATE	TFT	
DECIMAL =	2 PLACE ±	DR	4/2/93	3090 BAYVIEW VILLAGE DR. SANTA CLARA, CA 95051	
ANGLE =	3 PLACE ±	CHKD	4/3/93	PHONE (408) 767-7878 FAX 910-338-0004	
APPLICATION		APPD	5/1/93	AM MONITOR FRONT PANEL ASSY	
		BA	5/1/93	SCALE 300%	5102-3880

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923	5102-3881	MODEL	NEXT ASSY	APPLICATION
SHEET 1 OF 1				



REVISIONS				
REV	DESCRIPTION	DR	DATE	APPD
A	RELEASE TO PROD	K. K.	4-27-93	/s/
B	HIGHER POWER XMER	EA	7-13-93	

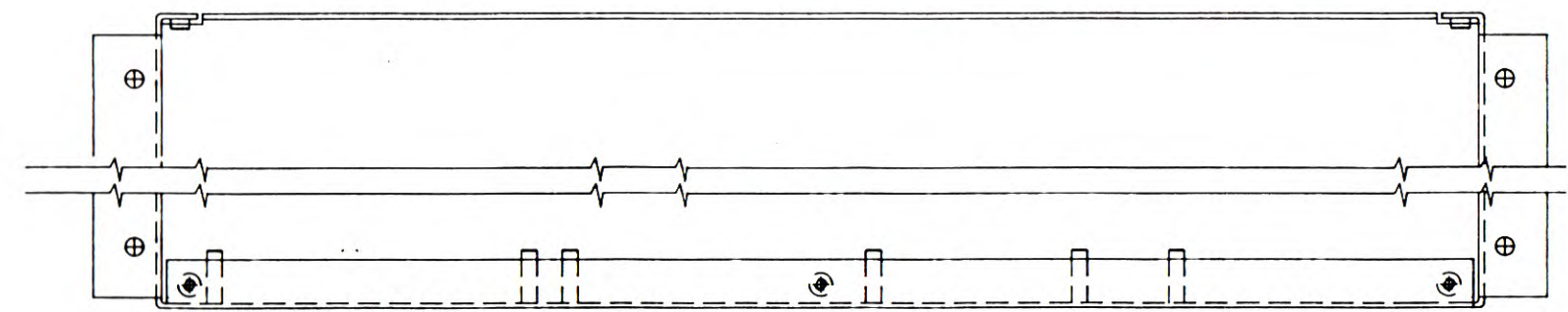


FIG. 6-3

ITEM	QNTY	PART NO.	DESCRIPTION
8	1	1900-0005	FUSE 1/2 A 5 B
7	2	1710-1200	GND LUG BNC
6	1	5102-3892	POWER XMER ASSY
5	2	2200-3110	INSULATED RF BNC 31-10
4	1	1910-0006	CURCOM FILTER
3	2	2111-0004	6-32 KEP NUT
2	2	2106-0005	6-32 X 1/2 LG PH SCREW
1	1	2001-3119	CHASSIS

923	5102-3000	APPROVALS	DATE	 3090 SANDHEAD VILLAGE DR. SANTA CLARA, CA 95050 (408) 767-7878 FAX 408-930-0984
MODEL	NEXT ASSY	DESIGNED BY	DATE	
APPLICATION	AL	DATE	DATE	AM MONITOR CHASSIS ASSY REV NO 5102-3001 REV B

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED
	A	RELEASE TO PRODUCTION	4/30/93	<i>J. Suer</i>

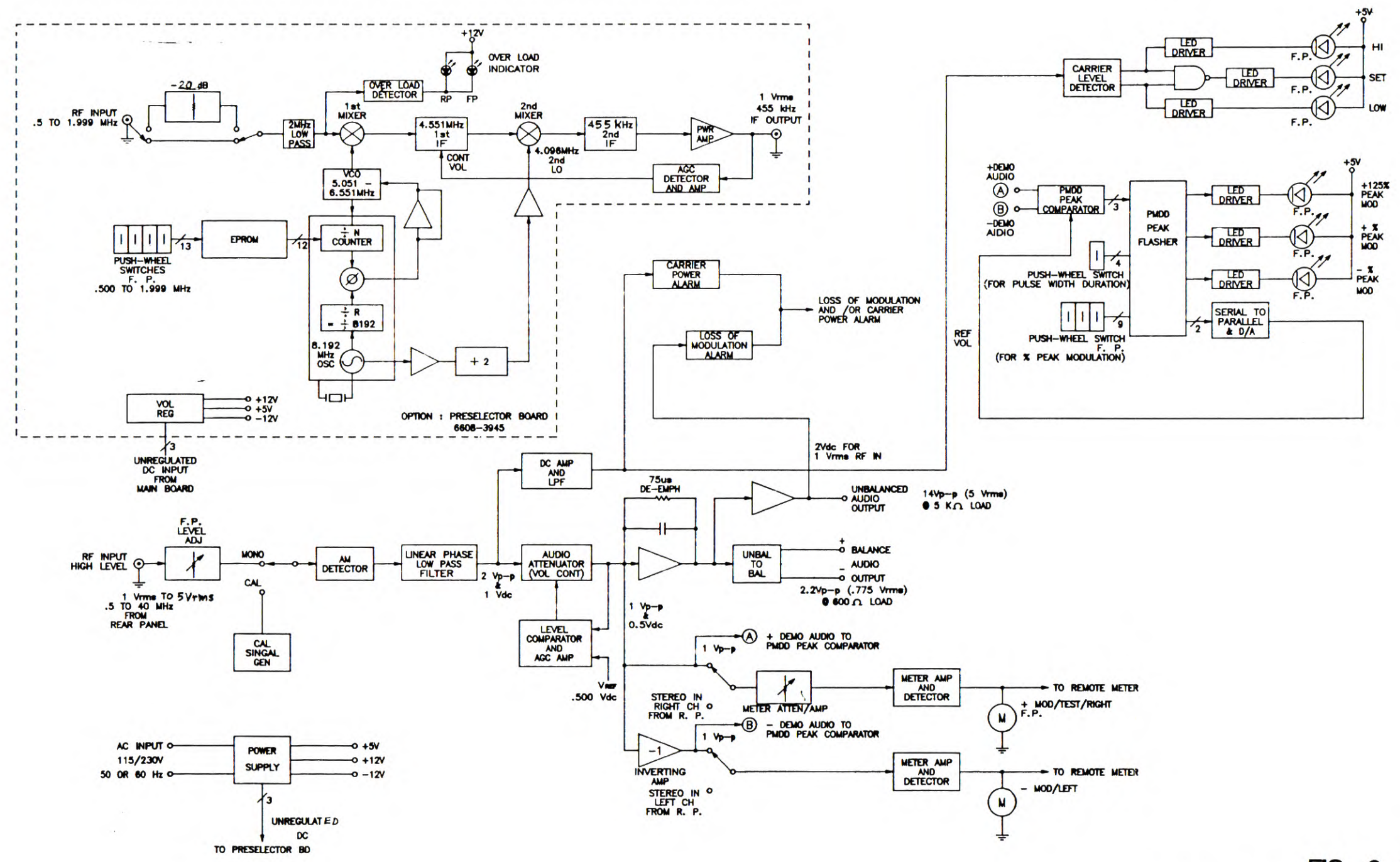

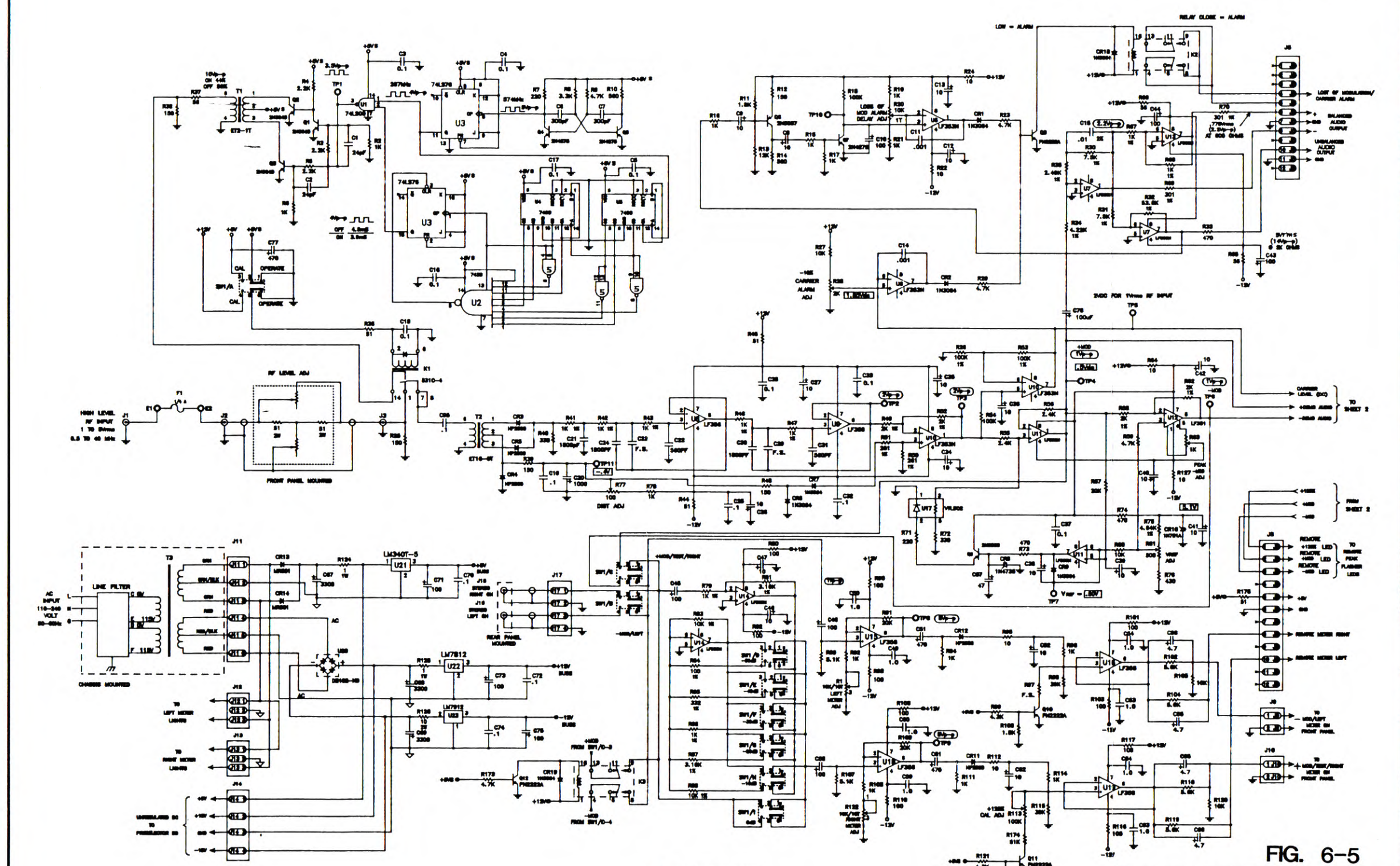


FIG. 6-4

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APPROVALS		DATE	 3090 OAKMEAD VILLAGE DR. SANTA CLARA, CA 95051 (408)727-7272 TWX 910-338-0584
DESIGN	JUDY LIU	4/30/93	
DESIGN	<i>TSP</i>	4/30/93	
DESIGN	<i>J. Suer</i>	4/30/93	
MODEL	NEXT ASSY		AM MONITOR SYSTEM BLOCK DIAGRAM
APPLICATION			SIZE C FROM NO. DWS. NO. 6600-2764 REV. A SCALE NONE SHEET 1 OF 1

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED
	A	RELEASE TO PRODUCTION	4/30/93	<i>J. Suen</i>



NOTES - UNLESS OTHERWISE SPECIFIED:
 1. ALL RESISTOR VALUES ARE IN OHMS UNLESS OTHERWISE SPECIFIED.
 2. ALL CAPACITOR VALUES ARE IN MICROFARADS.
 3. ALL INDUCTOR VALUES ARE IN MICROHENRIES.

FIG. 6-5

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APPROVED		DATE			3090 OAKMEAD VILLAGE DR. SANTA CLARA, CA. 95051 (408)727-7272 TWX 910-338-0584		
DESIGNED	JUDY LIU	4/30/93			SCHEMATIC		
CHECKED	TSP	4/30/93		AM MONITOR MAIN BOARD			
MODEL	923	6608-3946	ENGR.	J. Suen	4/30/93	SIZE	F3CM NO.
APPLICATION			DWG. NO.	6601-3946	REV.	A	
			SCALE	NONE	SHEET	1 OF 2	

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED
	A	RELEASE TO PRODUCTION	4/30/93	J. Suen

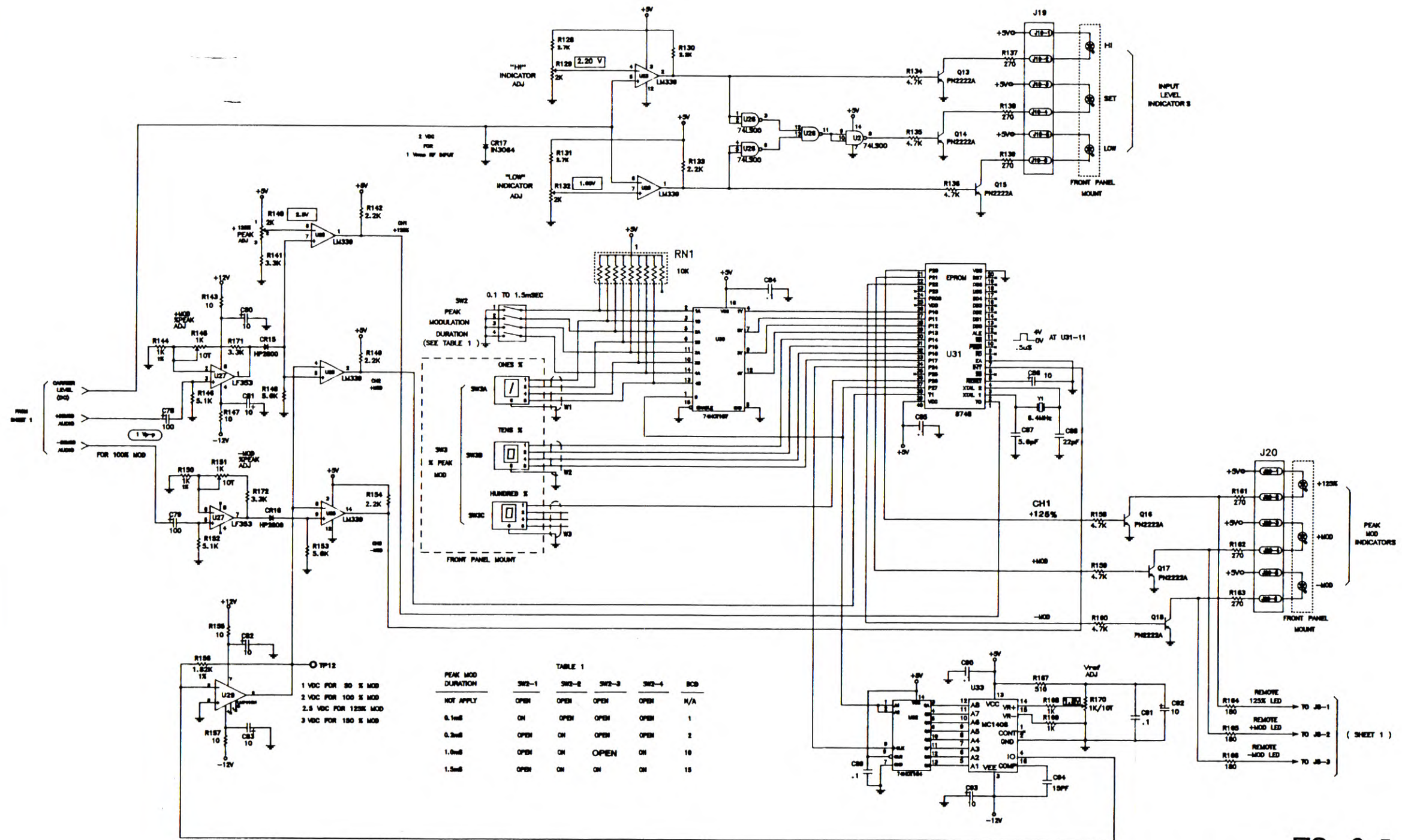
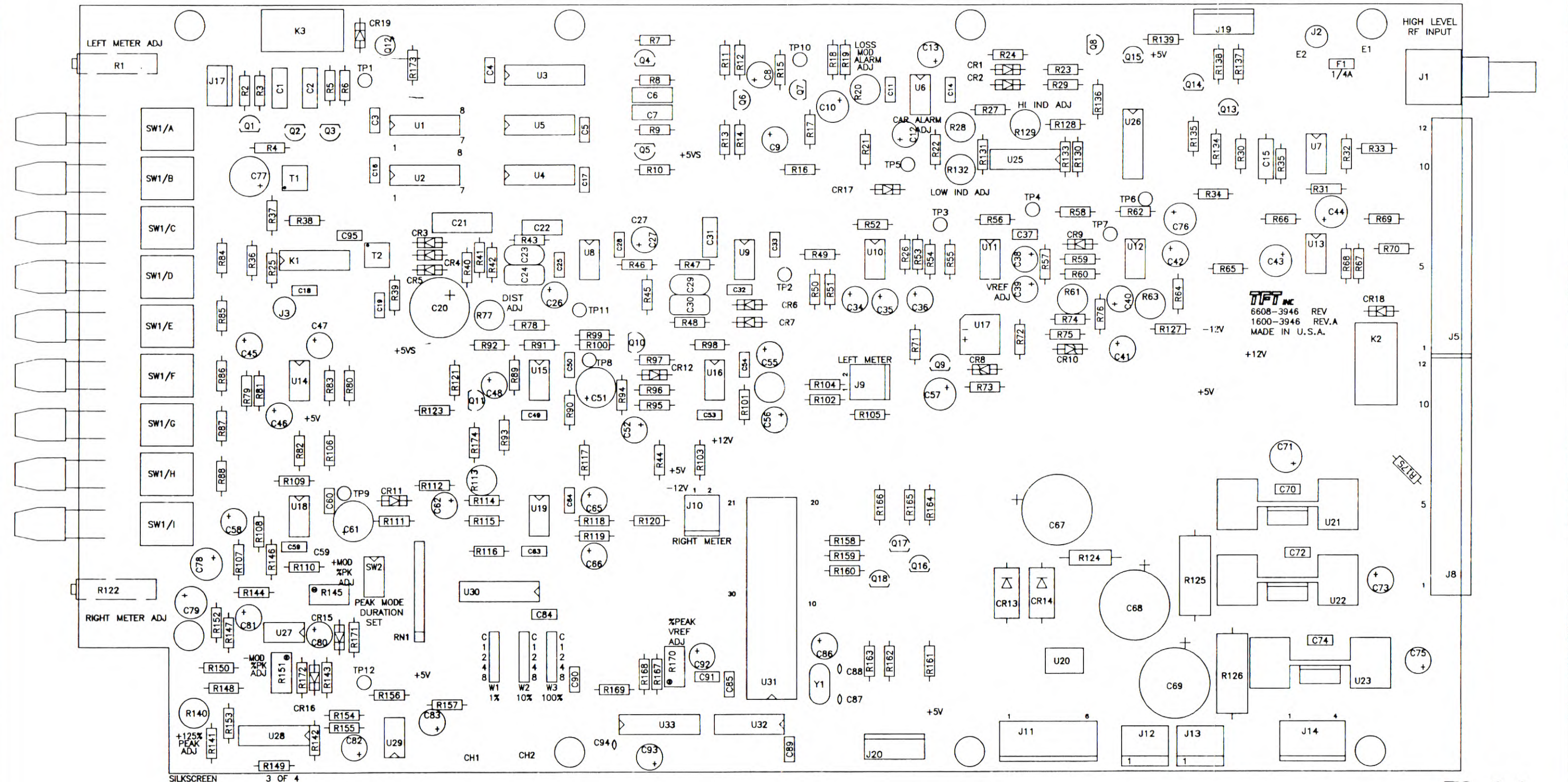


FIG. 6-5

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APPROVALS		DATE	TPT INC		3090 OAKMEAD VILLAGE DR. SANTA CLARA, CA. 95051 (408)727-7272 TWX 910-338-0584	
DRAWN	JUDY LIU	4/30/93	SCHEMATIC		6601-3946	
CHECKED	JSP	4/30/93	AM MONITOR MAIN BOARD		REV. A	
MODEL	6608-3946	DATE	SCALE	NONE	SHEET 2 OF 2	
MODEL	NEXT ASSY	DATE	APPLICATION			
			G.A. P. Suen		4/30/93	

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
A		RELEASE TO PRODUCTION	4/30/83	Jsw



TPT INC
 6608-3946 REV
 1600-3946 REV.A
 MADE IN U.S.A.

FIG. 6-6

		3090 OAKMEAD VILLAGE DR. SANTA CLARA, CA. 95051 (408)727-7272 TWX 910-338-0584	
PCB ASSY			
AM MONITOR MAIN BOARD			
923	3102-3897	SIZE FROM NO.	DWG. NO. 6608-3946
MODEL	NEXT ASSY	D	REV. A
APPLICATION	SCALE 2:1	SHEET 1 OF 1	

DATE	APPROVED
4/30/83	JUDY LUJ
4/20/83	T.P.
4/20/83	J. Swann
4/18/83	J. Swann

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
C001	CAP MICA 24 PF	1	1001-0240
C002	CAP MICA 24 PF	1	1001-0240
C003	CAP CER 0.1MF CK05BX K	1	1015-0001
C004	CAP CER 0.1MF CK05BX K	1	1015-0001
C005	CAP CER 0.1MF CK05BX K	1	1015-0001
C006	CAP MICA 300 PF	1	1001-0301
C007	CAP MICA 300 PF	1	1001-0301
C008	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C009	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C010	CAP ELECT VT MT 100UF (NO SUB.)	1	1010-0110
C011	CAP CER 0.001MF CK05	1	1015-0010
C012	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C013	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C014	CAP CER 0.001MF CK05	1	1015-0010
C015	CAP POLY CARB .01 MF 2% 5	1	1006-0001
C016	CAP CER 0.1MF CK05BX K	1	1015-0001
C017	CAP CER 0.1MF CK05BX K	1	1015-0001
C018	CAP CER 0.1MF CK05BX K	1	1015-0001
C019	CAP CER 0.1MF CK05BX K	1	1015-0001
C020	CAP ELECT 1000MFD 25V VERT MT	1	1010-1000
C021	CAP MICA 1500PF 500	1	1001-1501
C022	CAP MICA 560 PF 300V	1	1001-0561
C024	.0018MFD 2% 50V POLY CAP	1	1002-0182
C025	CAP CER 0.1MF CK05BX K	1	1015-0001
C026	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C027	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C028	CAP CER 0.1MF CK05BX K	1	1015-0001
C029	F.S. PART	1	XX00-0002
C030	.0018MFD 2% 50V POLY CAP	1	1002-0182
C031	CAP MICA 560 PF 300V	1	1001-0561
C032	CAP CER 0.1MF CK05BX K	1	1015-0001
C033	CAP CER 0.1MF CK05BX K	1	1015-0001
C034	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C035	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C036	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C037	CAP CER 0.1MF CK05BX K	1	1015-0001
C038	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C039	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C040	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C041	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C042	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C043	CAP ELECT VT MT 100UF (NO SUB.)	1	1010-0110
C044	CAP ELECT VT MT 100UF (NO SUB.)	1	1010-0110

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
C045	CAP ELECT VT MT 100UF (NO SUB.)	1	1010-0110
C046	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C047	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C048	CAP ELECT VT MT 100UF (NO SUB.)	1	1010-0110
C049	CAP CER DISC 1MFD	1	1005-0001
C050	CAP CER DISC 1MFD	1	1005-0001
C051	CAP ELEC 470MF 25V VERT MNT	1	1010-0045
C052	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C053	CAP CER DISC 1MFD	1	1005-0001
C054	CAP CER DISC 1MFD	1	1005-0001
C055	CAP ELECT 4.7UF 16V VERT MT	1	1010-0047
C056	CAP ELECT 4.7UF 16V VERT MT	1	1010-0047
C057	CAP ELECT 47MFD 35V VERT MT	1	1010-0470
C058	CAP ELECT VT MT 100UF (NO SUB.)	1	1010-0110
C059	CAP CER DISC 1MFD	1	1005-0001
C060	CAP CER DISC 1MFD	1	1005-0001
C061	CAP ELEC 470MF 25V VERT MNT	1	1010-0045
C062	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C063	CAP CER DISC 1MFD	1	1005-0001
C064	CAP CER DISC 1MFD	1	1005-0001
C065	CAP ELECT 4.7UF 16V VERT MT	1	1010-0047
C066	CAP ELECT 4.7UF 16V VERT MT	1	1010-0047
C067	CAP ELEC VERT MT 3300MFD 25V	1	1010-3301
C068	CAP ELEC VERT MT 3300MFD 25V	1	1010-3301
C069	CAP ELEC VERT MT 3300MFD 25V	1	1010-3301
C070	CAP CER 0.1MF CK05BX K	1	1015-0001
C071	CAP ELECT VT MT 100UF (NO SUB.)	1	1010-0110
C072	CAP CER 0.1MF CK05BX K	1	1015-0001
C073	CAP ELECT VT MT 100UF (NO SUB.)	1	1010-0110
C074	CAP CER 0.1MF CK05BX K	1	1015-0001
C075	CAP ELECT VT MT 100UF (NO SUB.)	1	1010-0110
C076	CAP ELECT VT MT 100UF (NO SUB.)	1	1010-0110
C077	CAP ELEC 470MF 25V VERT MNT	1	1010-0045
C078	CAP ELECT VT MT 100UF (NO SUB.)	1	1010-0110
C079	CAP ELECT VT MT 100UF (NO SUB.)	1	1010-0110
C080	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C081	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C082	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C083	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C084	CAP CER 0.1MF CK05BX K	1	1015-0001
C085	CAP CER 0.1MF CK05BX K	1	1015-0001
C086	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C087	CAP MINI CER 5.6PF NPO RECT	1	1017-0056

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
C088	CAP MINI CER 22 PF NPO 63V	1	1017-0220
C089	CAP CER 0.1MF CK05BX K	1	1015-0001
C090	CAP CER 0.1MF CK05BX K	1	1015-0001
C091	CAP CER 0.1MF CK05BX K	1	1015-0001
C092	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C093	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C094	CAP MINI CER 15PF NPO RECT	1	1017-0150
C095	CAP CER 0.1MF CK05BX K	1	1015-0001
C096	CAP CER DISC 1MFD	1	1005-0001
CR01	DIO 1N3064	1	1281-3064
CR02	DIO 1N3064	1	1281-3064
CR03	DIO HP5082 HOT CARRIER	1	1282-2800
CR04	DIO HP5082 HOT CARRIER	1	1282-2800
CR05	DIO HP5082 HOT CARRIER	1	1282-2800
CR06	DIO 1N3064	1	1281-3064
CR07	DIO 1N3064	1	1281-3064
CR08	DIO 1N4735 ZENER	1	1283-4735
CR09	DIO 1N3064	1	1281-3064
CR10	DIODE ZENER 1N751A 5.1V 5%	1	1281-0751
CR11	DIO HP5082 HOT CARRIER	1	1282-2800
CR12	DIO HP5082 HOT CARRIER	1	1282-2800
CR13	D10 MR501	1	1281-0501
CR14	D10 MR501	1	1281-0501
CR15	DIO HP5082 HOT CARRIER	1	1282-2800
CR16	DIO HP5082 HOT CARRIER	1	1282-2800
CR17	DIO 1N3064	1	1281-3064
CR18	DIO 1N3064	1	1281-3064
CR19	DIO 1N3064	1	1281-3064
E001	1/8DX.35L GRN TEST TERMINAL	1	2140-0155
E002	1/8DX.35L GRN TEST TERMINAL	1	2140-0155
F001	FUSE 1/4A FB	1	1900-0025
HS01	HEATSINK .5 THK X 1 3/8"WX2"H	1	2010-2000
HS02	HEATSINK .5 THK X 1 3/8"WX2"H	1	2010-2000
HS03	HEATSINK .5 THK X 1 3/8"WX2"H	1	2010-2000
J001	R/A BNC PC MNT METAL BODY CONN	1	2200-7961
J002	RF COAX RECP CON FL-R-PC (1)	1	2220-0150
J003	RF COAX RECP CON FL-R-PC (1)	1	2220-0150
J004	PARTS NOT USED	1	X000-0001
J005	TERM BLK 12 POS .197 CTR MALE	1	1700-1012
J006	PARTS NOT USED	1	X000-0001
J007	PARTS NOT USED	1	X000-0001
J008	TERM BLK 12 POS .197 CTR MALE	1	1700-1012
J009	PLUG, LOCKING 2 PIN	1	2250-6002

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
J010	PLUG, LOCKING 2 PIN	1	2250-6002
J011	PLUG LOCK MOLEX 6 PIN	1	2250-6506
J012	PLUG, LOCKING 3 PIN	1	2250-6003
J013	PLUG, LOCKING 3 PIN	1	2250-6003
J014	PLUG, 4 PIN	1	2250-6004
J015	PARTS NOT USED	1	X000-0001
J016	PARTS NOT USED	1	X000-0001
J017	CONN MINI MOLEX 4PIN	1	2250-5854
J018	PARTS NOT USED	1	X000-0001
J019	CONN 6 PIN HEADER MALE .100 CTR	1	2250-5836
J020	CONN 6 PIN HEADER MALE .100 CTR	1	2250-5836
K001	RELAY SPDT 12V DIP	1	1880-0023
K002	RELAY 12VDC 2A AT 28V	1	1880-0022
K003	RELAY 12VDC 2A AT 28V	1	1880-0022
PCB1	MAIN BD MODEL 923	1	1600-3946
Q001	TRANS 2N3643	1	1271-3643
Q002	TRANS 2N3643	1	1271-3643
Q003	TRANS 2N3643	1	1271-3643
Q004	TRANS 2N4275	1	1271-4275
Q005	TRANS 2N4275	1	1271-4275
Q006	TRANS 2N5087	1	1271-5087
Q007	TRANS 2N4275	1	1271-4275
Q008	TRANS PN2222A NPN	1	1271-2223
Q009	TRANS 2N3563	1	1271-3563
Q010	TRANS PN2222A NPN	1	1271-2223
Q011	TRANS PN2222A NPN	1	1271-2223
Q012	TRANS PN2222A NPN	1	1271-2223
Q013	TRANS PN2222A NPN	1	1271-2223
Q014	TRANS PN2222A NPN	1	1271-2223
Q015	TRANS PN2222A NPN	1	1271-2223
Q016	TRANS PN2222A NPN	1	1271-2223
Q017	TRANS PN2222A NPN	1	1271-2223
Q018	TRANS PN2222A NPN	1	1271-2223
R001	RES VAR PC MT 10K 10T	1	1069-1002
R002	RES CAR FILM 1/4W 5% 1K	1	1065-1001
R003	RES CAR FILM 1/4W 5% 2.2K	1	1065-2201
R004	RES CAR FILM 1/4W 5% 2.2K	1	1065-2201
R005	RES CAR FILM 1/4W 5% 2.2K	1	1065-2201
R006	RES CAR FILM 1/4W 5% 1K	1	1065-1001
R007	RES CAR FILM 1/4W 5% 220	1	1065-0220
R008	RES CAR COMP 1/4W 5% 3.3K	1	1065-3301
R009	RES CAR FILM 4.7K 1/4W 5%	1	1065-4701
R010	RES CAR FILM 1/4W 5% 560	1	1065-0560

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
R011	RES CAR COMP 1/4W 5% 1.8K	1	1065-1801
R012	RES CAR FILM 1/4W 5% 150 OHM	1	1065-0150
R013	RES CAR COMP 1/4W 5% 12K	1	1065-1202
R014	RES CAR FILM 1/4W 5% 560	1	1065-0560
R015	RES CAR FILM 1/4W 5% 1K	1	1065-1001
R016	RES CAR FILM 1/4W 5% 1K	1	1065-1001
R017	RES CAR FILM 1/4W 5% 1K	1	1065-1001
R018	RES CAR COMP 1/4W 5% 100K	1	1065-1003
R019	RES CAR FILM 1/4W 5% 1K	1	1065-1001
R020	POT CERMET 10K PC MNT TOP ADJ	1	1072-1111
R021	RES CAR FILM 1/4W 5% 1K	1	1065-1001
R022	RES CAR FILM 1/4W 5% 10 OHM	1	1065-0010
R023	RES CAR FILM 4.7K 1/4W 5%	1	1065-4701
R024	RES CAR FILM 1/4W 5% 10 OHM	1	1065-0010
R025	RES CAR FILM 1/4W 5% 150 OHM	1	1065-0150
R026	RES MT FLM 1/8W 1% 100K	1	1061-1003
R027	RES CAR FILM 1/4W 5% 10K	1	1065-1002
R028	CERMET POT TRIM 2K TOP/BOT ADJ	1	1072-2011
R029	RES CAR FILM 4.7K 1/4W 5%	1	1065-4701
R030	RES MT FLM 1/8W 1% 7.5K	1	1061-7501
R031	RES MT FLM 1/8W 1% 7.5K	1	1061-7501
R032	RES MT FLM 1/8W 1% 47.5K	1	1061-4752
R033	RES CAR FILM 1/4W 5% 470 OHM	1	1065-0470
R034	RES MT FLM 1/8W 1% 3.57K	1	1061-3571
R035	RES MT FLM 1/8W 1% 2.49K	1	1061-2491
R036	RES CAR COMP 1/4W 5% 51	1	1065-0051
R037	RES CAR COMP 1/4W 5% 51	1	1065-0051
R038	RES CAR FILM 1/4W 5% 150 OHM	1	1065-0150
R039	RES CAR FILM 1/4W 5% 150 OHM	1	1065-0150
R040	RES CAR COMP 1/4W 5% 330	1	1065-0330
R041	RES MT FLM 1/8W 1% 1K	1	1061-1001
R042	RES MT FLM 1/8W 1% 1K	1	1061-1001
R043	RES MT FLM 1/8W 1% 1K	1	1061-1001
R044	RES CAR COMP 1/4W 5% 51	1	1065-0051
R045	RES CAR COMP 1/4W 5% 51	1	1065-0051
R046	RES MT FLM 1/8W 1% 1K	1	1061-1001
R047	RES MT FLM 1/8W 1% 1K	1	1061-1001
R048	RES CAR FILM 1/4W 5% 150 OHM	1	1065-0150
R049	RES MT FLM 1/8W 1% 2K	1	1061-2001
R050	RES MT FLM 1/8W 1% 261	1	1061-0261
R051	RES MT FLM 1/8W 1% 261	1	1061-0261
R052	RES MT FLM 1/8W 1% 2K	1	1061-2001
R053	RES MT FLM 1/8W 1% 100K	1	1061-1003

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
R054	RES CAR COMP 1/4W 5% 100K	1	1065-1003
R055	RES CAR FILM 1/4W 5% 2.4K	1	1065-2401
R056	RES CAR FILM 1/4W 5% 2.4K	1	1065-2401
R057	RES CAR COMP 1/4W 5% 20K	1	1065-2002
R058	RES MT FLM 1/8W 1% 2K	1	1061-2001
R059	RES CAR FILM 4.7K 1/4W 5%	1	1065-4701
R060	RES CAR FILM 1/4W 5% 10K	1	1065-1002
R061	CERMET POT TRIMMER 500 TOP/BOT ADJ	1	1072-0511
R062	RES MT FLM 1/8W 1% 2K	1	1061-2001
R063	CERMET POT TRIM 1K TOP/BOT ADJ	1	1072-1005
R064	RES CAR FILM 1/4W 5% 10 OHM	1	1065-0010
R065	RES CAR COMP 1/4W 5% 56	1	1065-0056
R066	RES CAR COMP 1/4W 5% 56	1	1065-0056
R067	RES MT FLM 1/8W 1% 1K	1	1061-1001
R068	RES MT FLM 1/8W 1% 1K	1	1061-1001
R069	RES MF 301 1% 1/8W	1	1061-0301
R070	RES MF 301 1% 1/8W	1	1061-0301
R071	RES CAR FILM 1/4W 5% 220	1	1065-0220
R072	RES CAR COMP 1/4W 5% 330	1	1065-0330
R073	RES CAR FILM 1/4W 5% 470 OHM	1	1065-0470
R074	RES CAR FILM 1/4W 5% 470 OHM	1	1065-0470
R075	RES MT FLM 1/8W 1% 4.64K	1	1061-4641
R076	RES CAR COMP 1/4W 430	1	1065-0430
R077	CERMET POT TRIM 100 TOP/BOT ADJ	1	1072-0101
R078	RES CAR FILM 1/4W 5% 1K	1	1065-1001
R079	RES MT FLM 1/8W 1% 1K	1	1061-1001
R080	RES CAR COMP 1/4W 5% 100	1	1065-0100
R081	RES MT FLM 1/8W 1% 3.16K	1	1061-3161
R082	RES CAR COMP 1/4W 5% 100	1	1065-0100
R083	RES MT FLM 1/8W 1% 10K	1	1061-1002
R084	RES MT FLM 1/8W 1% 100.	1	1061-0100
R085	RES CAR COMP 1/4W 5% 6.8K	1	1065-6801
R086	RES MT FLM 1/8W 1% 1K	1	1061-1001
R087	RES MT FLM 1/8W 1% 3.16K	1	1061-3161
R088	RES MT FLM 1/8W 1% 10K	1	1061-1002
R089	RES CAR COMP 1/4W 5% 5.1K	1	1065-5101
R090	RES CAR COMP 1/4W 5% 100	1	1065-0100
R091	RES CAR COMP 1/4W 5% 20K	1	1065-2002
R092	RES CAR FILM 1/4W 5% 1K	1	1065-1001
R093	RES CAR COMP 1/4W 5% 100	1	1065-0100
R094	RES CAR FILM 1/4W 5% 1K	1	1065-1001
R095	RES CAR FILM 1/4W 5% 10 OHM	1	1065-0010
R096	RES CAR FILM 1/4W 5% 1K	1	1065-1001

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
R097	F.S. PART	1	XX00-0002
R098	RES CAR COMP 1/4W 5% 20K	1	1065-2002
R099	RES CAR COMP 1/4W 5% 4.3K	1	1065-4301
R100	RES CAR COMP 1/4W 5% 1.8K	1	1065-1801
R101	RES CAR COMP 1/4W 5% 100	1	1065-0100
R102	RES CAR COMP 1/4W 5% 5.6K	1	1065-5601
R103	RES CAR COMP 1/4W 5% 100	1	1065-0100
R104	RES CAR COMP 1/4W 5% 5.6K	1	1065-5601
R105	RES CAR FILM 1/4W 5% 10K	1	1065-1002
R106	RES CAR COMP 1/4W 5% 100	1	1065-0100
R107	RES CAR COMP 1/4W 5% 5.1K	1	1065-5101
R108	RES CAR FILM 1/4W 5% 1K	1	1065-1001
R109	RES CAR COMP 1/4W 5% 20K	1	1065-2002
R110	RES CAR COMP 1/4W 5% 100	1	1065-0100
R111	RES CAR FILM 1/4W 5% 1K	1	1065-1001
R112	RES CAR FILM 1/4W 5% 10 OHM	1	1065-0010
R113	CERMET POT TRIP 100K TOP ADJ	1	1072-0103
R114	RES CAR FILM 1/4W 5% 1K	1	1065-1001
R115	RES CAR COMP 1/4W 5% 20K	1	1065-2002
R116	RES CAR COMP 1/4W 5% 100	1	1065-0100
R117	RES CAR COMP 1/4W 5% 100	1	1065-0100
R118	RES CAR COMP 1/4W 5% 5.6K	1	1065-5601
R119	RES CAR COMP 1/4W 5% 5.6K	1	1065-5601
R120	RES CAR FILM 1/4W 5% 10K	1	1065-1002
R121	RES CAR COMP 1/4W 5% 4.3K	1	1065-4301
R122	RES VAR PC MT 10K 10T	1	1069-1002
R123	RES CAR COMP 1/4W 5% 1.8K	1	1065-1801
R124	RES 1W 1.0 OHM 5% METAL OXIDE	1	1068-0071
R125	RES 1W 1.0 OHM 5% METAL OXIDE	1	1068-0071
R126	RES 10 OHM 2 WATT	1	1067-0010
R127	RES CAR FILM 1/4W 5% 10 OHM	1	1065-0010
R128	RES CAR FILM 1/4W 5% 2.7K	1	1065-2701
R129	CERMET POT TRIM 2K TOP/BOT ADJ	1	1072-2011
R130	RES CAR FILM 1/4W 5% 2.2K	1	1065-2201
R131	RES CAR FILM 1/4W 5% 2.7K	1	1065-2701
R132	CERMET POT TRIM 2K TOP/BOT ADJ	1	1072-2011
R133	RES CAR FILM 1/4W 5% 2.2K	1	1065-2201
R134	RES CAR FILM 4.7K 1/4W 5%	1	1065-4701
R135	RES CAR FILM 4.7K 1/4W 5%	1	1065-4701
R136	RES CAR FILM 4.7K 1/4W 5%	1	1065-4701
R137	RES CAR COMP 1/4W 5% 270	1	1065-0270
R138	RES CAR COMP 1/4W 5% 270	1	1065-0270
R139	RES CAR COMP 1/4W 5% 270	1	1065-0270

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
R140	CERMET POT TRIM 2K TOP/BOT ADJ	1	1072-2011
R141	RES CAR COMP 1/4W 5% 1.5K	1	1065-1501
R142	RES CAR FILM 1/4W 5% 2.2K	1	1065-2201
R143	RES CAR FILM 1/4W 5% 10 OHM	1	1065-0010
R144	RES MT FLM 1/8W 1% 1K	1	1061-1001
R145	RES VAR PC MT VERT 1K 10T	1	1072-1000
R146	RES CAR COMP 1/4W 5% 5.1K	1	1065-5101
R147	RES CAR FILM 1/4W 5% 10 OHM	1	1065-0010
R148	RES CAR COMP 1/4W 5% 5.6K	1	1065-5601
R149	RES CAR FILM 1/4W 5% 2.2K	1	1065-2201
R150	RES MT FLM 1/8W 1% 1K	1	1061-1001
R151	RES VAR PC MT VERT 1K 10T	1	1072-1000
R152	RES CAR COMP 1/4W 5% 5.1K	1	1065-5101
R153	RES CAR COMP 1/4W 5% 5.6K	1	1065-5601
R154	RES CAR FILM 1/4W 5% 2.2K	1	1065-2201
R155	RES CAR FILM 1/4W 5% 10 OHM	1	1065-0010
R156	(SUB 1061-1801)RES 1.82K MT FLM	1	1061-1821
R157	RES CAR FILM 1/4W 5% 10 OHM	1	1065-0010
R158	RES CAR FILM 4.7K 1/4W 5%	1	1065-4701
R159	RES CAR FILM 4.7K 1/4W 5%	1	1065-4701
R160	RES CAR FILM 4.7K 1/4W 5%	1	1065-4701
R161	RES CAR COMP 1/4W 5% 270	1	1065-0270
R162	RES CAR COMP 1/4W 5% 270	1	1065-0270
R163	RES CAR COMP 1/4W 5% 270	1	1065-0270
R164	RES CAR COMP 1/4W 5% 180	1	1065-0180
R165	RES CAR COMP 1/4W 5% 180	1	1065-0180
R166	RES CAR COMP 1/4W 5% 180	1	1065-0180
R167	RES CAR FILM 1/4W 5% 510 OHM	1	1065-0510
R168	RES CAR FILM 1/4W 5% 1K	1	1065-1001
R169	RES CAR FILM 1/4W 5% 1K	1	1065-1001
R170	RES VAR PC MT VERT 1K 10T	1	1072-1000
R171	RES CAR COMP 1/4W 5% 3.3K	1	1065-3301
R172	RES CAR COMP 1/4W 5% 3.3K	1	1065-3301
R173	RES CAR FILM 4.7K 1/4W 5%	1	1065-4701
R174	RES CAR COMP 1/4W 5% 18K	1	1065-1802
R175	RES CAR COMP 1/4W 5% 51	1	1065-0051
RN01	RES NETWORK 10K 10PIN SIP COM 5%	1	1073-1199
SW01	9 STA PB 12.5 1-3AND4-9 INTERLK	1	1850-0109
SW02	SWITCH 8 PIN DIP	1	1800-2066
T001	XMFR 1DB BW (.5-50MHZ 1:2 T2-1T)	1	1500-8121
T002	XMFR 1DB BW (.1-20MHZ) 1:16	1	1500-8116
TP01	1/8DX.35L BLK TEST TERMINAL	1	2140-0150
TP02	1/8DX.35L BRN TEST TERMINAL	1	2140-0151

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
TP03	1/8DX.35L RED TEST TERMINAL	1	2140-0152
TP04	1/8DX.35L ORN TEST TERMINAL	1	2140-0153
TP05	1/8DX.35L YEL TEST TERMINAL	1	2140-0154
U001	I/C SN74LS00N	1	1101-7400
U002	I/C SN7430N	1	1100-7430
U003	I/C DM74LS76N	1	1101-7476
U004	IC 74LS93 771	1	1101-7493
U005	IC 74LS93 771	1	1101-7493
U006	I/C LF353N DUAL J FET OP AMP	1	1100-0353
U007	I/C LF353N DUAL J FET OP AMP	1	1100-0353
U008	I/C LF356N	1	1100-0356
U009	I/C LF356N	1	1100-0356
U010	I/C LF353N DUAL J FET OP AMP	1	1100-0353
U011	I/C LF353N DUAL J FET OP AMP	1	1100-0353
U012	I/C LF351N	1	1100-0351
U013	I/C LF353N DUAL J FET OP AMP	1	1100-0353
U014	I/C LF353N DUAL J FET OP AMP	1	1100-0353
U015	I/C LF356N	1	1100-0356
U016	I/C LF356N	1	1100-0356
U017	OPTIC ISOLATOR	1	1099-0001
U018	I/C LF356N	1	1100-0356
U019	I/C LF356N	1	1100-0356
U020	DIODE BRIDGE 1 AMP 50V	1	1284-0004
U021	I/C LM340T-05	1	1100-7805
U022	I/C LM340T-12	1	1100-0340
U023	I/C MC7912	1	1100-7912
U025	I/C LM339 VOLTAGE COMPARATOR	1	1100-0339
U026	I/C SN74LS00N	1	1101-7400
U027	I/C LF353N DUAL J FET OP AMP	1	1100-0353
U028	I/C LM339 VOLTAGE COMPARATOR	1	1100-0339
U029	I/C LM741CN	1	1100-0741
U030	I/C 74LS157 QD 2/1 LINE MUX	1	1101-0157
U031	8748H 8BIT MICROPROC CHIP 40PIN	1	1102-8748
U032	I/C MM74LS164N	1	1101-0164
U033	I/C MC1408 D/A CONVERTER	1	1100-1408
U24	PARTS NOT USED	1	X000-0001
XU01	SOCKET I/C 14PIN	1	2250-1014
XU02	SOCKET I/C 14PIN	1	2250-1014
XU03	SOCKET, I/C 16 PIN	1	2250-1016
XU04	SOCKET I/C 14PIN	1	2250-1014
XU05	SOCKET I/C 14PIN	1	2250-1014
XU06	SOCKET, I/C 8 PIN	1	2250-1008
XU07	SOCKET, I/C 8 PIN	1	2250-1008

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
XU08	SOCKET, I/C 8 PIN	1	2250-1008
XU09	SOCKET, I/C 8 PIN	1	2250-1008
XU10	SOCKET, I/C 8 PIN	1	2250-1008
XU11	SOCKET, I/C 8 PIN	1	2250-1008
XU12	SOCKET, I/C 8 PIN	1	2250-1008
XU13	SOCKET, I/C 8 PIN	1	2250-1008
XU14	SOCKET, I/C 8 PIN	1	2250-1008
XU15	SOCKET, I/C 8 PIN	1	2250-1008
XU16	SOCKET, I/C 8 PIN	1	2250-1008
XU18	SOCKET, I/C 8 PIN	1	2250-1008
XU19	SOCKET, I/C 8 PIN	1	2250-1008
XU25	SOCKET I/C 14PIN	1	2250-1014
XU26	SOCKET I/C 14PIN	1	2250-1014
XU27	SOCKET, I/C 8 PIN	1	2250-1008
XU28	SOCKET I/C 14PIN	1	2250-1014
XU29	SOCKET, I/C 8 PIN	1	2250-1008
XU30	SOCKET, I/C 16 PIN	1	2250-1016
XU31	SOCKET I/C 40PN	1	2250-1040
XU32	SOCKET I/C 14PIN	1	2250-1014
XU33	SOCKET, I/C 16 PIN	1	2250-1016

APPENDIX - A

**TFT MODEL 923
RF PRESELECTOR OPTION
OPERATION AND MAINTENANCE INSTRUCTIONS**

**TFT, INC.
3090 OAKMEAD VILLAGE DRIVE
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Section A1

GENERAL INFORMATION

A1.1 EQUIPMENT DESCRIPTION

The TFT Model 923 RF Preselector is a circuit board intended for installation in the TFT Model 923 AM Modulation Monitor to enable off-the-air measurement of the modulation percentage of a selected transmitter carrier in the frequency range of 500 kHz to 1.99 MHz. The RF Preselector is configured as a double-conversion superheterodyne receiver front-end with a 455 kHz IF output. Tuning is done by entering the desired receive frequency into a 4-digit push-wheel switch. Frequency resolution is 1 kHz. Figure A1.1-1 is a block diagram of the RF Preselector.

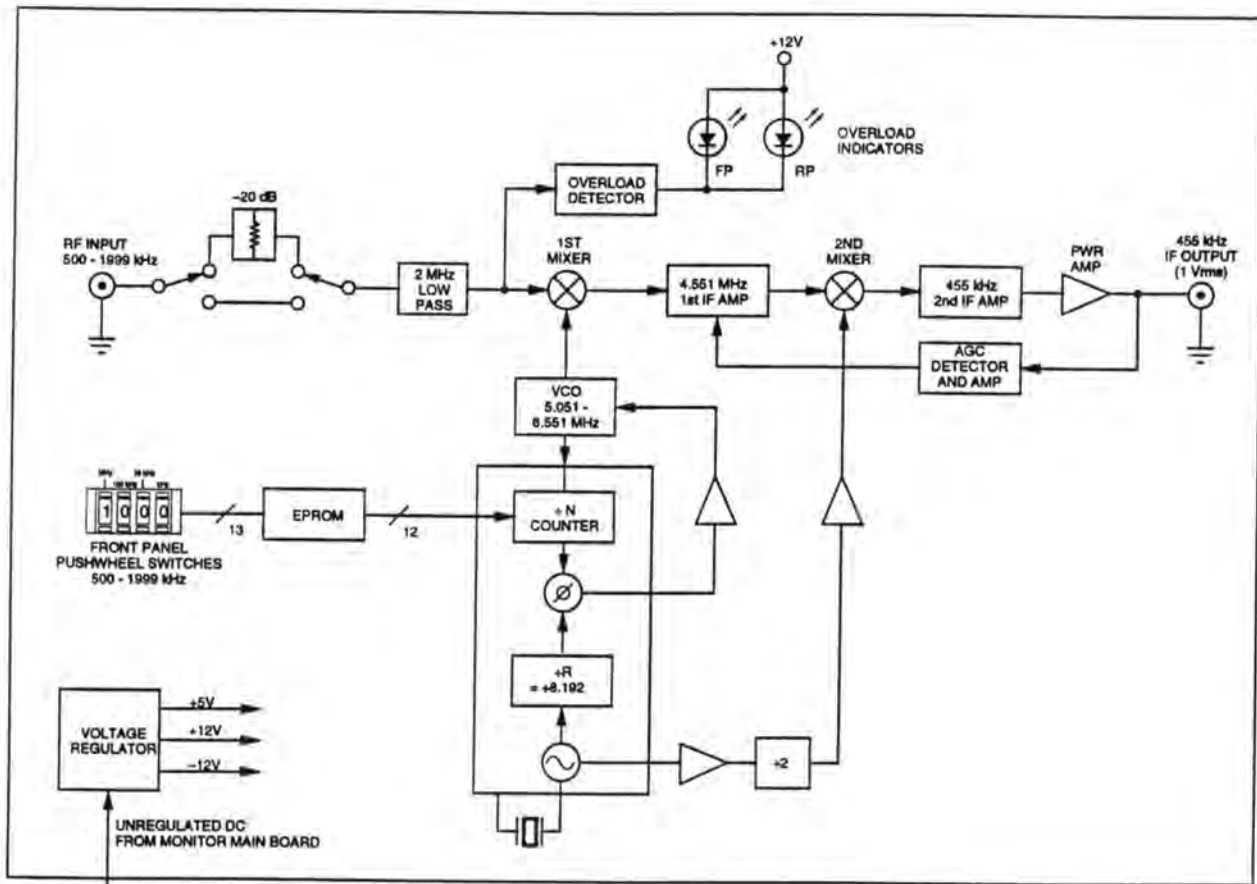


Figure A1.1-1. RF Preselector - Block Diagram

A1.2 SPECIFICATIONS

Frequency Range	500 kHz to 1.99 MHz
RF Sensitivity	100 μ V for 40 dB SNR; 1 mV for 55 dB SNR below 100% modulation
Input Impedance	50 ohms (nominal)
Tuning	4-digit pushwheel switch; 1 kHz resolution.
IF Bandwidth	\pm 40 kHz, 40 dB.
Image Rejection Ratio	> 60 dB
AGC Range	54 dB (100 μ V to 50 mV)
Output	455 kHz, 1Vrms into 50 ohms
Power Requirement	115/230 VAC 50/60 Hz, 15 watts max.
Operating Temperature	0°C to 50°C

A1.3 WARRANTY

TFT 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 non-conforming 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 (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.

A1.4 CLAIMS 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

**TFT, Inc.
3090 Oakmead Village Drive
Santa Clara, CA 95051**

Section A2

INSTALLATION

A2.1 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 A3 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.

A2.2 Power Requirements.

The RF Preselector derives its power from a 115/230 VAC source, 50 to 60 Hz, and requires 15 volt-amperes.

A2.3 Installation and Connections.

When the Model 923 RF preselector option is ordered with the Model 923 Monitor, the Preselector is factory installed in the same chassis as the Monitor. Only two connections are required:

- a. Connect the 455 kHz OUTPUT connector at the rear of the RF Preselector to the HIGH LEVEL RF INPUT connector at the rear of the Monitor with the short coax cable provided.
- b. Connect a rooftop antenna to the ANT INPUT connector at the rear of the RF Preselector. Where a strong signal can be expected (greater than 4 mV/meter), a Resonant Loop Antenna can be used, (see Fig. 2-1). In low signal locations, a long wire (approximately 200 feet) can be used with good results. When the Resonant Loop Antenna is used, connect the antenna to the Preselector with a 50-ohm coaxial cable. When a long wire is used, connect it directly to the ANT INPUT connector of the RF Preselector; a 51-ohm resistor should also be connected from the input to chassis ground.

When the Preselector is located in a very strong RF field, it is recommended that a notch filter be constructed and installed between the antenna and the ANT input of the Preselector. The circuit of Figure 2-2 provides a 20-dB notch at the frequency determined by L and C, with 6 dB attenuation at the other frequencies.

1

2

3

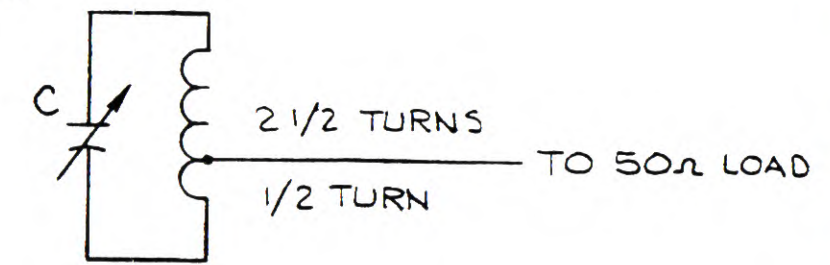
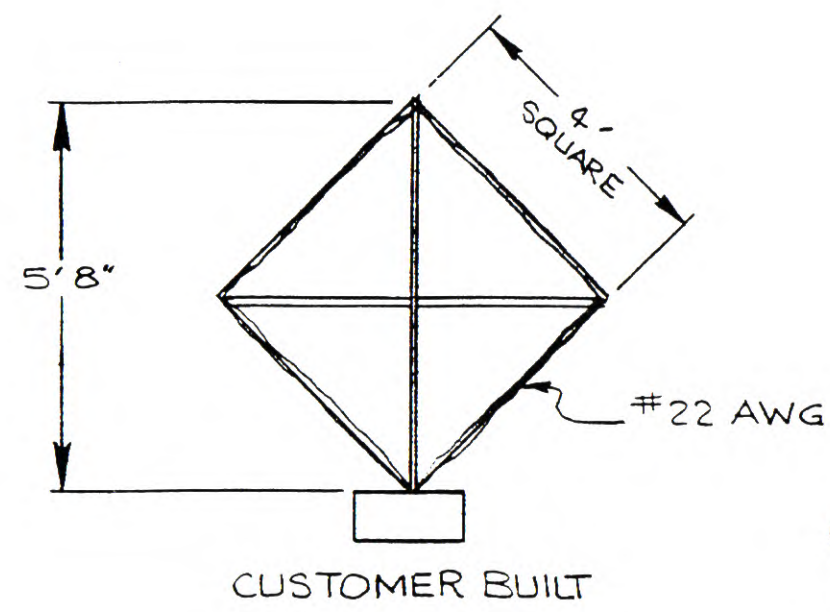
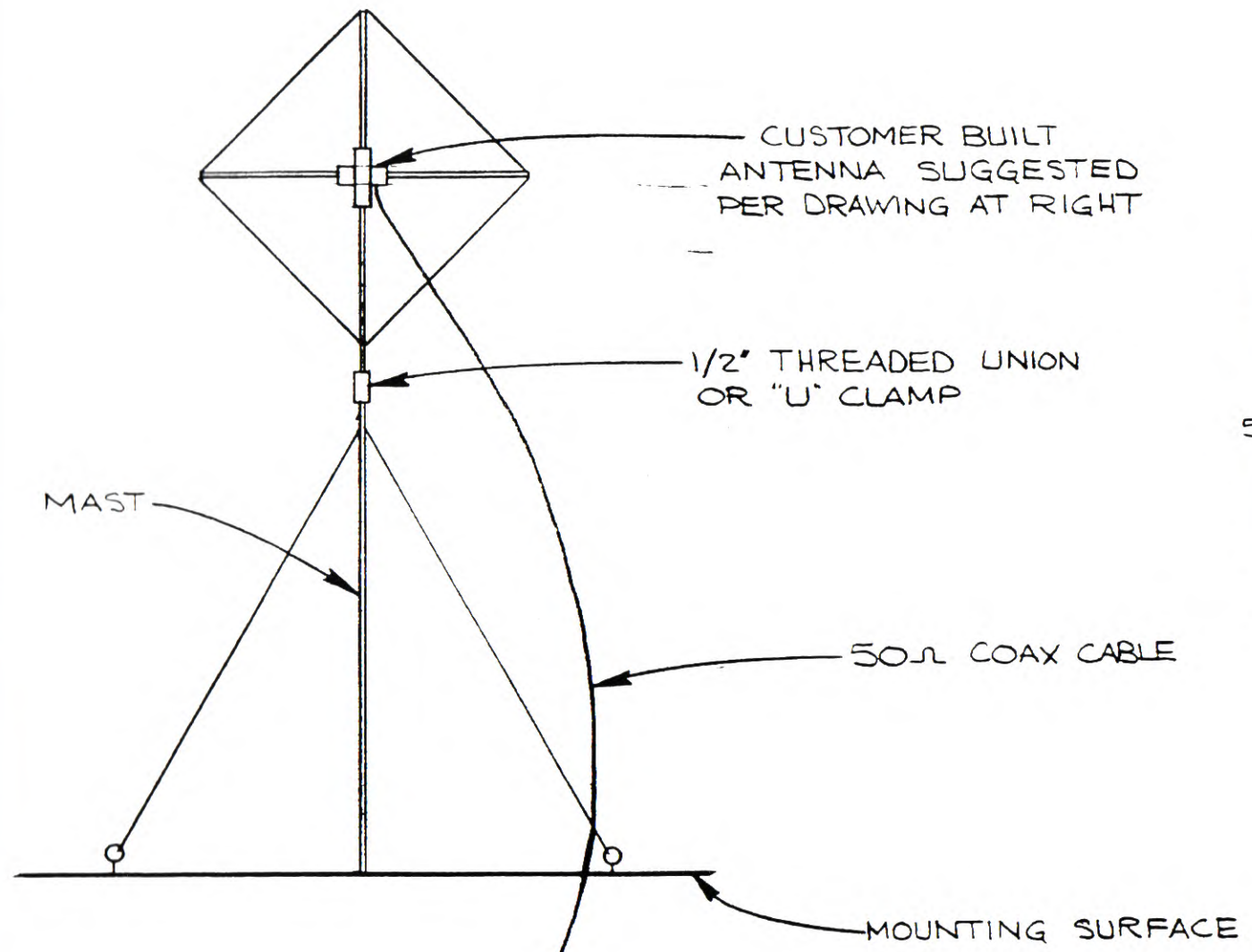
DWG. NO.

4

5

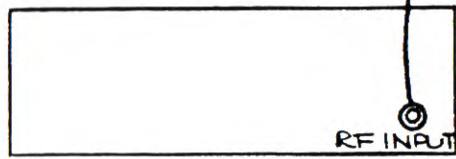
NEXT ASSY		USED ON		REVISIONS					
			754	SYM	DESCRIPTION	DR	CHK	AUTH	DATE
				C					8/17/77

A



TUNE C SO THAT ANTENNA RESONATES AT DESIRED FREQ.
 1600 KHZ C ≈ 30 pF
 540 KHZ C ≈ 600 pF

FIG.A2-1



MODEL 754/755 REAR PANEL

QTY PER ASSY	ITEM NO.	EN NO.	PART NO.	DESCRIPTION	REF. DES.
REMOVE ALL BURRS AND SHARP EDGES					
			DRAWN BY	DATE	TFT TIME & FREQUENCY TECHNOLOGY INC. 3000 Olcott St., Santa Clara, California 95050 (408) 246-6365
			CHK. BY		
			PROJ. ENG.		
			MFG. ENG.		
			APPD.		TITLE
			APPD.		SUGGESTED ANTENNA SET-UP 754/755
			ECO NO.		SIZE
					DRAWING NO.
					REV.
					B 6600-0007 C
					SCALE
					N/A
					SHT. OF
					1 OF 1

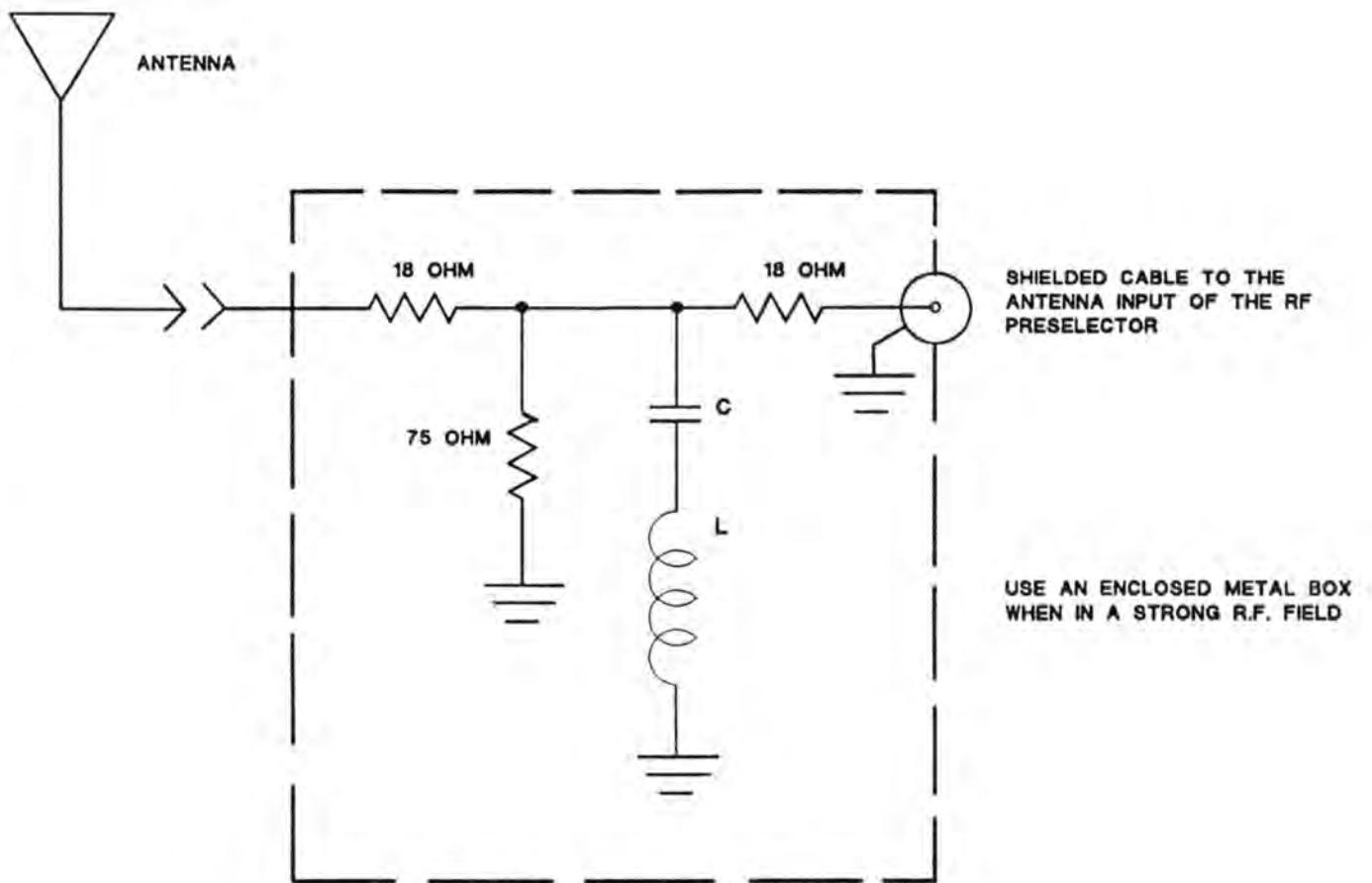
1

2

3

4

5



L = 40 - 50 uHy
 $Q \geq 50$
 MILLER 4629 OR EQUIVALENT

$$C = \frac{1}{(2\pi F)^2 L}$$

F = FREQUENCY OF SIGNAL TO BE REJECTED.

FIG. A2-2
 R.F. NOTCH FILTER

A2.4 Field Installation of RF Preselector Board

- a. Remove top cover from the instrument
- b. Remove front panel.
- c. Install the RF Preselector Board (Figure 6-1, Item 3) onto standoffs, using eight No. 6, 3/8-inch screws.
- d. Connect the coaxial cable from rear-panel 455 kHz OUTPUT connector to the HIGH LEVEL RF INPUT connector on the Main Board.
- e. Install the front panel. Make sure that the overload LED (CR3) protrudes through the OVERLOAD hole in the rear panel.
- f. Install the 4-digit pushwheel switch assembly to the front panel using four No 4 nuts.
- g. Install the enclosed LED cable assembly (Figure 6-1, Item 17) to the front panel. Plug the cable into J4 on the RF Preselector board.
- h. Plug the 4-pin connector on the cable assembly (Figure 6-1, Item 16) into J14 on the main board and J2 on the Preselector board.
- i. Reinstall the top cover onto the instrument.
- j. Refer to Section A2.3 for external connections.

Section A3 OPERATION

A3.1 General Information

The RF Preselector enables off-the-air operation of the Model 923 AM Modulation Monitor. After installation of the RF Preselector, the only change in operation of the Modulation Monitor is the entry of the desired monitor frequency via a front panel 4-digit pushwheel (Figure A3.3-1, Item 9).

A3.2 Turn-on and Warm-up

The RF Preselector has no on-off switch. It derives its operating power (3 levels of unregulated DC) from the Model 923 AM Modulation Monitor power supply and so is ON whenever the Model 923 AM Modulation Monitor is plugged into an appropriate power source. The RF Preselector requires only a 1-minute warm-up before it is ready for use.

A3.3 Controls, Indicators and Connectors

Model 923 AM Modulation Monitor Front and rear panel controls, indicators and connectors are shown in Figures A3.3-1 and A3.3-2. The functions of these items are listed in Tables A3.3-1 and A3.3-2.

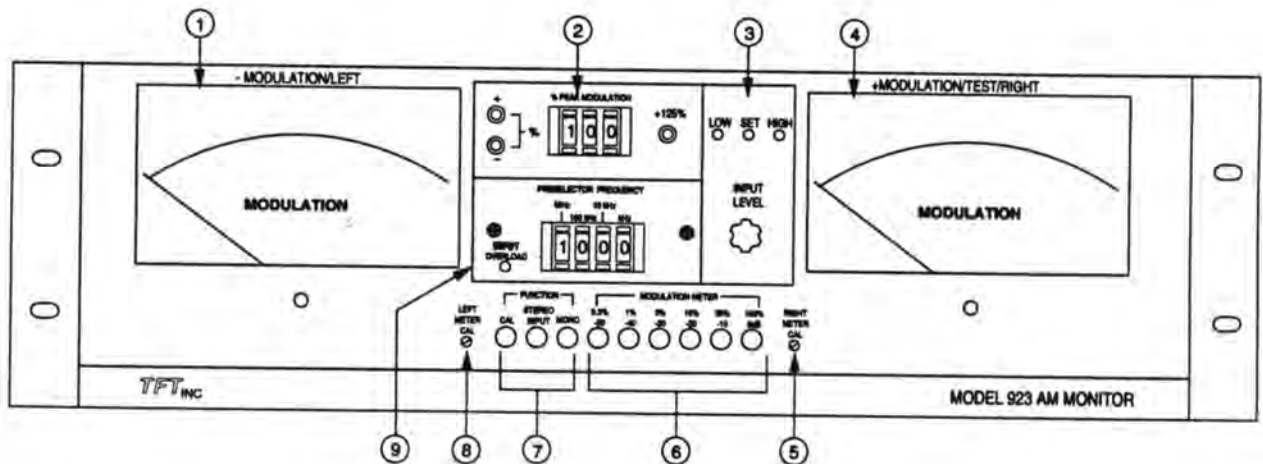


Figure A3.3-1. AM Monitor Front Panel Controls and Indicators

Table A3.3-1. AM Monitor Front Panel Controls and Indicators

ITEM	NAME	FUNCTION														
1	-MODULATION/LEFT	Analog meter. Indicates negative modulation percentage of carrier being monitored as described in Section 3.4.														
2	% PEAK MODULATION	<p>3-digit pushwheel switch and 3 LEDs. Used to indicate that a modulation peak has exceeded a reference level selected via the MODULATION METER switches (Item 6).</p> <p>The LEDs can respond to fast transients and peaks that the MODULATION meters cannot.</p> <p>The pushwheel switches should be set to the desired modulation reference modulation percentage. The \pm % LED pair will then flash when modulation peaks exceed the selected reference.</p> <p>The + 125% LED will flash when modulation exceeds 125% regardless of the setting of the pushwheel switches.</p>														
3	INPUT LEVEL	Three LED indicators and one potentiometer control. Used to adjust the carrier input level from the transmitter as described in Section 2.3. The indicator can also be used to observe changes in carrier power during modulation. SET LED lights when input signal level is correct. LOW LED lights when input level is too low. HIGH LED lights when input level is too high.														
4	+ MODULATION/TEST/ RIGHT	<p>Analog meter. Indicates positive modulation percentage of carrier being monitored as described in Section 3.4. The scale to be read depends on which MODULATION METER attenuation switch (Item 6) is depressed, as follows:</p> <table border="0" data-bbox="715 1383 1473 1659"> <thead> <tr> <th data-bbox="715 1383 1085 1457">Modulation Meter Switch</th> <th data-bbox="1085 1383 1473 1457">Applicable Meter Scale</th> </tr> </thead> <tbody> <tr> <td data-bbox="715 1457 1085 1489">100% (0 dB)</td> <td data-bbox="1085 1457 1473 1489">Top scale</td> </tr> <tr> <td data-bbox="715 1489 1085 1521">30% (-10)</td> <td data-bbox="1085 1489 1473 1521">Middle scale</td> </tr> <tr> <td data-bbox="715 1521 1085 1553">10% (-20)</td> <td data-bbox="1085 1521 1473 1553">Top scale + 10</td> </tr> <tr> <td data-bbox="715 1553 1085 1585">3% (-30)</td> <td data-bbox="1085 1553 1473 1585">Middle scale + 10</td> </tr> <tr> <td data-bbox="715 1585 1085 1617">1% (-40)</td> <td data-bbox="1085 1585 1473 1617">Top scale + 100</td> </tr> <tr> <td data-bbox="715 1617 1085 1649">0.3% (-50)</td> <td data-bbox="1085 1617 1473 1649">Middle scale + 100</td> </tr> </tbody> </table> <p>The + MODULATION meter is also use to indicate residual noise, as described in Sec.3.6. Residual noise in dB referenced to 100% modulation is the sum of the reading on the lower meter scale and the dB label on the depressed MODULATION METER switch.</p>	Modulation Meter Switch	Applicable Meter Scale	100% (0 dB)	Top scale	30% (-10)	Middle scale	10% (-20)	Top scale + 10	3% (-30)	Middle scale + 10	1% (-40)	Top scale + 100	0.3% (-50)	Middle scale + 100
Modulation Meter Switch	Applicable Meter Scale															
100% (0 dB)	Top scale															
30% (-10)	Middle scale															
10% (-20)	Top scale + 10															
3% (-30)	Middle scale + 10															
1% (-40)	Top scale + 100															
0.3% (-50)	Middle scale + 100															

Table A3.3-1. AM Monitor Front Panel Controls and Indicators (Continued)

ITEM	NAME	FUNCTION
5	RIGHT METER CAL	Screwdriver-adjust potentiometer. Used for calibrating + MODULATION meter as described in Section 3.4.
6	MODULATION METER	Set of six interlocked pushbutton switches. Each switch selects an attenuator to set the scale of the + MODULATION/TEST/RIGHT meter (Item 4)
7	FUNCTION	
8	LEFT METER CAL	Two interlocked pushbutton switches (MONO and STEREO INPUT) and one alternate-action pushbutton switch (CAL) used as follows: MONO Used for monitoring AM Monaural broadcast programs only. STEREO INPUT Reserved for future use. CAL On-off control of modulation calibrator. Use of the calibrator is explained in Section 3.5.
9	PRESELECTOR FREQUENCY	Screwdriver-adjust potentiometer. Used for calibrating -MODULATION meter as described in Section 3.4.
		4-digit pushwheel switch and LED. Pushwheel switch is for entering desired monitor frequency. PEAK OVERLOAD LED lights when RF input is too high for proper operation. RF input level can be reduced by 20 dB by changing position of HI/LOW SELECTOR switch on rear panel from LOW to HI.

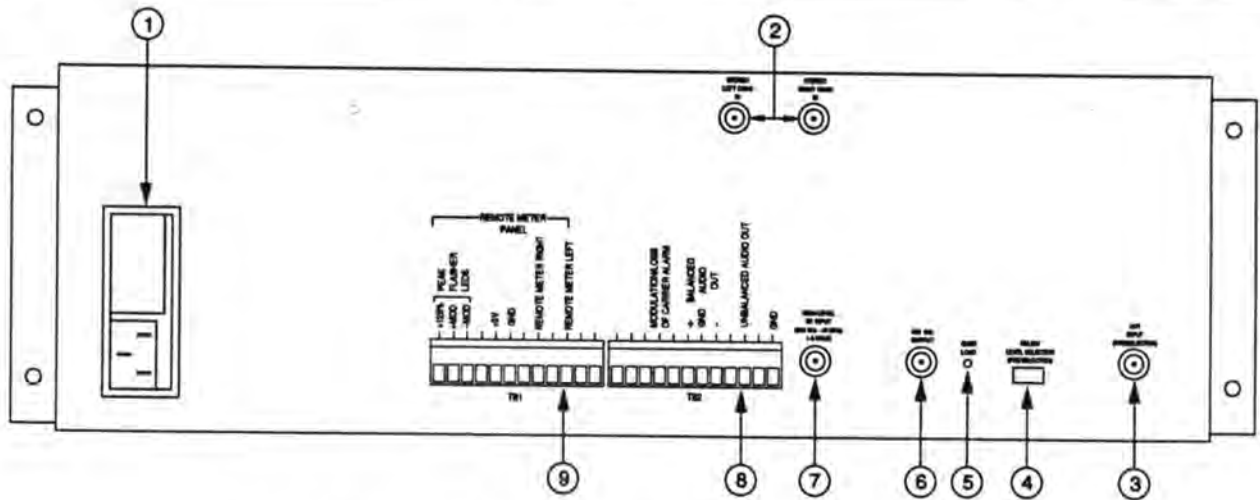


Figure A3.3-2. AM Monitor Rear Panel Controls and Connectors

Table A3.3-2. AM Monitor Rear Panel Controls and Connectors

ITEM	NAME	FUNCTION
1	(none)	Houses the power fuse, power line noise filters and input voltage selector for 115 or 230VAC.
2	STEREO LEFT CHAN IN RIGHT CHAN IN	TWO BNC input connectors reserved for future use.
3	ANT INPUT (PRESELECTOR)	BNC Connector. Used to connect an antenna to the RF Preselector when this option is installed.
4	HI/LOW LEVEL SELECTOR (PRESELECTOR)	2-position slide switch. Effective only with RF Preselector is installed. In the HI position, a 20 dB attenuator is inserted in the input line. LOW position is for RF input levels of 0.1 to 10 mVrms. HI position is for RF input levels of 10 to 50 mVrms.
5	OVERLOAD	LED. Effective only when RF Preselector is installed. Lights when RF input is too high for proper operation. The RF input level can be reduced by 20 dB by changing position of the HI/LOW Selector (Item 4) to HIGH.
6	455 kHz OUTPUT	BNC connector. Used to connect RF Preselector output to Model 923 RF input.
7	HI-LEVEL RF INPUT 500 kHz - 40 MHz 1-5 VRMS	BNC Connector: Provides a means for introducing transmitter carrier through a 50-ohm cable. Maximum voltage is 5 Vrms.
8	TB2	12-pin connector. Carries the following outputs: Loss of Carrier Alarm. When RF input drops below a preset level, this pair of terminals provides contact closure that can handle up to 2 amperes at up to 28 VDC. Modulation Alarm. When the modulation on the monitored carrier drops below 10% for a preset time period, this pair of terminals provides contact closure that can handle up to 2 amperes at up to 28 VDC. Balanced Audio Output. These terminals provide 2.2 Vp-p modified 75 μ sec AM Standard de-emphasized, balanced audio output across a 600-ohm load. Unbalanced Audio Output. This pair of terminals provides 14 Vp-p, modified 75 μ sec AM Standard de-emphasized unbalanced audio output across a 5 k-ohm load.
9	TB1	12-pin connector. Provides flashers and metering data for future Remote Meter Panel

A3.4 RF Preselector Operation

- a. Set the 4-digit pushwheel switch to the frequency of the carrier to be monitored.
- b. For 0.1 to 10 mVrms RF input level, set the HIGH/LOW SELECTOR to the LOW position. For 10 to 50 mVrms RF input level, set the HIGH/LOW SELECTOR to HIGH.

A3.5 Use of RF Preselector with Model 923 AM Monitor

When the RF Preselector is operated as described in Section A3.4, the SET LED should be ON. If it is not, adjust the INPUT LEVEL control on the front panel of the 923 AM Monitor. When changing stations on the RF Preselector, the equipment may require 5 to 10 seconds to return to the set mark on the Model 923 INPUT LEVEL indicators.

The calibration procedure for the Model 923 AM Monitor is not affected by the setting of any of the RF Preselector controls.

For information on the operation of the Model 923 AM Monitor, refer to this instruction manual, Section III.

SECTION A4

THEORY OF OPERATION

A4.1 Block Diagram Discussion (Figure 6-1).

The RF Preselector is a double-conversion superheterodyne receiver. The incoming RF signal is first passed through a 50-ohm, 20dB attenuator to reduce very strong signals that would overload the first mixer. It is then passed through a 2 MHz lowpass filter and upconverted to 4.551-MHz, thus eliminating the need for a tuned RF stage to reject images. The 4.551 MHz IF is then downconverted to the standard 455-kHz IF, where most of the band shaping is done, then amplified and fed to the output connector. An AGC circuit controls the gain of the first IF amplifier to maintain an output level of 1 volt rms at the rear-panel.

The local-oscillator input for both mixers is derived from an 8.192-MHz crystal oscillator. Its output is divided by 2 to obtain a 4.192 MHz signal as the LO input to the 2nd mixer.

The 8.192-MHz output is also divided by 8192 to obtain a 1-kHz signal which is used to phase-lock a synthesized LO in 1 kHz steps between 5.051 MHz and 6.551 MHz. The synthesizer consists of a divide-by-N phase-locked loop which locks the frequency of a voltage-controlled oscillator with the same accuracy as the 8.192MHz crystal oscillator. The 4-digit pushwheel switch on the front panel permits setting the oscillator frequency 4.551 MHz above the desired RF, for use as the LO input to the first mixer.

An overload detector at the input to the first mixer lights the PEAK OVERLOAD LED whenever the incoming signal exceeds 10 mV. By reducing the input signal level at the first mixer to less than 10 mV with the 20 dB attenuator, intermodulation distortion caused by other AM stations is held to a minimum.

A4.2 Lowpass Filter and Overload Detector (Figure 6-3).

The input 2-MHz lowpass filter, consisting of L1, L2 and associated capacitors, provides more than 60 dB image rejection. With the upconversion scheme used, all incoming signals capable of producing image interference are above 9 MHz, and so are rejected.

The output of overload detector CRI is compared in operational amplifier U1 with a fixed voltage which is factory adjusted so that any input signal greater than 10 mV drives the op amp output low to turn on OVERLOAD LEDs CR2 and CR3.

4.3 Time Base and Local Oscillator (Figure 6-3).

The RF Preselector time base consists of a 8.192-MHz crystal oscillator. The local oscillator for first mixer Z1 is a voltage controlled oscillator (VCO) (Q1) in a phase-locked loop. The VCO frequency is buffered by Q2 and Q4, and divided down to 1 kHz in a programmable divide-by-N circuit within U6. The resultant 1 kHz signal is compared in the phase detector within U6 with the 1-kHz reference obtained from the time base, as described in the preceding paragraph. The phase detector then produces $\emptyset R$ & $\emptyset V$ outputs at pins 8 and pin 9 respectively. They are filtered, combined and amplified by a loop amplifier U7 and its associated components to produce a loop-error signal which is a DC voltage. This DC voltage is applied to varactor diodes CR9 and CR10 to tune the VCO in a direction to reduce the phase difference to zero. The VCO output at the collector of buffer Q2 is fed to the local-oscillator input (pin 8) of mixer Z21 through emitter follower Q3.

The value of N for the divide-by-N circuit is selected to provide a 1-kHz input to the phase detector when the VCO frequency is 4.551 MHz above the frequency dialed in on the 4-digit pushwheel switch.

A4.4 First Mixer and 4.551-MHz IF Amplifier (Figure 6-3)

The 1st mixer Z1 is a doubly balanced ring modulator for good intermodulation distortion. The incoming RF signal is applied to pin 1, and the LO is applied at pin 8. The difference product of the LO and RF is 4.551 MHz and is amplified by the 4.551 MHz IF chain consisting of two dual-gate MOSFETs Q5 and A6. Dual-gate MOSFETs are used for low noise and wide dynamic range (i.e. low intermodulation distortion). Tank circuits consisting of L4, L5 and L6 are sync. tuned to 4.551 MHz

A4.5 Second Mixer, 455-kHz IF Amplifier, and AGC (Figure 6-3).

The second mixer, U2, is an active mixer. The 4.551-MHz first IF is applied to pin 1. The 455-kHz output appears at both pin 12 and pin 6. From pin 6, it goes through a wide-band IF filter-amplifier. The filtered and amplified output is amplified by Q8, Q9, and Q10 to furnish the RF Preselector output of 1 volt rms at J3.

The output of amplifier Q8/Q9 is also fed back to AGC detector CR6. Its DC output controls the gain of 1st IF amplifier Q5 and Q6 to maintain a constant RF Preselector output. The AGC voltage is adjusted by R54 for an RF Preselector output level of 1 volt RMS.

The 455-kHz IF Filter-Amplifier contains a 455-kHz multi-element ladder wide-band filter (FL1), and a two-stage amplifier (U3-1 and U3-7).

A4.6 Power Supply

The RF Preselector does not have its own power supply. The +5V, +12V and -12V are derived from corresponding unregulated DC outputs from the power supply on the AM Monitor Main Board by a cable assembly and regulated by U9, U11, and U14, respectively.

SECTION A5 MAINTENANCE

A5.1 General

Since the RF Preselector is a solid-state instrument and its power requirement is low, no maintenance problems due to high temperature should be encountered, provided the instrument is installed far 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 A5.2 and A5.3. Receiver performance checks are covered in Section A5.4.

Refer to the Model 923 AM Monitor instruction manual for maintenance procedures pertaining to the AM Modulation Monitor.

A5.2 Access

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

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

- a. Remove the four screws holding the front panel to the chassis.
- b. Remove the eight screws that hold the PC board to the standoffs mounted on the chassis. See Figure 6-1 for location of screws.
- c. Remove the four No. 4 nuts that hold the 4-digit pushwheel switch assembly to the front panel. Then separate this switch assembly from the front panel.
- d. Remove the front panel.
- e. Unplug two cables attached to the PC board.
- f. Pull out the PC board.

A5.3 Periodic Maintenance

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.

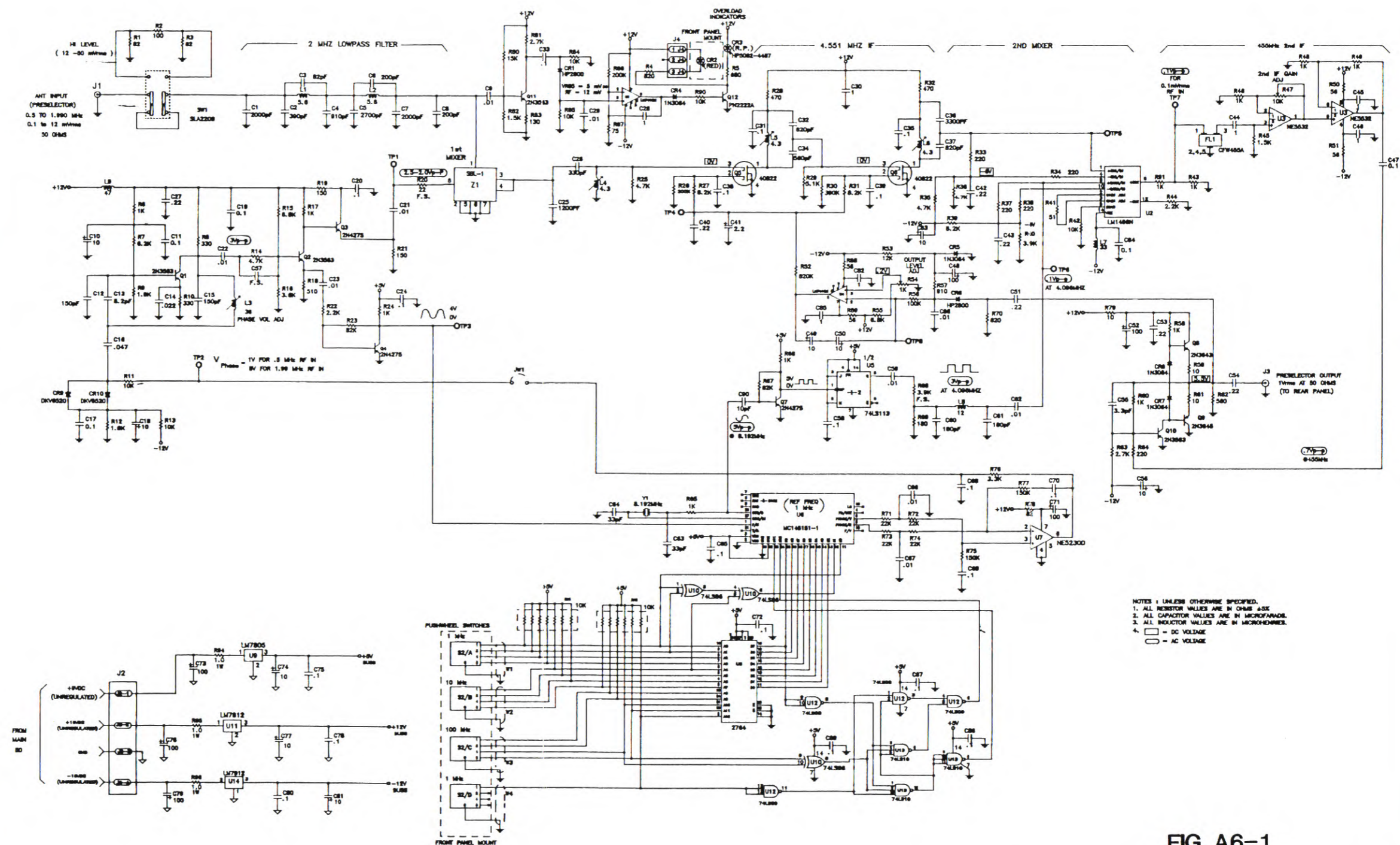
A5.4 Receiver Performance Checks.

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

- a. Connect the output of an appropriate signal generator to the rear panel ANT INPUT connector, and set the signal generator and tune the RF Preselector and the Signal Generator to the same frequency in the band from 500 to 1900 kHz.
- b. Set the RF LEVEL HIGH/LOW SELECTOR on the RF Preselector rear to the LOW position (minimum attenuation).
- c. Adjust the signal generator output to a minimum, and then increase the output until the carrier level indicators on the 923 AM Monitor come up to the SET mark. The signal generator output for this condition should be 100 microvolts or less. (Make sure the R.F. attenuator on the 923 AM Monitor is at or near its minimum attenuation position).
- d. With no modulation on the signal from the signal generator, and the output level set for 100 microvolts, the residual noise measured by the Model 923 AM Monitor should be less than 40 dB. (Refer to the Model 923 instruction manual section 3.6 for the method of measuring residual noise.)
- e. Increase the signal generator output to 1 millivolt. The residual noise should drop to less than 55 dB.

If the Receiver circuits pass this test, the RF Preselector is operating satisfactorily.

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED
	A	RELEASE TO PRODUCTION	4/28/93	



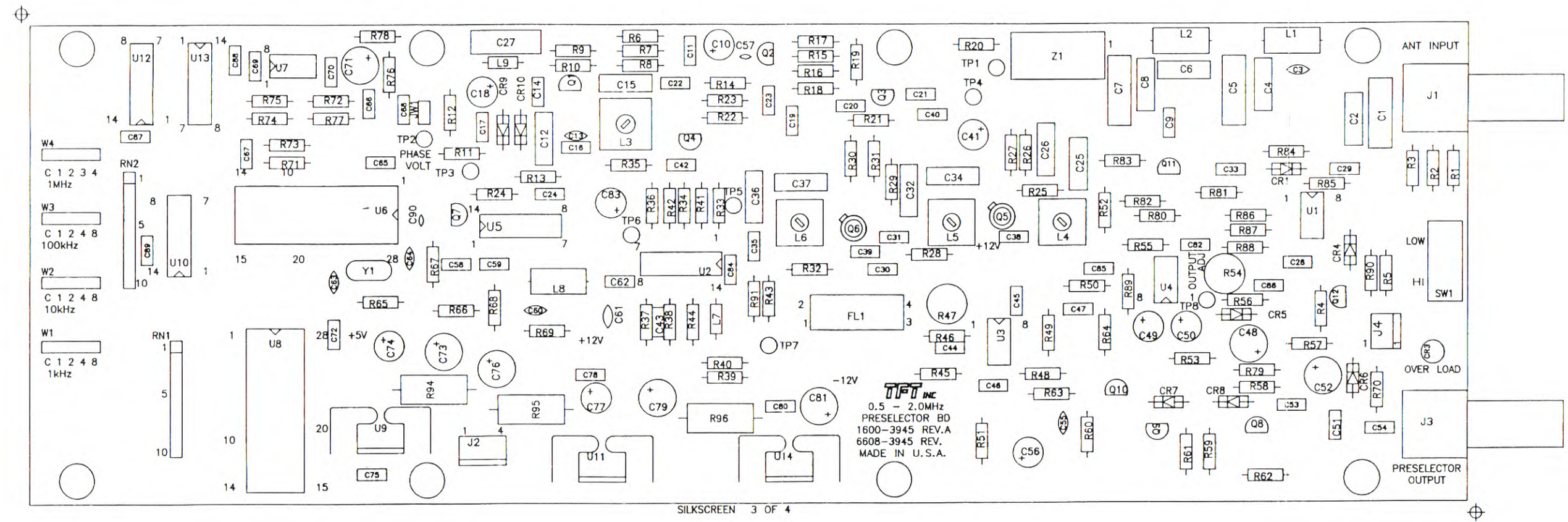
- NOTES: UNLESS OTHERWISE SPECIFIED:
 1. ALL RESISTOR VALUES ARE IN OHMS UNLESS OTHERWISE SPECIFIED.
 2. ALL CAPACITOR VALUES ARE IN MICROFARADS.
 3. ALL INDUCTOR VALUES ARE IN MICROHENRIES.
 4. □ = DC VOLTAGE
 ○ = AC VOLTAGE

FIG. A6-1

If You Didn't Get This From My Site,
 Then It Was Stolen From...
www.SteamPoweredRadio.Com

APPROVALS		DATE	TPT INC 3090 OAKMEAD VILLAGE DR. SANTA CLARA, CA. 95051 (408)727-7272 TWX 910-338-0584	
DESIGN	JUDY LIU	4/28/93	SCHEMATIC	
CHECKED	[Signature]	4/28/93	0.5-2.0MHz PRESELECTOR BD	
ENGR	[Signature]	4/30/93	SIZE	FSCM NO.
APP	[Signature]	4/28/93	C	DWG. NO. 6601-3945
Q.A.	[Signature]	5/5/93	SCALE	NONE
APPLICATION			SHEET	1 OF 1

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	RELEASE TO PRODUCTION	4/28/93	<i>T. Lee</i>



SILKSCREEN 3 OF 4

FIG. A6-2

TFT INC		3090 OAKMEAD VILLAGE DR. SANTA CLARA, CA. 95051 (408)727-7272 FAX 910-338-0584	
PCB ASSY		0.5-2.0MHz PRESELECTOR BD	
MODEL	923	SIZE	D
NEXT ASSY	7100-4250	FROM NO.	
APPLICATION		SCALE	2:1
DATE	4/28/93	OWN. NO.	6608-3945
APPROVED	JUDY LIU	REV.	A
DATE	4/20/93	SHEET 1 OF 1	

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www.SteamPoweredRadio.Com

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
C001	CAP MICA 2000 PF	1	1001-0202
C002	CAP MICA 390 PF	1	1001-0391
C003	CAP MINI CER 82PF NPO RECT	1	1017-0820
C004	CAP MICA 910PF	1	1001-0911
C005	CAP MICA 2700 PF	1	1001-0272
C006	CAP MICA 200 PF	1	1001-0201
C007	CAP MICA 2000 PF	1	1001-0202
C008	CAP MICA 200 PF	1	1001-0201
C009	CAP CER .01MF CK05BX103K	1	1015-0002
C010	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C011	CAP CER 0.1MF CK05BX K	1	1015-0001
C012	CAP MICA 150 PF	1	1001-0151
C013	CAP MINI CER 8.2 PF NPO RECT	1	1017-0082
C014	CAP CER .022MF CK05BX K	1	1015-0005
C015	CAP MICA 150 PF	1	1001-0151
C016	CAP CER .047MF CK05BX473K	1	1015-0006
C017	CAP CER 0.1MF CK05BX K	1	1015-0001
C018	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C019	CAP CER 0.1MF CK05BX K	1	1015-0001
C020	CAP CER 0.1MF CK05BX K	1	1015-0001
C021	CAP CER .01MF CK05BX103K	1	1015-0002
C022	CAP CER 100PF CK05BX101K	1	1015-0100
C023	CAP CER .01MF CK05BX103K	1	1015-0002
C024	CAP CER 0.1MF CK05BX K	1	1015-0001
C025	CAP MICA 1200 PF	1	1001-0122
C026	CAP MICA 330 PF	1	1001-0331
C027	CAP CER .22MF CK06BX224K	1	1015-0003
C028	CAP CER DISC 1MFD	1	1005-0001
C029	CAP CER .01MF CK05BX103K	1	1015-0002
C030	CAP CER DISC 1MFD	1	1005-0001
C031	CAP CER 0.1MF CK05BX K	1	1015-0001
C032	CAP MICA 620 PF	1	1001-0621
C033	CAP CER 0.1MF CK05BX K	1	1015-0001
C034	CAP MICA 560 PF 300V	1	1001-0561
C035	CAP CER 0.1MF CK05BX K	1	1015-0001
C036	CAP MICA 3300 PF	1	1001-0332
C037	CAP MICA 820 PF	1	1001-0821
C038	CAP CER 0.1MF CK05BX K	1	1015-0001
C039	CAP CER 0.1MF CK05BX K	1	1015-0001
C040	CAP CER .22MF CK06BX224K	1	1015-0003
C041	CAP DIPPED TANT 2.2 UF 25V	1	1008-0023
C042	CAP CER .22MF CK06BX224K	1	1015-0003
C043	CAP CER .22MF CK06BX224K	1	1015-0003

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
C044	CAP CER DISC 1MFD	1	1005-0001
C045	CAP CER DISC 1MFD	1	1005-0001
C046	CAP CER DISC 1MFD	1	1005-0001
C047	CAP CER 0.1MF CK05BX K	1	1015-0001
C048	CAP ELECT VT MT 100UF (NO SUB.)	1	1010-0110
C049	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C050	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C051	CAP CER .22MF CK06BX224K	1	1015-0003
C052	CAP ELECT VT MT 100UF (NO SUB.)	1	1010-0110
C053	CAP CER .22MF CK06BX224K	1	1015-0003
C054	CAP CER .22MF CK06BX224K	1	1015-0003
C055	CAP MINI CER 3.3PF NPO RECT	1	1017-0033
C056	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C057	F.S. PART	1	XX00-0002
C058	CAP CER 0.1MF CK05BX K	1	1015-0001
C059	CAP CER .01MF CK05BX103K	1	1015-0002
C060	CAP MINI CER 180PF NPO 63V	1	1017-0181
C061	CAP MINI CER 180PF NPO 63V	1	1017-0181
C062	CAP CER .01MF CK05BX103K	1	1015-0002
C063	CAP MINI CER 39PF NPO RECT	1	1017-0390
C064	CAP MINI CER 39PF NPO RECT	1	1017-0390
C065	CAP CER 0.1MF CK05BX K	1	1015-0001
C066	CAP CER .01MF CK05BX103K	1	1015-0002
C067	CAP CER .01MF CK05BX103K	1	1015-0002
C068	CAP CER .22MF CK06BX224K	1	1015-0003
C069	CAP CER 0.1MF CK05BX K	1	1015-0001
C070	CAP CER 0.1MF CK05BX K	1	1015-0001
C071	CAP ELECT VT MT 100UF (NO SUB.)	1	1010-0110
C072	CAP CER 0.1MF CK05BX K	1	1015-0001
C073	CAP ELECT VT MT 100UF (NO SUB.)	1	1010-0110
C074	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C075	CAP CER 0.1MF CK05BX K	1	1015-0001
C076	CAP ELECT VT MT 100UF (NO SUB.)	1	1010-0110
C077	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C078	CAP CER 0.1MF CK05BX K	1	1015-0001
C079	CAP ELECT VT MT 100UF (NO SUB.)	1	1010-0110
C080	CAP CER 0.1MF CK05BX K	1	1015-0001
C081	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C082	CAP CER DISC 1MFD	1	1005-0001
C083	CAP ELECT 10 MFD 25V VERT MT	1	1010-0099
C084	CAP CER 0.1MF CK05BX K	1	1015-0001
C085	CAP CER DISC 1MFD	1	1005-0001
C086	CAP CER .01MF CK05BX103K	1	1015-0002

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
C087	CAP CER 0.1MF CK05BX K	1	1015-0001
C088	CAP CER 0.1MF CK05BX K	1	1015-0001
C089	CAP CER 0.1MF CK05BX K	1	1015-0001
C090	CAP MINI CER 10PF NPO RECT	1	1017-0100
CR01	DIO HP5082 HOT CARRIER	1	1282-2800
CR02	PARTS NOT USED	1	X000-0001
CR03	LED HP 5082-4487 CLEAR	1	1285-4487
CR04	DIO 1N3064	1	1281-3064
CR05	DIO 1N3064	1	1281-3064
CR06	DIO HP5082 HOT CARRIER	1	1282-2800
CR07	DIO 1N3064	1	1281-3064
CR08	DIO 1N3064	1	1281-3064
CR09	DIO VARICAP DKV6520	1	1290-6520
CR10	DIO VARICAP DKV6520	1	1290-6520
FL01	FIL 455KHZ/13KHZ BW CFM455 (QA TST)	1	1052-0146
HS01	HEATSINK VERT MT .39 X .86	1	2010-5943
HS02	HEATSINK VERT MT .39 X .86	1	2010-5943
HS03	HEATSINK VERT MT .39 X .86	1	2010-5943
J001	R/A BNC PC MNT METAL BODY CONN	1	2200-7961
J002	CONN MINI MOLEX 4PIN	1	2250-5854
J003	R/A BNC PC MNT METAL BODY CONN	1	2200-7961
J004	CONN 3PIN HEADER MALE .100 CTR	1	2250-5830
JW01	SOCKET JUMPER 2 PIN	1	2250-2502
L001	CHOKE RF 5.6 UH	1	1530-0056
L002	CHOKE RF 5.6 UH	1	1530-0056
L003	50T VARIABLE INDUCTOR	1	1550-0050
L004	IND VAR I/H 21T	1	1550-0004
L005	IND VAR I/H 21T	1	1550-0004
L006	IND VAR I/H 21T	1	1550-0004
L007	CHOKE MOLDED 33UH 10%	1	1531-0330
L008	CHOKE RF 12 UH	1	1530-0120
L009	CHOKE 47UH	1	1531-0470
PCB1	PRESELECTOR BD MODEL 923	1	1600-3945
Q001	TRANS 2N3563	1	1271-3563
Q002	TRANS 2N3563	1	1271-3563
Q003	TRANS 2N4275	1	1271-4275
Q004	TRANS 2N4275	1	1271-4275
Q005	TRANS 40822 FET	1	1271-4082
Q006	TRANS 40822 FET	1	1271-4082
Q007	TRANS 2N4275	1	1271-4275
Q008	TRANS 2N3643	1	1271-3643
Q009	TRANS 2N3645	1	1271-3645
Q010	TRANS 2N3563	1	1271-3563

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
Q011	TRANS 2N3563	1	1271-3563
Q012	TRANS PN2222A NPN	1	1271-2223
R001	RES CAR COMP 1/4W 5% 62	1	1065-0062
R002	RES CAR COMP 1/4W 5% 240	1	1065-0240
R003	RES CAR COMP 1/4W 5% 62	1	1065-0062
R004	RES CAR FILM 1/4W 5% 820 OHM	1	1065-0820
R005	RES CAR COMP 1/4W 5% 680	1	1065-0680
R006	RES CAR FILM 1/4W 5% 1K	1	1065-1001
R007	RES CAR COMP 1/4W 5% 6.2K	1	1065-6201
R008	RES CAR COMP 1/4W 5% 330	1	1065-0330
R009	RES CAR COMP 1/4W 5% 1.8K	1	1065-1801
R010	RES CAR COMP 1/4W 5% 330	1	1065-0330
R011	RES CAR FILM 1/4W 5% 10K	1	1065-1002
R012	RES CAR COMP 1/4W 5% 1.8K	1	1065-1801
R013	RES CAR FILM 1/4W 5% 10K	1	1065-1002
R014	RES CAR FILM 4.7K 1/4W 5%	1	1065-4701
R015	RES CAR COMP 1/4W 5% 6.8K	1	1065-6801
R016	RES CAR FILM 1/4W 5% 3.6K	1	1065-3601
R017	RES CAR FILM 1/4W 5% 1K	1	1065-1001
R018	RES CAR FILM 1/4W 5% 510 OHM	1	1065-0510
R019	RES CAR FILM 1/4W 5% 150 OHM	1	1065-0150
R020	RES CAR COMP 1/4W 5% 22	1	1065-0022
R021	RES CAR FILM 1/4W 5% 150 OHM	1	1065-0150
R022	RES CAR FILM 1/4W 5% 2.2K	1	1065-2201
R023	RES CAR COMP 1/4W 5% 82K	1	1065-8202
R024	RES CAR FILM 1/4W 5% 1K	1	1065-1001
R025	RES CAR FILM 4.7K 1/4W 5%	1	1065-4701
R026	RES CAR 1/4W 5% 200K	1	1065-2003
R027	RES CAR COMP 1/4W 5% 8.2K	1	1065-8201
R028	RES CAR FILM 1/4W 5% 470 OHM	1	1065-0470
R029	RES CAR COMP 1/4W 5% 5.1K	1	1065-5101
R030	RES CAR COMP 1/4W 5% 390K	1	1065-3903
R031	RES CAR COMP 1/4W 5% 8.2K	1	1065-8201
R032	RES CAR FILM 1/4W 5% 470 OHM	1	1065-0470
R033	RES CAR FILM 1/4W 5% 220	1	1065-0220
R034	RES CAR FILM 1/4W 5% 220	1	1065-0220
R035	RES CAR FILM 4.7K 1/4W 5%	1	1065-4701
R036	RES CAR FILM 4.7K 1/4W 5%	1	1065-4701
R037	RES CAR FILM 1/4W 5% 220	1	1065-0220
R038	RES CAR FILM 1/4W 5% 220	1	1065-0220
R039	RES CAR COMP 1/4W 5% 8.2K	1	1065-8201
R040	RES CAR COMP 1/4W 5% 3.9K	1	1065-3901
R041	RES CAR COMP 1/4W 5% 51	1	1065-0051

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
R042	RES CAR FILM 1/4W 5% 10K	1	1065-1002
R043	RES CAR FILM 1/4W 5% 1K	1	1065-1001
R044	RES CAR FILM 1/4W 5% 2.2K	1	1065-2201
R045	RES CAR COMP 1/4W 5% 1.5K	1	1065-1501
R046	RES CAR FILM 1/4W 5% 1K	1	1065-1001
R047	POT CERMET 10K PC MNT TOP ADJ	1	1072-1111
R048	RES CAR FILM 1/4W 5% 1K	1	1065-1001
R049	RES CAR FILM 1/4W 5% 1K	1	1065-1001
R050	RES CAR COMP 1/4W 5% 56	1	1065-0056
R051	RES CAR COMP 1/4W 5% 56	1	1065-0056
R052	RES CAR COMP 1/4W 5% 820K	1	1065-8203
R053	RES CAR COMP 1/4W 5% 12K	1	1065-1202
R054	CERMET POT TRIM 1K TOP/BOT ADJ	1	1072-1005
R055	RES CAR COMP 1/4W 5% 6.8K	1	1065-6801
R056	RES CAR COMP 1/4W 5% 100K	1	1065-1003
R057	RES CAR COMP 1/4W 5% 910	1	1065-0910
R058	RES CAR FILM 1/4W 5% 1K	1	1065-1001
R059	RES CAR FILM 1/4W 5% 10 OHM	1	1065-0010
R060	RES CAR FILM 1/4W 5% 1K	1	1065-1001
R061	RES CAR FILM 1/4W 5% 10 OHM	1	1065-0010
R062	RES CAR FILM 1/4W 5% 560	1	1065-0560
R063	RES CAR FILM 1/4W 5% 2.7K	1	1065-2701
R064	RES CAR FILM 1/4W 5% 220	1	1065-0220
R065	RES CAR FILM 1/4W 5% 1K	1	1065-1001
R066	RES CAR FILM 1/4W 5% 1K	1	1065-1001
R067	RES CAR COMP 1/4W 5% 82K	1	1065-8202
R068	RES CAR COMP 1/4W 5% 3.9K	1	1065-3901
R069	RES CAR COMP 1/4W 5% 180	1	1065-0180
R070	RES CAR FILM 1/4W 5% 820 OHM	1	1065-0820
R071	RES CAR COMP 1/4W 5% 22K	1	1065-2202
R072	RES CAR COMP 1/4W 5% 22K	1	1065-2202
R073	RES CAR COMP 1/4W 5% 22K	1	1065-2202
R074	RES CAR COMP 1/4W 5% 22K	1	1065-2202
R075	RES CAR FILM 1/4W 5% 150K	1	1065-1503
R076	RES CAR COMP 1/4W 5% 3.3K	1	1065-3301
R077	RES CAR FILM 1/4W 5% 150K	1	1065-1503
R078	RES CAR COMP 1/4W 5% 82	1	1065-0082
R079	RES CAR FILM 1/4W 5% 10 OHM	1	1065-0010
R080	RES CAR FILM 1/4W 5% 15K	1	1065-1502
R081	RES CAR FILM 1/4W 5% 2.7K	1	1065-2701
R082	RES CAR COMP 1/4W 5% 1.5K	1	1065-1501
R083	RES CAR COMP 1/4W 5% 130	1	1065-0130
R084	RES CAR FILM 1/4W 5% 10K	1	1065-1002

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
R085	RES CAR FILM 1/4W 5% 10K	1	1065-1002
R086	RES CAR 1/4W 5% 200K	1	1065-2003
R087	RES CAR COMP 1/4W 5% 75	1	1065-0075
R088	RES CAR COMP 1/4W 5% 56	1	1065-0056
R089	RES CAR COMP 1/4W 5% 56	1	1065-0056
R090	RES CAR FILM 1/4W 5% 10K	1	1065-1002
R091	RES CAR FILM 1/4W 5% 1K	1	1065-1001
R092	PARTS NOT USED	1	X000-0001
R093	PARTS NOT USED	1	X000-0001
R094	RES 1W 1.0 OHM 5% METAL OXIDE	1	1068-0071
R095	RES 1W 1.0 OHM 5% METAL OXIDE	1	1068-0071
R096	RES 1W 1.0 OHM 5% METAL OXIDE	1	1068-0071
RN01	RES NETWORK 10K 10PIN SIP COM 5%	1	1073-1199
RN02	RES NETWORK 10K 10PIN SIP COM 5%	1	1073-1199
SW01	2P2T R/A SLIDE SWITCH SLC2209	1	1840-2209
TP01	1/8DX.35L BLK TEST TERMINAL	1	2140-0150
TP02	1/8DX.35L BRN TEST TERMINAL	1	2140-0151
TP03	1/8DX.35L RED TEST TERMINAL	1	2140-0152
TP04	1/8DX.35L ORN TEST TERMINAL	1	2140-0153
TP05	1/8DX.35L YEL TEST TERMINAL	1	2140-0154
TP06	1/8DX.35L GRN TEST TERMINAL	1	2140-0155
TP07	1/8DX.35L BLK TEST TERMINAL	1	2140-0150
TP08	1/8DX.35L RED TEST TERMINAL	1	2140-0152
U001	I/C LM741CN	1	1100-0741
U002	I/C LM1496N BALANCED MOD/DEM0D	1	1100-1496
U003	I/C NE5532P LIN DUAL DP AMP	1	1100-5532
U004	I/C LM741CN	1	1100-0741
U005	I/C 74HC113 DUAL J-K FLIP FLOP	1	1104-0113
U006	I/C MC145151-1 CMOS PLL	1	1102-4551
U007	NE5230D LO VOLT OP AMP I/C 8 PIN	1	1100-5230
U008	IC D2764A-4 EPROM	1	1102-2764
U009	I/C LM340T-05	1	1100-7805
U010	I/C DM74LS86N	1	1101-7486
U011	I/C LM340T-12	1	1100-0340
U012	I/C SN74LS00N	1	1101-7400
U013	I/C SN74LS10N	1	1101-7410
U014	I/C MC7912	1	1100-7912
XU01	SOCKET, I/C 8 PIN	1	2250-1008
XU02	SOCKET I/C 14PIN	1	2250-1014
XU03	SOCKET, I/C 8 PIN	1	2250-1008
XU04	SOCKET, I/C 8 PIN	1	2250-1008
XU05	SOCKET I/C 14PIN	1	2250-1014
XU06	SOCKET I/C DIP-28 PIN	1	2250-1028

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
XU07	SOCKET, I/C 8 PIN	1	2250-1008
XU08	SOCKET I/C DIP-28 PIN	1	2250-1028
XU10	SOCKET I/C 14PIN	1	2250-1014
XU12	SOCKET I/C 14PIN	1	2250-1014
XU13	SOCKET I/C 14PIN	1	2250-1014
Y001	8.192 MHZ XTAL HC 43/U-2	1	2400-0819
Z001	MIXER 2-6 CHANNEL SBL-1	1	4500-0001