

DIGITAL REMOTE CONTROL SYSTEM  
MODEL 7601 MANUAL



71-11

**TFT**

**TIME AND FREQUENCY  
TECHNOLOGY, INC.**

Instrument Serial No. \_\_\_\_\_

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DIGITAL REMOTE CONTROL SYSTEM

MODEL 7601 MANUAL



760K

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7601R

549-22

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SECTION 1  
GENERAL INFORMATION

1.1            General Description.

The TFT Model 7601 provides digital remote control of AM, FM, and TV transmitters.

Options include an SCA Generator and Detector for use with radio or TV communications links, and a Status Alarm Option. These options can be ordered with the Model 7601, in which case they are installed at the factory; or they can be ordered later and installed by the customer in the field.

1.1.1            Model 7601 Digital Telemetry/Control System.

This system consists of a Model 7601-C unit for use at the control site, and a Model 7601-R unit for use at the remote site. The two units may be linked by telephone wire line (TELECO) or by STL microwave or radio (SCA). The system provides 10 channels of raise/lower or on/off control, and a display of telemetry from the remote site for each of the 10 channels. The Model 7601 alone is a complete remote-control system. However, its capabilities can be increased by use of the Status Option described in Subsection 1.1.2.

Individual channels are selected by means of a thumbwheel switch on the front panel of the 7601-C. Once selected, the channel number is sent to the 7601-R to select the channel at the remote point. The system addresses this channel and displays the meter reading from the remote site on a front-panel 3 digit telemetry display on the 7601-C. Meter readings are updated three times per second.

Control commands are initiated by pushing either the UP/ON or DOWN/OFF button on the front panel. When a command is activated at the control point, a signal is fed back from the remote point. This signal verifies receipt of the command by illuminating the active command button. To ensure data accuracy and to reduce the possibility of operator error, each control command is sent twice. The two are then compared at the remote site, bit by bit. Only if they match exactly are the commands carried out.

A control failsafe circuit in the 7601-R monitors reception of control and sync bits, and if these bits are not received for a period of 20 to 55 seconds (adjustable), contacts on a relay open to shut down the transmitter. These relay contacts are also opened by a power failure in the 7601-R.

A telemetry failsafe circuit in the 7601-C monitors the telemetry data from the 7601-R and produces a high-level TTL output when

### 1.1.1 Model 7601 Digital Telemetry/Control System Continued.

there is a downlink data failure lasting more than 7 to 12 seconds. This output also puts the failsafe bit sent up to the 7601-R at a high logic level.

The Model 7601-R has a front-panel DVM for telemetry readout, together with scaling potentiometers, so that one man can calibrate the system on-site. For such local operations, a switch on the 7601-R locks out control from the 7601-C control and overrides the telemetry and control failsafes. In local operation, the channel may be selected by the thumbwheel switch on the 7601-R.

### 1.1.2 Status Monitoring Option

The Status Option provides 10 status channels, each with its own independent LED indicator. The status indicators can also be used to verify on/off functions. The Status Alarm output can be used to drive external devices and alarms.

### 1.2 Specifications.

System Capacity

- a) 10 channels of momentary up/down or on/off control with telemetry reading.
- b) 10 channels of status display. (optional)

#### TELEMETRY

Accuracy	.1% of reading $\pm 1$ count.
Update	Three updates per second.
Analog Input Voltage (Tele +, -)	$\pm 1$ vdc. (do not exceed $+4$ volts absolute maximum into A-D converter).
Input Common-Mode Voltage	$\pm 350$ vdc.
Input Impedance	50 kilohms.
Input Isolation	Optically isolated.

#### Control Outputs

7601-R (Up/on, down/off rear barrier strip)	Relay contact closure, isolated, AC/DC rated, noninductive load:  1A at 115vac or 2A at 26vdc.
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## 1.2 Specifications Continued

Data Transmission	Digital puls-code-modulated FSK modems; 600-baud control, 300-baud telemetry.
Modem	Maximum allowable attenuation 30dB 600 OHM impedance Send level - 6 dBm
Communication Link Requirements	
Telephone Line	Two-wire unconditioned, Series 3002 data circuit.
Audio Channel	Any voice-grade channel having a bandwidth of 300Hz to 3kHz. Maximum attenuation of -30dB.
Radio (STL)	Plug-in FM subcarrier modulator and demodulator for command link.
Radio (off-air)	SCA frequencies. (Consult factory)
SCA/Subcarrier Modulator Output	Adjustable 0-800mV rms.
SCA/Subcarrier Demodulator Input Range	20mV to 700mV rms
Fail-Safe Provisions	
Uplink Control 7601-R	Normally closed relay contacts rated (noninductive load) for 0.5A at 115vac or 1A at 26vdc. Adjustable delay of approximately 20 to 55 seconds.
Downlink Telemetry 7601-R	10-second nominal delay. Output for driving external one-hour timer and TV fail-safe units for full compliance with FCC Rule 73.676.
Downlink Telemetry 7601-C	Rear panel TTL output. 10-second nominal delay.
Local Mode Indication (7610-R Rear Panel)	Relay contact closure. Contacts rated (noninductive load) for 0.5A at 115 vac or 1A at 26vdc.
STATUS INPUTS	
Status Inputs (7601R rear panel)	Dry contact closure or TTL logic level. Programmable active HIGH, or active LOW.

## 1.2

Specifications Continued

Programming inputs (7601R rear panel)	Normally open connection programs status input for active LOW operation. Connecting the programming input to ground programs that channel for active HIGH operation.
STATUS ALARM OUTPUT (7601-C)	Open collector output capable of standing off 30 VDC and sinking 200 mA.
Power Required	
Model 7601-C	115VAC $\pm 10\%$ , 50 to 400Hz, 15 watts maximum.
Model 7601-R	115VAC $\pm 10\%$ , 50 to 400Hz, 25 watts maximum.
Operating Temperature	0 <sup>o</sup> to 50 <sup>o</sup> C.
Mounting	19-inch rack.
Height and Weight	
Model 7601-C	5-1/4 inches, 12 pounds.
Model 7601-R	5-1/4 inches, 16 pounds.

## 1.3

Accessory Equipment.

Various adapters may be purchased from Time and Frequency Technology, Inc. These accessories provide the conversion and proper DC voltage level output for the telemetry monitoring input connections to the 7601-R.



1.4

Warranty

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

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

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

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

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

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

1.5

Claim for Damage in Shipment

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

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

PLEASE ADVISE US IF WE CAN ASSIST YOU IN ANY MANNER

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

SECTION 2  
INSTALLATION

2.1            Unpacking and Inspection

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

Model 7601 requires a prime power source of 117 vac, 50 to 400Hz. They can also be wired for 230 vac operation on special order. Power required for each model is as follows:

<u>Model</u>	<u>Power</u>
7601-C	15 W
7601-R	25 W

2.2            Pre-Installation Checkout

To ensure that the Model 7601 is completely functional when it is received, the following closed-loop checkout should be performed before installation. The 7601-C and 7601-R are interconnected to simulate actual installation.

2.2.1        Set-Up Combinations

- (1) TELCO link both directions  
7601C SW1 4, 5 and 6 to ON  
7601R SW1 2 and 6 to ON  
Installed in the 7601C there is a non-functional jumper that connects J4-2 to J3-11 to allow field installation of the SCA option.

Bench Test:

Connect TELCO terminals together with a 30 dB pad to bench test system.

- (2) "C" SCA Det, "R" SCA Gen, TELCO uplink.  
7601C SW1 2, 4, 5 and 6 to ON  
7601R SW1 2, 3, 5 and 6 to ON

Bench Test:

Connect TELCO terminals together with a 30 dB pad and 7601 C J14 to 7601R J19.



Set-Up Combinations (Cont'd.)

- (3) "C" SCA Det, "R" SCA Gen, Ext SCA uplink.  
7601C SW1 1, 2, 4, 5 and 6 to ON  
7601R SW1 2, 3, 5 and 6 to ON

Bench Test:

Connect 7601C J14 to 7601R J19 and 7601C J13 to 7601R J18. Also connect a 620  $\Omega$  1/4W resistor across the TELCO terminals on both units.

- (4) "C" SCA Gen, "R" SCA Det, Telco downlink.  
7601C SW1 4, 5, 6 and 7  
7601R SW1 2 and 6

Bench Test:

Connect TELCO terminals together with a 30 dB pad and 7601C J13 to 7601R J18.

- (5) "C" SCA Gen, "R" SCA Det, Ext SCA, TSL downline.  
7601C SW1 2, 4, 5, 6 and 7 to ON  
7601R SW1 2, 4 and 6 to ON  
7601C jumper J4-2 to J3-11 and J1-1 to J1-2  
7601R jumper J8-2 to J9-11 and P1-11 to P1-12 on SCA card.

Bench Test:

Connect 7601 C J13 to 7601R J18 and 7601C J14 to 7601R J19. Also connect a 620  $\Omega$  1/4W resistor across the TELCO terminals of both units.

- (6) "C" SCA Gen and Det, "R" SCA Gen and Det.  
7601C SW1 2, 4, 5, 6 and 7 to ON  
7601R SW1 2, 3, 5 and 6 to ON  
7601C jumper J4-2 to J3-11  
7601R jumper J8-2 to J9-11

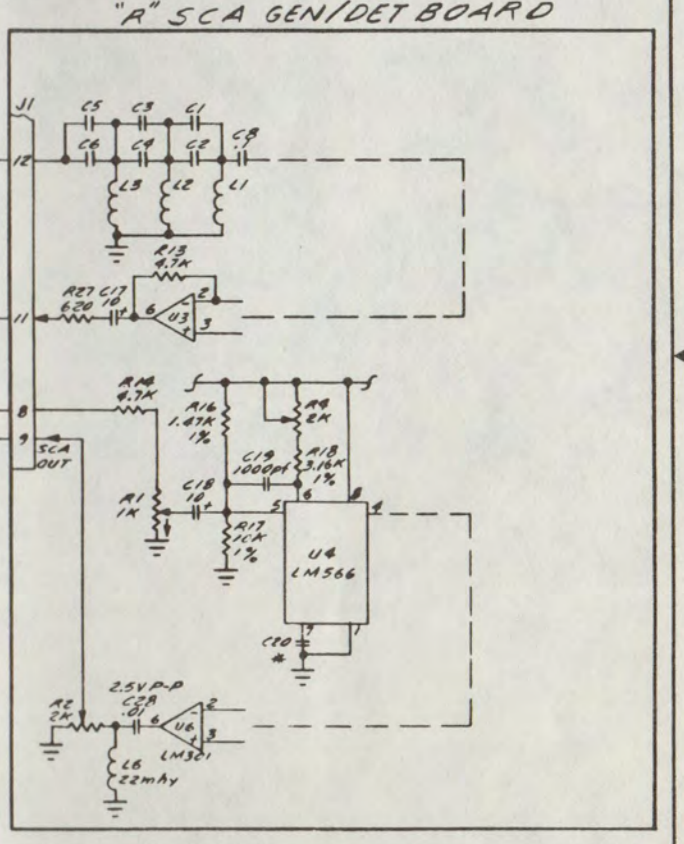
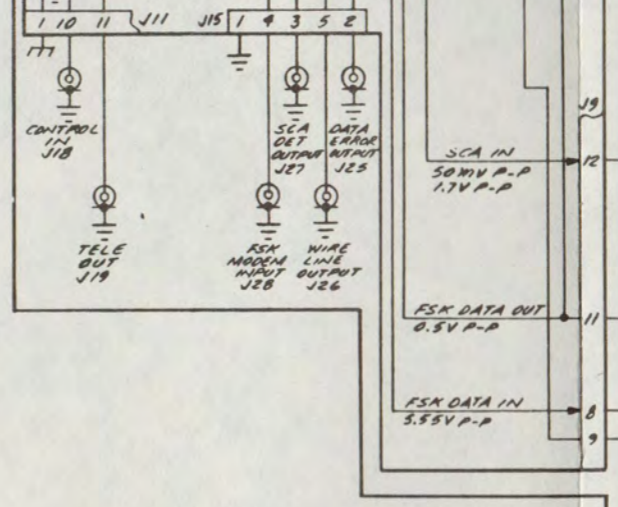
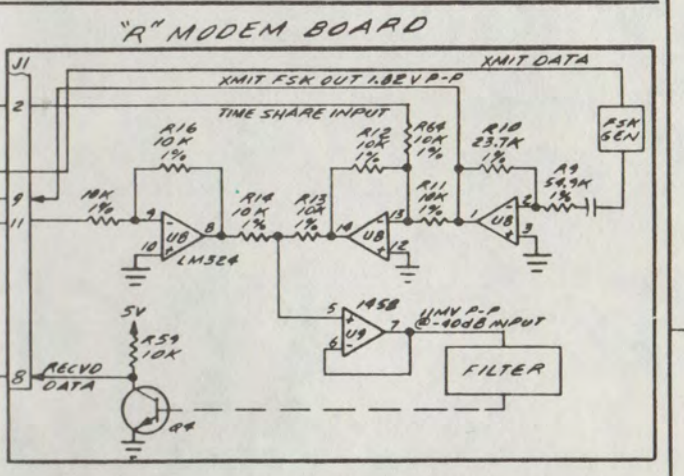
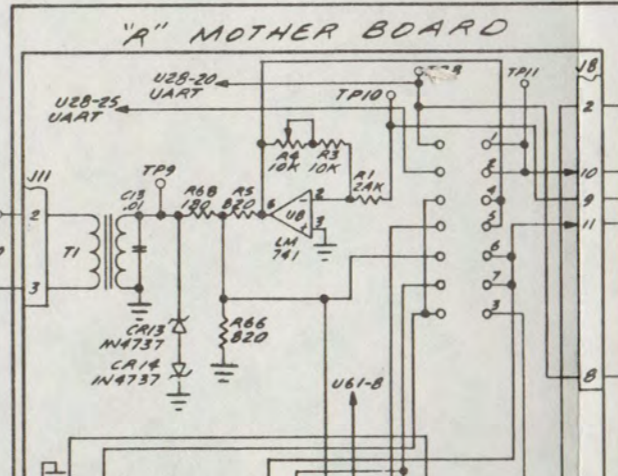
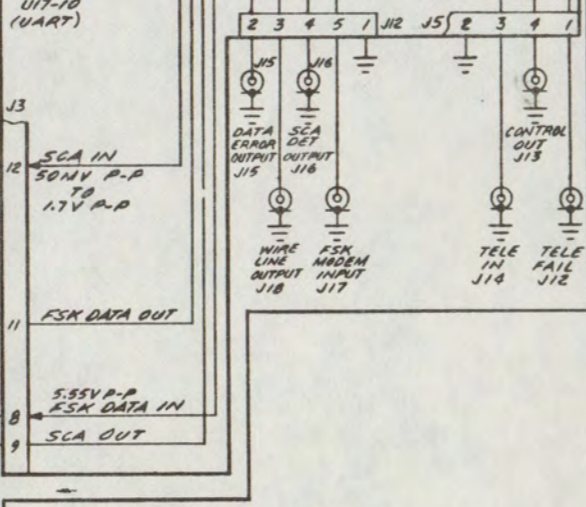
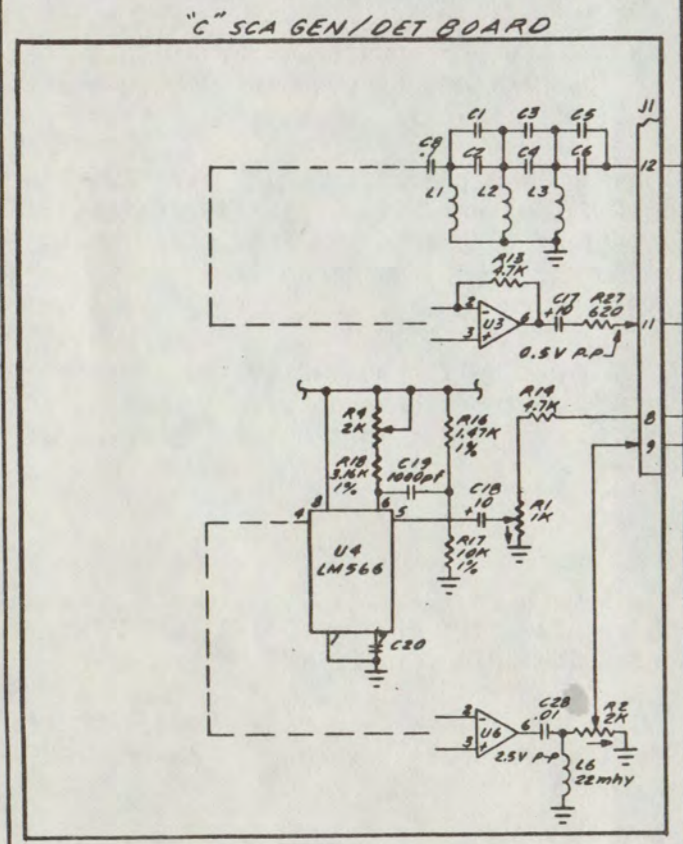
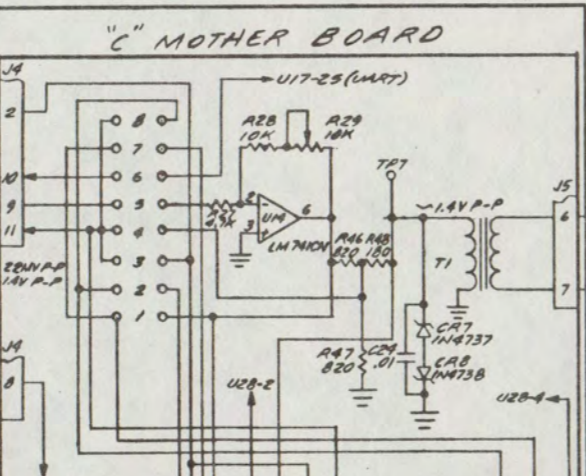
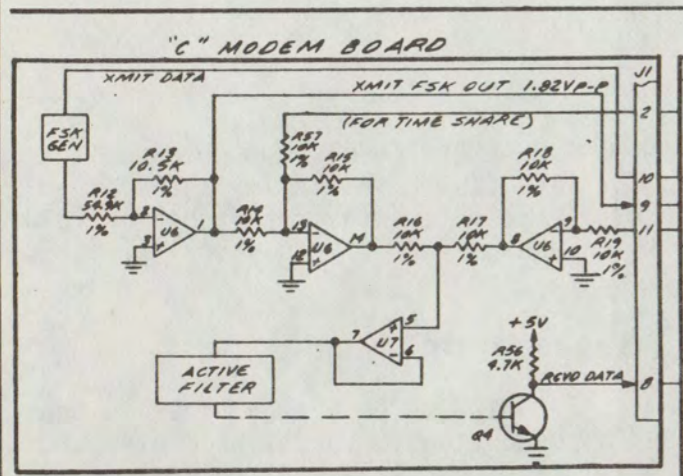
Bench Test:

Connect 7601C J13 to 7601R J18 and 7601C J14 to 7601R J19. Also connect a 620  $\Omega$  1/4W resistor across the TELCO terminals of both units.

- (7) "C" Ext SCA Gen and Det, "R" Ext SCA Gen and Det.  
7601C SW1 1, 2, 4, 5, 6 to ON  
7601R SW1 2, 4 and 6 to ON  
7601C jumper J3-11 to J3-12  
7601R jumper J9-11 to J9-12

Bench Test:

Connect 7601C J13 to 7601R J18 and 7601C J14 to 7601R J19. Also connect a 620  $\Omega$  1/4W resistor across the TELCO terminals of both units.



**SET UP COMBINATIONS**

1. TELCO LINK BOTH DIRECTIONS  
7610C SWI 4,5 AND 6 TO ON  
7610A SWI 2 AND 6 TO ON  
INSTALLED IN THE 7610C THERE IS A NON-FUNCTIONAL JUMPER THAT CONNECTS J4-2 TO J3-11 TO ALLOW FIELD INSTALLATION OF THE SCA OPTION  
BENCH TEST;  
CONNECT TELCO TERMINALS TOGETHER WITH A 300Ω PAD TO BENCH TEST SYSTEM
2. "C" SCA DET, "R" SCA GEN, TELCO UPLINK  
7610C SWI 2,4,5 AND 6 TO ON  
7610A SWI 2,3,5 AND 6 TO ON  
BENCH TEST;  
CONNECT TELCO TERMINALS TOGETHER WITH A 300Ω PAD AND 7610C J19 TO 7610A J19
3. "C" SCA DET, "R" SCA GEN, EXT SCA UPLINK  
7610C SWI 1,2,4,5 AND 6 TO ON  
7610A SWI 2,3,5 AND 6 TO ON  
BENCH TEST;  
CONNECT 7610C J19 TO 7610A J19 AND 7610C J13 TO 7610A J18. ALSO CONNECT A 620Ω 1/4W RESISTOR ACROSS THE TELCO TERMINALS ON BOTH UNITS.
4. "C" SCA GEN, "R" SCA DET, TELCO DOWNLINK  
7610C SWI 4,5,6 AND 7  
7610A SWI 2 AND 6  
BENCH TEST;  
CONNECT TELCO TERMINALS TOGETHER WITH A 300Ω PAD AND 7610C J13 TO 7610A J18
5. "C" SCA GEN, "R" SCA DET, EXT SCA, TSL DOWNLINK  
7610C SWI 2,4,5,6 AND 7 TO ON  
7610A SWI 2,4 AND 6 TO ON  
7610C JUMPER J4-2 TO J3-11 AND J1-1 TO J1-2  
7610A JUMPER J8-2 TO J9-11 AND R1-11 TO R1-12 ON SCA CARD  
BENCH TEST;  
CONNECT 7610C J13 TO 7610A J18 AND 7610C J14 TO 7610A J19  
ALSO CONNECT A 620Ω 1/4W RESISTOR ACROSS THE TELCO TERMINALS OF BOTH UNITS.

6. "C" SCA GEN AND DET, "R" SCA GEN AND DET  
7610C SWI 2,4,5,6 AND 7 TO ON  
7610A SWI 2,3,5 AND 6 TO ON  
7610C JUMPER J4-2 TO J3-11  
7610A JUMPER J8-2 TO J9-11  
BENCH TEST;  
CONNECT 7610C J13 TO 7610A J18 AND 7610C J14 TO 7610A J19. ALSO CONNECT A 620Ω 1/4W RESISTOR ACROSS THE TELCO TERMINALS OF BOTH UNITS
7. "C" EXT SCA GEN AND DET, "R" EXT SCA GEN AND DET  
7610C SWI 1,2,4,5,6 TO ON  
7610A SWI 2,4 AND 6 TO ON  
7610C JUMPER J3-11 TO J3-12  
7610A JUMPER J9-11 TO J9-12  
BENCH TEST;  
CONNECT 7610C J13 TO 7610A J18 AND 7610C J14 TO 7610A J19. ALSO CONNECT A 620Ω 1/4W RESISTOR ACROSS THE TELCO TERMINALS OF BOTH UNITS

CONTRACT NO.		MEM TIME & FREQUENCY TECHNOLOGY INC.	
APPROVALS	DATE		
DRAWN	2/9/82	7601, 7610, 7615 DATA LINKS	
CHECKED		ISSUED	4/1/82
		SIZE	D
		FSCM NO.	
		DWG NO.	6600-2211
		REV	A
		SCALE	1:1
		SHEET	1 OF 1

2.2.2 System Checkout Procedure.

2.2.2.1 Model 7601-C.

a. The 7601-R LOCAL MODE switch must not be activated.

b. Using the 7601-C CHANNEL SELECT thumbwheel switches, dial in channels 0 through 9. The TELEMETRY DATA display should read 000 +002. As each of the channels is selected, the corresponding relay in the Model 7601-R should be heard energizing. Audibly verify relay operation for all 10 channels.

c. UP/ON and DOWN/OFF Control.

- (1) Depress the 7601-C UP/ON button. Verify that the UP/ON pushbuttons on both the 7601-C and the 7601-R light. Release the button.
- (2) Depress the DOWN/OFF button. Verify that the DOWN/OFF pushbuttons on both the 7601-C and 7601-R light. Release the button.
- (3) Simultaneously depress the UP/ON and DOWN/OFF pushbuttons on the 7601-C. Verify that no buttons light on either the 7601-C or 7601-R.

2.2.2.2 Model 7601-R.

a. With the LOCAL MODE switch not activated, verify that the 7601-R UP and DOWN control switches have no effect when depressed and do not light. Also, verify that the 7601-R TELEMETRY DATA display is inactive (blank).

b. Local Control

- (1) Depress the LOCAL MODE switch. Verify that the switch lights and that the 7601-R TELEMETRY DATA readout indicates 000 +2.
- (2) The 7601-C should indicate data (000). Verify by selecting channels 0 through 9 on the 7601-R.
- (3) Alternately depress the UP/ON and DOWN/OFF switches on the 7601-C and verify that they have no control of the 7601-R.

c. UP/ON and DOWN/OFF Control.

- (1) Depress the 7601-R UP/ON button. Verify that the UP/ON pushbuttons on both the 7601-C and 7601-R Light. Release the UP/ON button.

#### 2.2.2.2

#### Model 7601-R Continued.

- (2) Depress the 7601-R DOWN/OFF button. Verify that the DOWN/OFF pushbuttons on both the 7601-C and 7601-R light. Release the DOWN/OFF button.
- (3) Simultaneously depress both the UP/ON and DOWN/OFF pushbuttons on the 7601-R. Verify that no UP or DOWN pushbuttons light on either the 7601-C or 7601-R.

#### d. Control Failsafe.

- (1) Place an ohmmeter across the CONTL FAILSAFE terminals on the 7601-R rear panel connector J17. It should read less than 1 ohm.
- (2) Remove AC power to the Model 7601-C. After a time delay of 20 to 55 seconds (adjustable), the relay contacts should open and the ohmmeter reading should go to infinity.

#### e. Telemetry Calibration.

- (1) Connect an external DC voltage source (not to exceed +1.00 VDC) to the TELE + and - terminals for channel 0 on the 7601-R rear panel. Adjust the front panel calibration potentiometer for channel 0 fully clockwise.
- (2) With the LOCAL MODE button depressed, select channel 0 and verify that a reading corresponding to this input voltage is indicated on the display. Adjust the front panel calibration potentiometer counterclockwise for this channel and verify that the readout changes on both the 7601-R and 7601-C.
- (3) Repeat steps (1) and (2) for the nine remaining channels, if desired.

#### 2.2.2.3

#### Phone Line Loss.

If a wire or phone line link is to be used between the 7601-C and 7601-R, insert a 30-dB, 600-ohm attenuator between the two units, using the resistors supplied. Repeat the steps under the 7601-C system checkout procedure.

## 2.3 Installation and Connections.

The 7601 C/R, units are designed for installation in a standard 19-inch relay rack. Required connections to the units are given below.

### 2.3.1 Model 7601-C Rear Panel Connections. (Figure 3-2)

a. When a TELCO communication link is to be used, connect the TELCO line to the TELCO terminals on terminal strip J12.

b. When a radio microwave uplink is to be used, connect CONTROL OUT connector J13 to the station's SCA generator. If there is no SCA Generator at the station, the optional SCA Generator/Detector Card must be installed in the 7601-C; then the CONTROL OUT connector is connected directly to the multiplex input of the station's STL transmitter (see Figure 6-3.) The output level of the SCA generator within the 7601-C should be adjusted by adjusting R2 of the SCA generator - detector board to the level required by the STL transmitter.

c. When a radio or TV SCA communication downlink is to be used, connect TELEMETRY IN connector J14 to the station's SCA Monitor output. If there is no station SCA Monitor, the optional SCA Generator/Detector Card must be installed in the 7601-C; then the TELEMETRY IN connector directly to the composite, or SCA subcarrier output of the stations's FM or TV receiver (see figure 6-3).

d. For a visual or aural indication of downlink data failure at the control site, connect an appropriate device to the TELE FAIL terminal strip J12. These terminals provide a high-level TTL output when a downlink failure lasts more than 7 to 12 seconds.

e. If the optional status system is used, an alarm may be connected to the status alarm output. This output provides a 0 to +5V D.C. logic output to drive TTL circuitry, or it may be used to drive a relay or D.C. lamp directly. A logic 0 is provided when any of the status indicators are illuminated. If all status indicators are "OFF" the status alarm output will be a logic "1".

### 2.3.2 Model 7601-R Rear Panel Connections. (Figure 3-4)

a. When a TELCO communication link is to be used, connect the TELCO line to the TELCO terminals on terminal strip J17.

b. When a radio microwave uplink is to be used, connect CONTROL IN connector J18 to the multiplex output of the STL receiver at the remote site.

c. When a radio or TV SCA subcarrier downlink is to be used, connect TELEMETRY OUT CONNECTOR J19 to the SCA modulation input of the FM or TV transmitter. The output level of the SCA generator within the 7601-R should be adjusted by adjusting R2 of the SCA generator detector board to the level required by the radio or RV transmitter.

### 2.3.2

### Model 7601-R Rear Panel Connections Continued.

d. Connect the LOCAL MODE terminals of terminal strip J17 to an appropriate device to indicate remote-site local-mode operation. These terminals provide a relay contact closure during local-mode operation. Relay contacts are rated for 0.5A at 115vac or 1A at 26vdc.

e. Connect an appropriate device to the CONTL FAILSAFE terminals of terminal strip J17 to remove power to the transmitter during uplink failure or local power failure. These terminals provide a relay contact closure during normal operation, and a contact opening for uplink failure or power failure. Relay contacts are rated for 0.5 A at 115vac or 1A at 26vdc.

f. To provide an indication at the remote site of downlink telemetry failure, connect an appropriate device to the TELE FAILSAFE terminals of terminal strip J17. These terminals supply a 12 volt relay energizing voltage when there is a downlink failure. Current is limited by a 100-ohm resistor.

g. On the 7601-R front panel, turn the channel calibration potentiometers (Reference 1 in Figure 3-3) fully counterclockwise if the DC input voltage is to exceed 1 volt. Connect each of the telemetry monitoring points through an appropriate interface to provide a low level DC signal to the pair of terminals on the TELE-/+ terminal strip corresponding to the desired channel. The input line can float at a voltage of up to + 350 volts with respect to ground, but the voltage across any pair of TELE-/+ terminals must be such that the voltage out of the calibration potentiometer does not exceed 1 volt DC. Calibration of the individual channels is covered in Section 3.5.

h. Connect each pair of terminals (A-B) on the UP terminal strip to an appropriate device for turning on a piece of equipment or increasing the value of a quantity. The relay contact closure from A to B for each channel is rated at 115vac, 1A or 2A at 26vdc.

i. Connect each pair of terminals (A-B) on the DOWN terminal strip to an appropriate device for turning off a piece of equipment or decreasing the value of a quantity. The relay contact closure from A to B for each channel is rated at 115vac, 1A or 2A at 26vdc.

j. If the optional status system is used, connect the terminal marked STATUS INPUTS to the desired sensors. These inputs may be programmed for either active HIGH, or active LOW inputs. Inputs must be either a contact closure to ground, or a TTL logic level.

k. If the optional status system is used, the inputs may be programmed for active HIGH, or active LOW inputs. The inputs on the barrier strip marked PROGRAM INPUT provide this capability. By grounding a channels programming input, you program the STATUS input for an active HIGH level. This means that the front-panel LED for that channel



### 2.3.2 Model 7601-R Rear Panel Connections Continued.

will come ON when the STATUS input for that channel is at a HIGH logic level, or left open. If the programming input for a channel is left ungrounded (open, or logic HIGH) the STATUS INPUT is programmed for an active LOW input.

1. If the model ADS-01 data path selector is to be used with the model 7601, the DATA ERROR OUTPUT, FSK modem INPUT, SCA DET OUTPUT, and WIRE LINE OUTPUT connector will be used. The DATA ERROR OUTPUT on the 7601 should be connected to the DATA ERROR INPUT of the ADS-01. If an SCA channel and a TELCO line are being used as the main and alternate data paths, the following connections should be made. The FSK MODEM INPUT on the 7601 is connected to the FSK MODEM OUTPUT at the ADS-01. The SCA DET OUTPUT on the 7601 is connected to the DATA PATH 1 input of the ADS-01. The WIRE LINE OUTPUT on the 7601 should be connected to the DATA PATH 2 input of the ADS-01. When operated in this mode, the jumper connecting the FSK detector input to the TELCO input to the 7601.

### 2.4 Field Installation of Options.

#### 2.4.1 SCA Generator and Detector Card.

In the 7601-C, the SCA Generator and/or Detector (1 card) is mounted on top of the FSK Modem card, using spacers furnished. A cable (furnished) connects the card with J3 on the 7601-C Mother Board. Two BNC connectors (furnished) must be mounted in the CONTROL OUT and TELEMETRY IN locations on the 7601-C rear panel. The wires, in the bundle from J5 (see Figure 6-1-3), must be soldered to the BNC connectors.

To install the SCA Generator and/or Detector (1 card) in the 7601-R, a card guide pair (furnished) must first be mounted on the 7601-R Mother Board. The guides are installed using four screws on each side. Then the SCA Card is plugged into J9 on the Mother Board. Two BNC connectors (furnished) must be mounted in the TELEMETRY OUT and CONTROL IN locations on the 7601-R rear panel. The wires, in the bundle from J11 (see Figure 6-2-3) must be soldered to the BNC connectors.

The jumpers on the 7601-C and 7601-R Mother Boards must be installed in accordance with Table 2-1.

#### 2.4.2 Installation of Status Option 7601R.

Remove top cover. Remove cover plate on rear panel. Install Status Board (6608-1960) on front panel using two No. 4 screws provided. Align pots with the holes in the front panel.

Install the 26 conductor cable from the Status Board J1 to the Mother Board J2. Install the 2 conductor Cable from the Status Board J4 to the Mother Board J10.

Install the 10 position barrier strip in the middle

#### 2.4.5 Installation of Status Option 7601R Continued.

cutouts labeled STATUS INPUT and PROGRAM INPUT. Orient the barrier strips so that the solid brown wire is for channel 0 and the white/brown wire is for channel 9. Attach the barrier strips using four No. 6 screws and hex nuts provided. Connect the STATUS INPUT barrier strip to the Status Board J2. Connect the PROGRAM INPUT barrier strip to the Status Board J3.

Replace the top cover and change the front panel function card.

#### 2.4.3 Installation of Status Option 7601-C.

Remove the instrument top cover. Install the Status Board (6608-1940) on the front panel using the two No. 4 screws provided.

Install the 26 conductor ribbon cable from the Status Board J1 to the Mother Board J8. Do not twist the cable. J1 pin 1 should go to J8 pin 1.

Install the 2 conductor cable (with a socket on each end) from the Status Board J3 to the Mother Board J2.

Install the 2 conductor cable on the Status Board J2. Solder the other end to the rear panel barrier strip terminals marked STATUS ALARM. The black wire goes to the terminal marked as ground.

Replace the top cover and change the front panel function card.

## SECTION 3

### OPERATION

#### 3.1 General.

The Model 7601 provides a means of controlling a remote transmitter and of displaying telemetry from the remote transmitter indicating the status of important operational parameters. By means of front-panel thumbwheel and pushbutton switches, the operator can control ten different up/down or on/off functions at the remote site. A front-panel display indicates the value of the parameter measured at the remote site on the selected channel.

At the remote site, thumbwheel and pushbutton switches permit controlling the transmitter locally for calibration of telemetry analog voltages or other purposes. Parameter measurements can be displayed here in the same way that they are displayed at the control site.

An optional status system enables the operator to monitor up to 10 on-off type information channels, such as intrusion and fire alarms.

#### 3.2 Turn-On and Warm-Up.

Since both units are of solid-state design, no warmup is required.

#### 3.3 Controls, Connectors, and Indicators.

##### 3.3.1 Model 7601-C Front Panel.

Fig. 3.1  
Ref. No.

<u>Ref. No.</u>	<u>Name</u>	<u>Function</u>
1	TELEMETRY DATA display	This 3 digit display indicates the value of the parameter being measured on the selected channel. A reading of 999 corresponds to 999 millivolts into the DVM out of the calibration potentiometer (At 7601-R.)
2	CHANNEL SELECT thumbwheel switch	Permits selection of the desired channel for control.
3	UP/ON pushbutton switch	When depressed, this switch transmits an UP or ON command to the remote device controlled by

3.3.1 Model 7601-C Front Panel Continued.

Fig. 3.1  
Ref.No.

<u>Ref.No.</u>	<u>Name</u>	<u>Function</u>
3	Continued.	the selected channel. The switch lights to verify that the command has been received at the remote point.
4	DOWN/OFF pushbutton switch	When depressed, this switch transmits a DOWN or OFF command to the remote device controlled by the selected channel. The switch lights to verify that the command has been received at the remote point.
5	CHANNEL IDENTIFICATION CARD	This card provides identification of the assigned function and units for each channel.
6	Status Indicators	These LED's are controlled by the information present at the status and programming inputs at the 7601-R.

3.3.2 Model 7601-C Rear Panel.

Fig. 3-2  
Ref. No.

<u>Ref. No.</u>	<u>Name</u>	<u>Function</u>
1	AC fuse	Fuses AC input to power transformer.
2	TELCO fuse	Fuses TELCO telephone line.
3	SUBCARRIER CONTROL OUT connector J13 (Option)	SCA or FSK output for STL microwave uplink.
4	SUBCARRIER TELEMETRY IN connector J14 (Option)	SCA or FSK telemetry input connector for radio or TVdownlink.
5	Terminal strip J12	TELCO: Provides bidirectional TELCO connection through a 600-ohm transformer.

## 3.3.2

Model 7601-C Rear Panel Continued.

Fig. 3-2  
Ref. No.

	<u>Name</u>	<u>Function</u>
5	Continued.	<p>TELE FAIL: Provides a high-level TTL output when there is a downlink data failure lasting more than 7 to 12 seconds.</p> <p>STATUS ALARM: Provides an alarm output when any of the status indicators are illuminated.</p>
6	115 VAC POWER cord	Provides connections to a prime power source (115 VAC unless otherwise specified).
7	RECEIVE LEVEL pin jacks	Provides a test voltage proportional to the received signal level thru the FSK modem detector filters.
8	Grounding bolt	Provides a means of connecting chassis ground.
9	DATA ERROR OUTPUT J15	This output provides signals to the ADS-01 accessory to indicate errors in the received telemetry information.
10	SCA DET Output J16	Provides a demodulated SCA output to drive one of the data path inputs of the ADS-01 Data Path Selector.
11	FSK MODEM Input J17	This connector returns the FSK data from the selected data path via the ADS-01 Data Path selector to the FSK modem in the 7601.
12	WIRE LINE output J18	This connector routes the FSK data received on the TELCO Input to one of the data path inputs on the ADS-01 Data Path Selector.

NEXT ASSY		USED ON		REVISIONS			
ITEM NO.	EN NO.	SYM	DESCRIPTION	DR	CHK	AUTH	DATE
5004-7601	7601	A					

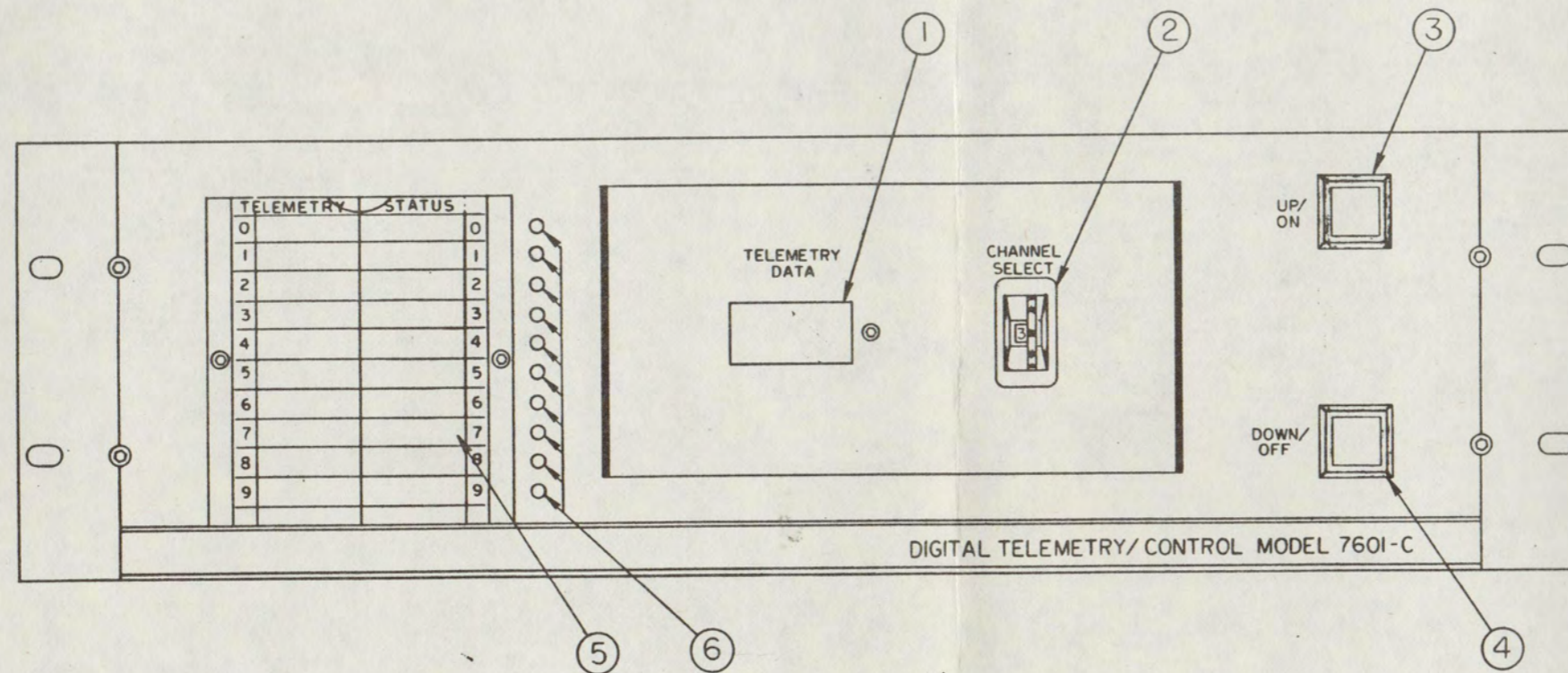


FIG 3-1

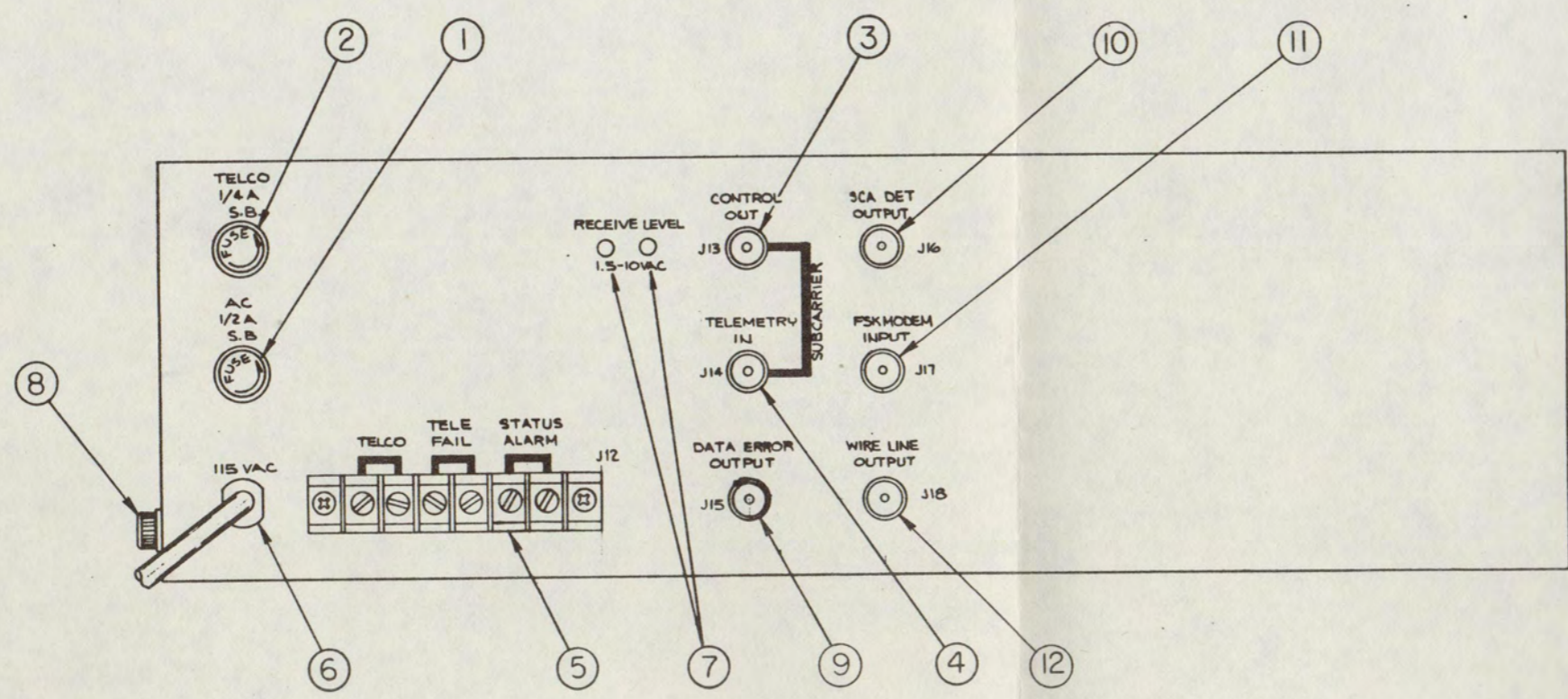


FIG 3-2

If You Didn't Get This From My Site,  
Then It Was Stolen From...  
[www.SteamPoweredRadio.Com](http://www.SteamPoweredRadio.Com)

QTY PER ASSY	ITEM NO.	EN NO.	PART NO.	DESCRIPTION	REF DES
<p><b>REMOVE ALL BURRS AND SHARP EDGES</b></p> <p>TOLERANCES UNLESS OTHERWISE SPECIFIED .XX ±     ANGLULAR ± .XXX ±     ±</p> <p>DO NOT SCALE THIS PRINT</p>					
DRAWN BY: <i>[Signature]</i>		DATE: 10/7/77		<p><b>TET TIME &amp; FREQUENCY TECHNOLOGY INC</b> 3000 Orchard St. Santa Clara, California 95050 (408) 246-6366</p>	
CHK. BY: <i>[Signature]</i>		PROJ. ENG. <i>[Signature]</i>		<p>TITLE: <b>FRONT AND REAR PANEL 7601-C</b></p> <p>SIZE: <b>D</b>    DRAWING NO: <b>6600-1530</b>    REV: <b>A</b></p> <p>SCALE:     SHT. OF:   </p>	
MFG. ENG.		APPD.		REV.	
APPD.		ECO NO.		SCALE	

NEXT ASSY		USED ON		REVISIONS			
ITEM NO.	EN. NO.	PART NO.	DESCRIPTION	DR	CHK	AUTH	DATE
5004-7601	7601	SYM	REL. TO PRODUCTION	TD	ST	288	1/7/77

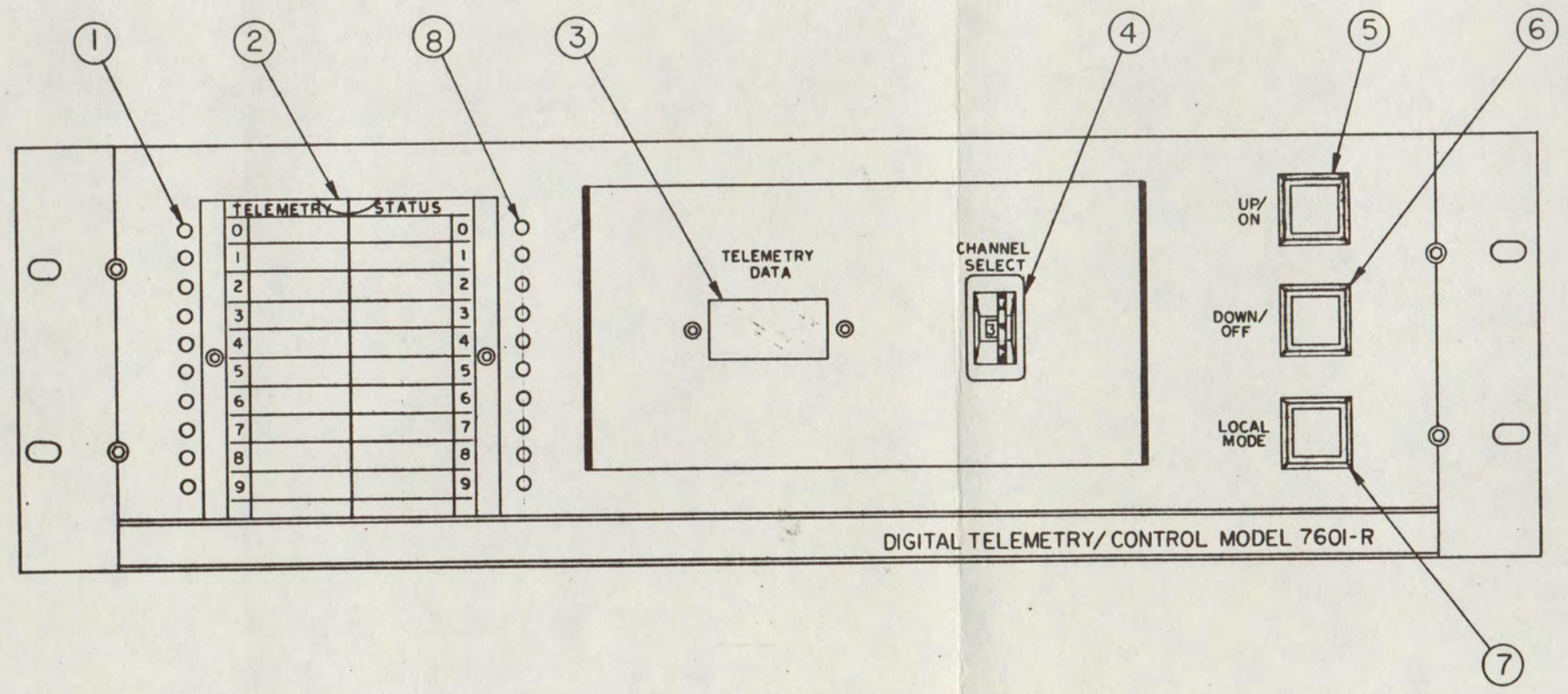


FIG 3-3

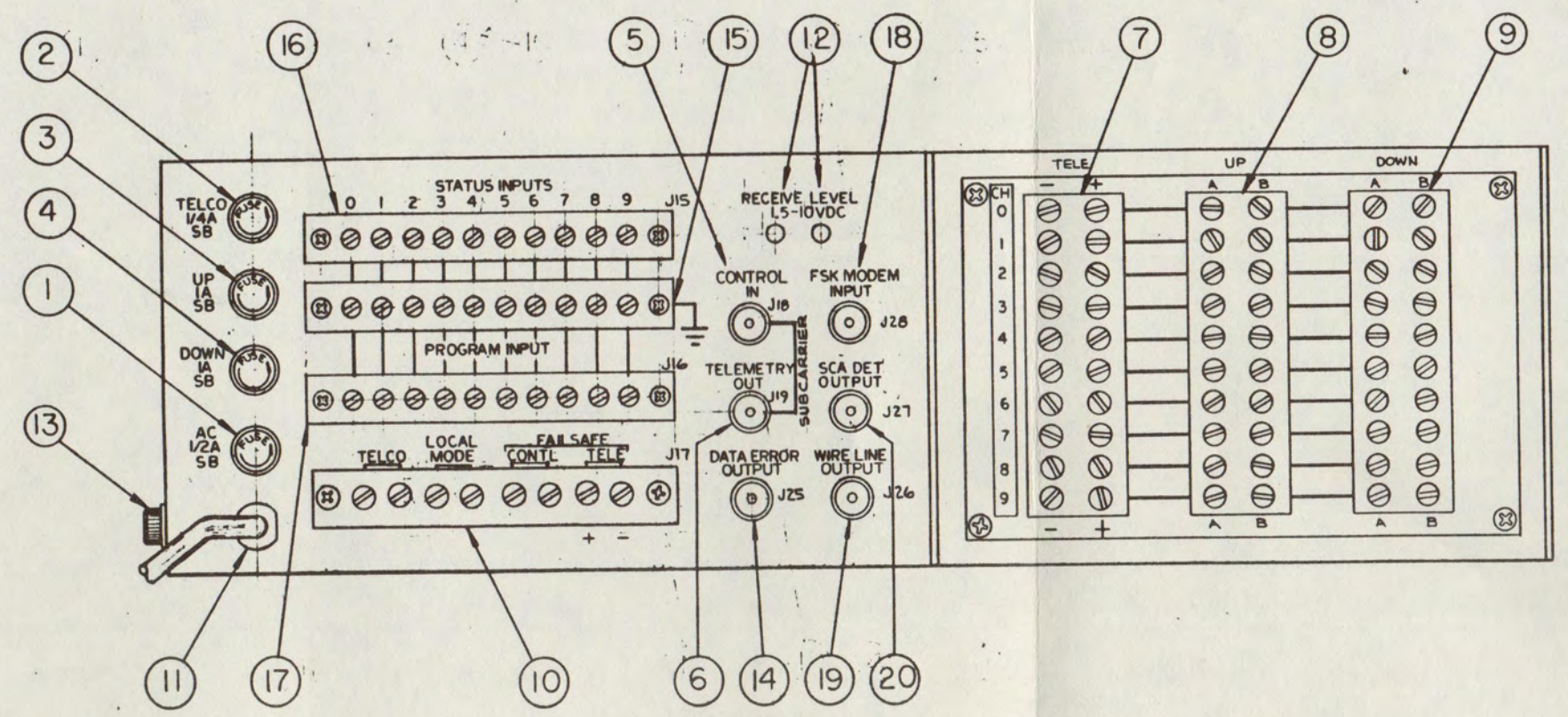


FIG 3-4

QTY PER ASSY	ITEM NO.	EN. NO.	PART NO.	DESCRIPTION	REF. DES.
REMOVE ALL BURRS AND SHARP EDGES					
TOLERANCES UNLESS OTHERWISE SPECIFIED					
.XX ±					
.XXX ±					
DO NOT SCALE THIS PRINT					

LIST OF MATERIALS	DATE	TITLE
DRAWN BY: [Signature] CHK BY: [Signature] PROJ. ENG.: MFG. ENG.: APPD.: RCD NO.:	10-13-77	<b>TET TIME &amp; FREQUENCY TECHNOLOGY INC.</b> 3880 Olcott St., Santa Clara, California 95050 (408) 240-8288 FRONT AND REAR PANEL 7601-R SCALE 1/1 SHEET 1 OF 1

3.3.3 Model 7601-R Front Panel.

Fig. 3-3  
Ref. No.

	<u>Name</u>	<u>Function</u>
1	Calibration or scaling potentiometers	Used to calibrate the analog telemetry voltages received through the rear-panel barrier strip of the 7601-R for readout by the TELEMETRY DATA display DVM. Each channel has its own calibration potentiometer.
2	Channel identification card	Removable card provides identification of the assigned function and units for each channel.
3	TELEMETRY DATA display	This 3 digit display indicates the value of the parameter being measured on the selected channel. A reading of 999 corresponds to 999 millivolts into the DVM out of the calibration potentiometers. Channel selection is by the 7601-R CHANNEL SELECT thumbwheel switches, in the local mode. When not in the local mode, the TELEMETRY DATA display is blanked out.
4	CHANNEL SELECT thumbwheel switch	When the LOCAL MODE switch is depressed, the operating channel can be selected at the remote site by means of the CHANNEL SELECT thumbwheel switches on the 7601-R.
5	UP/ON pushbutton switch	When the LOCAL MODE switch is depressed, depressing the UP/ON switch transmits an UP or ON command to the device controlled by the selected channel. This switch is lighted whenever an UP or ON command occurs, from either the 7601-C or from the 7601-R in the local mode.
6	DOWN/OFF pushbutton switch	When the LOCAL MODE switch is depressed, depressing the DOWN/OFF switch transmits a DOWN or OFF command to the device



## 3.3.3

Model 7601-R Front Panel Continued.Fig. 3-3  
Ref. No.

	<u>Name</u>	<u>Function</u>
6	continued.	controlled by the selected channel. This switch is lighted whenever a DOWN or OFF command occurs, from either the 7601-C or from the 7601-R in the local mode.
7	LOCAL MODE pushbutton switch	When depressed, control is transferred from the Model 7601-C to the Model 7601-R. Depressing the switch causes it to light, indicating local control, and also activates the 7601-R TELEMETRY DATA display.
8	STATUS indicators	These LED's are controlled by information present at the status and programming inputs at the rear panel barrier strips.

## 3.3.4

Model 7601-R Rear Panel.Fig. 3-4  
Ref. No.

	<u>Name</u>	<u>Function</u>
1	AC fuse	Fuses AC input to power transformer
2	TELCO fuse	Fuses TELCO telephone line.
3	UP fuse	Fuses UP control line.
4	DOWN fuse	Fuses DOWN control line.
5	SUBCARRIER CONTROL IN connector J18	Provides means of connecting the SCA input from the STL uplink.
6	SUBCARRIER TELEMETRY OUT connector J19	Provides the SCA or FSK output for the radio or TV downlink.
7	TELE terminal strip	Provides means of introducing DC telemetry sampling voltage to be read out on the TELEMETRY DATA display when the corresponding channel is selected. A positive DC voltage applied to the + terminal will give a positive reading on the display.

3.3.4 Model 7601-R Rear Panel Continued

Fig. 3-4  
Ref. No.

	<u>Name</u>	<u>Function</u>
8	UP terminal strip	When the UP/ON pushbutton is depressed at the 7601-C or at the 7601-R in the local mode, provides a relay contact closure from A to B for the selected channel.
9	DOWN terminal strip	When the DOWN/OFF pushbutton is depressed at either the 7601-C or the 7601-R in the local mode, provides a relay contact closure from A to B for the selected channel.
10	Terminal strip J17	<p>TELCO terminals: Provide connection to TELCO line.</p> <p>LOCAL MODE terminals: Provides a relay closure when the 7601-R is in the local mode.</p> <p>FAILSAFE CONTL terminals: Provide relay contact closure when operation is normal. If power fails at the 7601-R, or if the command uplink fails, the relay contacts open. A time delay adjustable from approximately 20 to 55 seconds occurs between uplink failure and contact opening.</p> <p>FAILSAFE TELE terminals: Provide a 12-volt relay energizing voltage when there is a telemetry failure on the downlink. There is a fixed time delay of 7 to 12 seconds between downlink failure and appearance of the relay voltage.</p>
11	115VAC POWER cord	Provides means for connecting to a prime power source (115 VAC unless otherwise specified).
12	RECEIVE LEVEL	Provides a test voltage proportional to the received signal level thru the FSK Modem detector filters.

### 3.3.4 Model 7601-R Rear Panel Continued.

Fig. 3-4  
Ref. No.

	<u>Name</u>	<u>Function</u>
13	Grounding Bolt	Provides a means of connecting chassis ground.
14	DATA ERROR OUTPUT	This output provides signals to the ADS-01 accessory to indicate errors in the received command information.
15	(ground terminals)	These ground connections are to be used with the status and programming inputs.
16	STATUS inputs	These inputs activate the front panel status indicators. These inputs can be programmed for active HIGH, or active LOW operation.
17	PROGRAMMING inputs	These inputs program the status inputs for active HIGH, or active LOW operation. Grounding the programming input denotes active HIGH operation for the STATUS input.
18	FSK MODEM INPUT J17	This connector returns the FSK data from the selected data path via the ADS-01 Data Path Selector to the FSK modem in the 7601.
19	WIRE LINE OUTPUT J18	This connector routes the FSK data received on the TELCO Input to one of the data path inputs on the ADS-01 Data Path Selector.
20	SCA DET OUTPUT J16	Provides a demodulated SCA output to drive one of the data path inputs of the ADS-01 Data Path Selector.

### 3.4 Telemetry Data and Channel Display.

If the operator at the control point wishes to control or monitor a remote transmitter parameter from the 7601-C front panel, he refers to the card to determine the channel number of the device he wishes to control or the circuit he wishes to monitor, and selects that channel by using the thumbwheel CHANNEL SELECT switch.

### 3.4 Telemetry Data and Channel Display Continued.

To turn on the controlled device or, if the controlled device is capable of increasing or decreasing one of its parameters, to increase the value of the parameter, the operator presses the UP/ON button; the pushbutton will illuminate to indicate that the command has been executed at the remote site. Alternatively, to turn off a device or decrease a parameter, he presses the DOWN/OFF button; again, the pushbutton will illuminate when the command has been executed.

The analog voltage from the point monitored on the selected channel will be displayed in digital form on the TELEMETRY DATA display. After the device has been commanded and/or the telemetry observed on the selected channel, another channel may be selected for control and monitoring.

The remote transmitter is normally controlled at the control site. However, for channel calibration or other maintenance purposes, an operator at the remote site can control the local transmitter by pressing the LOCAL MODE button on the 7601-R front panel. The CHANNEL SELECT thumbwheel switch and the UP/ON and DOWN/OFF pushbuttons can then be used in the same way as those at the control site. The analog voltage monitored on the selected channel will appear on the 7601-R TELEMETRY DATA display. This display is blanked when LOCAL MODE operation is not selected.

### 3.5 Calibration of Telemetry Data Display.

The calibration potentiometers (Reference No. 1 in Figure 3-3) should be turned fully counterclockwise (if input voltages are greater than 1 volt) before input voltages are applied to the TELE +/- terminals on the 7601-R rear panel, as described in Section 2.3.2g or 2.3.5a. To calibrate the display, press the LOCAL MODE switch on the 7601-R front panel, select the channel to be checked, and adjust the calibration potentiometer for the selected channel to display the value of the parameter being sampled. For example, if Channel 3 is monitoring the final amplifier plate voltage for which the transmitter's analog meter indicates 2840 volts, the Channel 3 potentiometer could be adjusted for a digital display of 284 (i.e. 0.284 VDC into 7601-R DVM). The 7601-R will not accurately display a count greater than +999, i.e. +.999 VDC into the DVM.

### 3.6 Failsafe Circuits.

A failure of the command data to reach the remote site and control the transmitter will cause the transmitter to go off the air if such failure lasts for 20 to 55 seconds (adjustable).

A failure in the telemetry transmission from the remote site to the control site lasting more than 10 seconds will cause the TELE-FAIL output to be activated on the 7601-C rear panel (Reference No. 5 in Figure 3-2).

### 3.7

#### Status Monitoring System. (Option)

When this option is installed, the 7601-C has 10 front panel LED's, each of which indicates the status of circuits or devices at the remote site. They can also be used to verify on-off functions. The circuit or device being monitored by each status LED is recorded on a card immediately to the left of the LED's.

The 7601-R has a similar set of 10 LED's for status indication at the remote site.

## SECTION 4

### THEORY OF OPERATION

#### 4.1 Block Diagram Discussion.

##### 4.1.1 7601-C Block Diagram. (Figure 6-1-1)

The 7601-C converts the binary control data from its CHANNEL SELECT thumbwheel switches, from its UP/ON and DOWN/OFF pushbutton switches into serial binary data for transmission over the communication link to the remote site. The 7601-C also receives serial binary telemetry data from the remote site and converts it to 8-bit parallel data for the TELEMETRY DATA and STATUS displays.

The transmit function is diagrammed on the left-hand side of Figure 6-1-1. The four lines from the thumbwheel CHANNEL SELECT switch provides BCD outputs from 0 to 9 (10 channels). The UP/ON and DOWN/OFF switches require one bit each. The four CHANNEL SELECT bits with one telemetry failsafe bit from the receiver circuits are applied as parallel inputs to shift register U13. The same bits are applied, for redundancy to increase reliability, as parallel inputs to shift register U12. Similarly, one bit from the front panel UP/ON switch, and one bit from the front panel DOWN/OFF switch are applied to U11.

A load pulse from the control and timing circuitry loads these inputs into the shift registers. A clock pulse loads this data into the Universal Asynchronous Receiver/Transmitter (UART) at terminals TX1 through TX7, together with a logic zero from the end-of-word generator (see top row of Table 4-1). Start, stop, and parity bits are added in the UART, and all 11 bits are then fed out of the UART from its TRO output as serial data to the FSK generator in the modem.

A shift pulse from the UART then shifts out the next bit from all shift registers, so that the data in the second row of Table 4-1 is loaded into the UART, converted to serial data, and sent to the modem. This continues through the eighth bit from the shift registers, at which time the output of the end-of-word generator is a logic one. See TX8. This signals the end of the command word; the shift registers are then reloaded and the entire cycle is repeated.

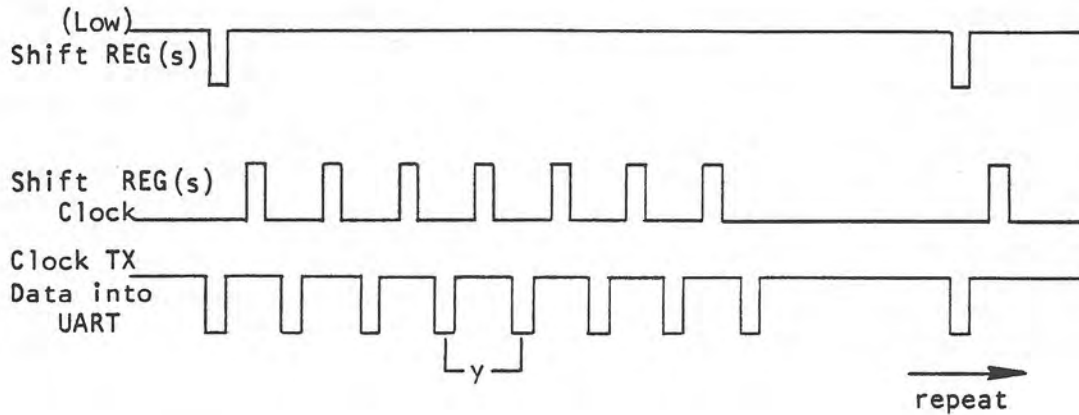
Table 4-1. Model 7601-C Transmit Data Format

Loaded S/R Bit	Bit	TX1	TX2	TX3	TX4	First 7615		First 7615	
						TX5	TX6	TX7	TX8
H	1	TELE FAIL	CH4	UP	0	0	0	0	0
G	2	CH1	CH2	DOWN	0	0	0	0	0
F	3	CH2	CH1	0	0	0	0	0	0
E	4	CH4	TELE FAIL	0	0	0	0	0	0
D	5	CH8	0	0	0	0	0	0	0
C	6	0	0	0	0	0	0	0	0
B	7	0	0	DOWN	0	0	0	0	0
A	8	0	CH8	UP	0	0	0	0	1 (sync)

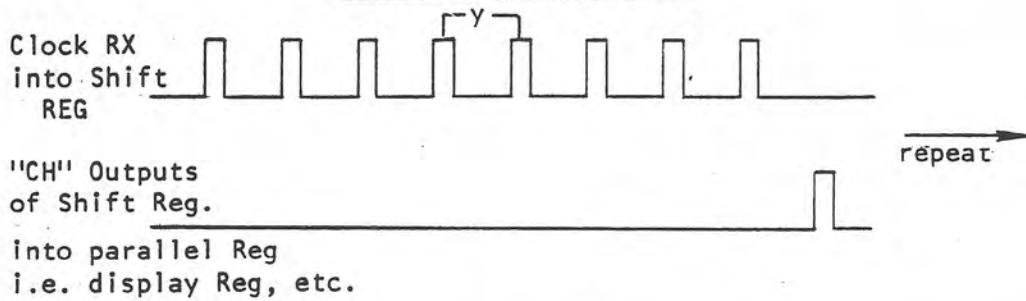
- NOTES:
1. The letters in the Loaded S/R Bit column represent the data bits initially stored in each shift register. H is the first bit to be shifted out, and A is the last.
  2. CH 1 through CH 8 denote the 4-bit BCD output of the LSD CHANNEL SELECT switch.

The receive function is diagrammed on the right-hand side of Figure 6-1-1. Serial data from the remote site enters the UART at the Receiver Input (RI). When the UART detects a start bit, it starts loading one 8-bit serial character within the UART. After the character is loaded, the Data Received (DR) line is set high. This allows the shift registers to sample the UART parallel data output at terminals RX1 through RX8. When the shift registers sample the output, they strobe the Data Received Reset (DRR) line to a logic zero to reset the DR line.

7601 R/C XMIT CYCLE



7601 R/C RECEIVE CYCLE



NOTE: There are eight y times during a complete XMIT or REC Cycle. During each y time the UART is sending or Receiving serial data as follows:

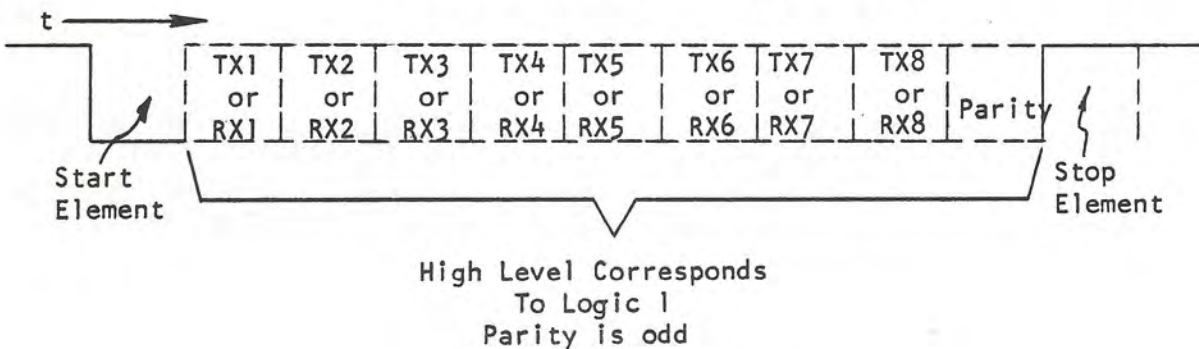


Figure 4-1. Timing Diagram



The parallel data at UART outputs RX1, RX2, and RX3 is applied to the serial inputs of 8-bit shift registers U26, U25, and U23. When the DR line from the UART goes high, the input data is shifted into the three shift registers. Data at TX4 through RX7 is shifted into the Status Option at the same time (when that option is installed). A logic zero from RX8 is applied to the end-of-word detect and control circuitry; this input remains low for the end of the word. At the end of the first shift, the data shown on the top row of Table 4-2 has been shifted into the registers. The control circuitry then strobes the UART's DRR line to a logic zero to reset it, and then the next serial inputs from the remote site are converted to parallel data at RX1 through RX8. This data, corresponding to the second line of Table 4-2, is shifted into the shift registers. This process continues until eight bits of data have been received for each shift register.

Table 4-2. Model 7601-C Receive Data Format

Loaded S/R Bit	Bit	Status Information							
		RX1	RX2	RX3	RX4	RX5	RX6	RX7	RX8
H	1	80	0	UP	8	--	0	--	0
G	2	40	0	DOWN	7	0	0	0	0
F	3	20	0	0	6	0	0	0	0
E	4	10	0	0	5	0	0	0	0
D	5	8	800	0	4	0	0	0	0
C	6	4	400	0	3	0	0	0	0
B	7	2	200	0	2	10	0	0	0
A	8	1	100	0	1	9	0	9	(sync) <sup>1</sup>

NOTES:

The numbers in the RX1 and RX2 columns refer to the BCD data for the four digits of the TELEMETRY DATA display. Other entries in the table are similar to those in Table 4-1, except that Table 4-2 RX4-RX7 describes status displays.

A latch pulse, which is produced by the control circuit after eight shift pulses have been received, clocks the outputs of the shift registers into parallel registers for the displays. The UART RX1 and RX2 outputs from shift registers U26 and U25 provide the data received from the remote sites (in BCD form) for the three digits of the TELEMETRY DATA display, as shown in Table 4-2. The 12 bits of BCD information are decoded on the display board to drive the TELEMETRY DATA display.

The two RX3 bits are used to light the UP or DOWN pushbuttons to verify that the proper up or down command was received at the remote site. The outputs of RX4 through RX7 are used to indicate the status of circuits controlled by the Model 7601-C when that option is installed.

When there is a downlink data failure lasting 7 to 12 seconds, it is detected in the tele failsafe circuit, which applies a logic one to one of the parallel inputs of transmitter shift register U13. The downlink failure is also indicated at the rear-panel at the TELE FAIL terminals of J12.

#### 4.1.2 7601-R Block Diagram. (Figure 6-2-1).

The serial control-word data from the control site is fed from the FSK modem into the UART through its R1 terminal. The operation of the UART is as described for the 7601-C. The parallel data at RX1, RX2, and RX3 is shifted into shift registers U32, U31, and U33; this is the data in the top row of Table 4-1. As each serial character is received from the control site, it is converted to parallel data by the UART and shifted into the shift registers. When all eight bits have been shifted into the shift registers, the 8-bit word in shift register U32 is compared with the 8-bit word in U31. Since the same data was transmitted for these two words (see the TX1 and TX2 columns in Table 4-1), each bit stored in U32 should be the same as the corresponding bit in U31. If the two agree, the channel compare circuit sends a clock enable to register U38/U39, so that the 8-bit word can be clocked into the register. This word contains seven bits of channel select information plus the telemetry failsafe bit. If this bit is high, it indicates that there has been a failure to receive the telemetry at the control site for a period of 7 to 12 seconds. This bit is applied to the telemetry failsafe circuit, which delivers 12 volts to rear-panel TELE FAILSAFE terminals when the bit is high, for energizing an external relay.

The 7-bit channel select word in register U38/U39 is clocked into the 2-to-1 multiplexer by the end-of-word latch pulse. If the LOCAL MODE pushbutton is not pressed, the register bits are delivered to the relay select logic circuit. If the pushbutton is pressed, the multiplexer selects the output of the 7601-R front panel thumbwheel CHANNEL SELECT switches for input to the relay select logic circuit.

#### 4.1.3 7601 Communication Link. (Options) (Figure 6-3).

The communication link between the control site and the transmitter site can be a telephone line (TELCO) or a radio link (STL microwave for control commands up, and the broadcast transmitter for telemetry down). Uplink commands are sent at a 600 baud data rate, and downlink telemetry at a 300-baud rate. The various jumpers shown in Figure 6-3 are set for the type of link to be used.

The logic-level serial data from the UART in the 7601-C is converted to serial-data tones in the FSK generator on the 7601-C modem card. Logic one becomes a 2400-Hz tone, and logic zero a 2900-Hz tone. For TELCO transmission, these tones are transformer-coupled into a standard 600-ohm telephone line. For transmission over an STL, the tones are fed to the studio's SCA generator to modulate the subcarrier before it is applied to the STL transmitter. If the studio has no SCA generator, an optional SCA generator card must be used. The jumpers shown, are set to establish the appropriate path for the FSK signal.

At the remote site, the FSK signal is transformer-coupled into the FSK detector on the 7601-R modem card if transmission was over a telephone line; or demodulated in the optional SCA detector card and fed to the FSK detector if transmission was via an STL. The logic-level serial data from the FSK detector is applied to the 7602-R UART for serial-to parallel conversion.

On the telemetry downlink, the logic-level serial data from the 7601-R UART is converted to FSK tones (1200 Hz for logic one, 1500 Hz for logic zero). For TELCO transmission, the FSK signal is transformer-coupled into the same telephone line that was used for the uplink. For downlink transmission over the broadcast transmitter's subcarrier, the FSK signal is applied to the transmitter's SCA modulation input. If such an input is not available, the FSK signal must be routed through an optional SCA generator card.

If a TELCO downlink is used, the FSK on the telephone line is transformer-coupled (same transformer for up-link) at the control site into the FSK detector on the 7601-C modem card. If the broadcast transmitter is used for downlink communication, the SCA is demodulated by the station's SCA monitor; or, if a monitor is not available, by an optional SCA detector card. The FSK signal is then fed to the FSK detector. The FSK detector output is the logic-level telemetry signal; it is applied to the RI input of the UART in the 7601-C.

The data at UART terminal RX3 is loaded into shift register U33. The UP shift register bits 1 and 8 should be the same level, and the DOWN bits 2 and 7 should be the same level. These are compared in the up/down control circuits; if they agree, the UP and DOWN control signals are fed through to the UP and DOWN relays. If the LOCAL MODE button on the 7601-R is pressed, the multiplexer will deliver UP and DOWN control signals from front-panel UP/ON and DOWN/OFF switches instead of the signals from shift register U33.

The logic level at RX8 is a zero for the first seven bits, and a one for the eighth bit to identify the end of the command word. This produces a latch, which clocks the channel select word into register U38/U39, and also the UP and DOWN control signals from the UP/DOWN control circuit. The end-of-word bit is also applied, together with control timing pulses, to the control failsafe circuit. If either or both of these inputs fail to appear for a period of 20 to 55 seconds (adjustable), the control failsafe circuit detects this condition and deenergizes the control failsafe relay. The relay contacts are brought out to the rear-panel CONTL FAILSAFE terminals for control of the transmitter.

The relay logic circuit decodes the 4-bit channel select word to energize the relay (1 of 10) on the relay board that corresponds to the channel selected. Each relay has three pairs of contacts. One pair is connected to a pair of terminals corresponding to the rear-panel TELE +/-strip; thus the telemetry analog voltage applied to that pair of terminals will be sent to the A/D converter for transmission back to the control site in digital form when that particular channel is selected.

A second pair of contacts within the same relay connects the rear-panel UP A and B terminals for that channel to the UP relay; thus if the UP bit in the command word is a logic one for that channel, the energizing of the UP relay will place a short across that channel's UP A and B terminals. The DOWN circuit operates similarly.

The analog voltage for the selected channel is fed from the relay card to the A/D converter, and the resulting digital data is stored in a register. The 12 bit BCD register output (four bits for the three digits) is applied to shift registers U24 and U25. The register output also drives the 7601-R TELEMETRY DATA display when the LOCAL MODE button is pressed.

Four channel-select bits from the 2-to-1 multiplexer are applied to shift register U26. The UP verification bit and the DOWN verification bit from the UP/DOWN control circuit are applied to the input of shift register U26. The shift registers are loaded and then their bits are shifted into UART terminals TX1 through TX3 as described in Section 4.1.1. The data from the optional Status Board and the output of the end-of-word shift register are also shifted into the UART. The resulting serial output is fed from the UART's TRO terminal to the FSK modem for transmission to the 7601-C at the control site.

4.1.4 The optional Model 7601 Status Monitoring System is used to expand the on/off status indication capability of the Model 7601.

At the 7601-R, status inputs, which can be contact closures or TTL inputs, are introduced through the rear panel STATUS terminals. After inversion and buffering, they are applied through display drivers to the front panel STATUS display LEDs. The status inputs are also applied to the parallel inputs of two shift registers. Each shift register handles eight bits. The serial outputs of the shift registers are routed to the D11 and D12 inputs to the 7601-R UART.

From the 7601-R UART, the data is sent over the communication link to the 7601-C, where the 7601-C UART delivers it in serial form to the 7601-C Status Board over D01 and D02, (Figure 6-4-1). The data goes through another double-compare process. If the data bits compare, the data will be clocked into the holding register and fed through drivers to the front panel STATUS LEDs.

4.2 7601-C Mother Board. (Figure 6-1-3)

4.2.1 Transmit Circuits.

Inputs from the front panel UP/ON, DOWN/OFF, and CHANNEL SELECT switches enter through J10.

The data is parallel loaded into shift registers U11, U12, and U13. U11 takes the DOWN bit at pins 5 and 12, and UP bit at pins 11 and 6. The channel bits are loaded into both U12 and U13 for redundancy to improve reliability. A TELE FAIL bit from the telemetry fail circuitry (described later) is also applied to U12 and U13.

The transmit inputs (TX1 through TX8) of UART U17 comes from the serial outputs of shift registers U10 through U13. The THRL input to the UART, which is generated by U16, loads the outputs of the shift registers in the UART at a 3Hz rate. Shift register bit H is the first to be loaded into the UART (see top row of Table 4-1). When the transmitter register is empty, the TRE output of the UART will deliver a pulse to the THRL input to load the next outputs of the shift registers (second line of Table 4-1). However, at the end of the eighth loading, shift register U10 will produce a logic 1 output from its A input, and this will set flip-flop U15 and turn off gate U27, preventing another loading. When U16 clears U15, UART loading can again start. After each parallel loading of the UART, the data is clocked out by the transmit clock at pin 40 of U17 and the data is delivered serially from pin 25 to the FSK modem through J4-10. Timing of the transmit cycle is shown in Figure 4-1.

Since the transmit rate for the data from the 7601-C to the 7601-R is 600 baud and the receive rate from the 7601-R to the 7601-C is 300 baud, two independent clocks are required by the UART. U5 is the clock generator, and it operates at 9600 Hz. Divider U6 provides a 4800 Hz output at pin 14, and a 600-Hz output at pin 11. The UART receive clock at pin 17 at U17 is normally connected through a jumper from pad B to pad F (near U6 in Figure 6-1-3) to the 4800-Hz output of U6-14. The UART transmit clock (pin 40 of U17) is normally jumpered from pad D to pad E to the 9600-Hz output of U21.

#### 4.2.2 Receive Circuits.

Serial data from the 7601-R enters the 7601-C Mother Board through pin 8 of J4 and is shifted into the UART through its RI terminal. After loading, the UART sets its DR line high. This feeds through U24-3, U27-8, and U31-12 to the shift clock inputs of shift registers U23, U25, and U26; it also provides a shift pulse to the STATUS option (when installed) through pin 9 of J8. The data from RX1 through RX8 of the UART is shifted into the shift registers as described in Section 4.1.1.

After all the shift pulses are received, a sync pulse is received from pin 5 of U17. The sync pulse is ANDed with a pulse derived from pin 5 of U17. U17 is programmed for add parity by a ground on pin 39; if parity of the received data word is even (parity error), pin 13 will go high. Likewise, if there is no valid stop bit, the framing error output (pin 14) will go high. If there is no parity error or framing error, U19 will not be set, and the  $\bar{Q}$  output of U19 will be high. ANDing this with the pulse from U24-8 produces a latch pulse, which is delivered through inverter U28-2 and inverter-drivers U28-8 and U30-6 to the Display Board for latching the received data into the display registers and optional external BCD OUT. The latch pulse is also used for the following purposes:

- a. It clocks the polarity data bit into U19-5 for the display.
- b. It is sent through inverter-driver U28-10 to the STATUS option to latch the received data into registers there.
- c. It is applied through emitter follower Q2 to the base of switch Q1. C27 charges through R38, but as long as latch pulses are received regularly, Q1 will prevent C27 from fully charging. If, however, latch pulses are not received for a period of approximately 10 seconds, C27 will charge to +5 volts and thus apply a logic 1 through U29-3 as a TELE FAIL signal. This signal is fed to the display for driving the TELE FAIL LED. The TELE FAIL output of U29-3 is also sent to shift registers U12 and U13 for incorporating into the data transmitted to the 7610-R, and to TELE FAIL terminal J12 on the rear panel of the 7610-C.
- d. It clocks the received UP and DOWN data from pins 13 and 12 of shift register U23 into flip-flops U22-9 and U22-5 for driving the front panel UP and DOWN verification lamps through the open-collector drivers in U20.

#### 4.2.3 Communication Link Switching.

U14 is an amplifier for the transmitted FSK from the modem. Its gain is adjusted by R29 for an output of 0 dBm into 600-ohm transformer load. T1 is the TELCO transformer, used for both uplink transmission and downlink reception.

#### 4.2.4 Power Supply.

The primary of power transformer T2 is normally wired for 115-volt operation as shown in Figure 6-1-3, but can be wired for 230 volts on special order. Full-wave rectifier CR2/CR4 with regulator U1 and filter capacitors C11 and C12 supplies regulated +12 volts DC to the 7601-C Mother Board and connected boards. Full-wave rectifier CR1/CR3 with regulator U2 and filter capacitors C13 and C14 supplies -12 volts DC to the 7601-C Mother Board and connected boards. Full-wave rectifier CR5/CR6 supplies DC voltage to regulators U3 and U4. The +5V output of U3 is used for 7601-C Mother Board circuits, and the +5V output of U4 goes to the Display Board.

#### 4.3 7601-C DISplay Board. (Figure 6-1-4)

U1 through U6 are combined latches and BCD decoders. The latches serve as holding registers for the received data from the 7601-C Mother Board, and the decoders drive the seven-segment displays DS5 through DS7. The latch pulse for the latches comes from the 7601-C Mother Board through pin 4 of J2.

DS5 through DS7 are the TELEMETRY DATA displays; DS5 is the most significant digit and has a maximum count of 9. The segment lettering for DS5 is typical for all the seven-segment displays, and is explained in the lower portion of the diagram.

#### 4.4 7601-R Mother Board. (Figure 6-2-3)

##### 4.4.1 Receive Circuits.

When the TELCO communication option is selected, the FSK control signal from the 7601-C enters the 7601-R Mother Board through pins 2 and 3 of J11 (Sheet 1 of Figure 6-2-3). It is fed through T1 and jumper 6 (which will be jumpered--see Table 2-1) to pin 11 of J8. From here, the signal goes to the FSK Modem Board, where it is converted to a TTL-level signal (see Section 4.8) and returned through pin 8 of J8 to the receiver in (R1) terminal of UART U28 (Sheet 2 of Figure 6-2-3). If an SCA communication option is selected, the received signal at rear panel CONTROL IN connector J18 will be detected on the SCA Board (see Section 4.9) and routed through jumper 7 and pin 11 of J8 through the FSK Modem Board to the R1 terminal of the UART.

The UART processes the data as described in Section 4.1.2 U31, U32, and U33 are shift registers for the data out of the UART. The UP/DOWN information in U33 is processed by U36, U64-4, and U64-2 to ensure that both UP command bits or both DOWN command bits have been received, but not UP and DOWN commands simultaneously. If both UP bits are received, a logic 1 is delivered to pin 6 of U39. If both DOWN bits are received, a logic 1 is delivered to pin 11 of U39.

#### 4.4.1

#### Receiver Circuits Continued.

The contents of U32 and U31 (channel select information) are compared in U34 and U37. If they compare, a logic 1 is delivered by pin 3 of U37 (Sheet 3 of Figure 6-2-3) to AND gate U61-10 to gate through the sync pulse from RX8 of the UART at pin 6 of U61. When the site compare is high (see preceding paragraph), the sync pulse will be gated through U61-11, to be used as the clocklatch pulse for register U38/U39. The inputs to U38 will be the six most significant bits of the channel select word. The output at U39-2 will be the least significant bit of the channel select word, the TELE FAIL bit at U39-5; the UP command bit at pin 7; and the DOWN command bit at pin 10. When the RX8 sync pulse is received, the channel select word is applied to 2-to-1 multiplexers U40 and U41.

When LOCAL MODE pushbutton S3 is depressed, +5V is applied to pin 1 of U40 and U41 to cause these multiplexers to select their B inputs, which come from the 7601-R front panel CHANNEL SELECT switches. When S3 is not depressed, the multiplexers select their A inputs, which are the channel select bits from register U38/U39. The selected multiplexer outputs are applied through CMOS-to-TTL buffers U46 and U47-11, to the 7-bit register consisting of U48 and U50-9. U49, U52-6, U45-11, and U45-6 constitute a 7-bit digital comparator for the purpose of detecting a change in channel selection. If there is no compare (U45-6=high level), flip-flop U50-5 will become set by a 2400Hz clock signal from U45-8. With U50-5 set, U50-6 will be low (Logic 0) and so the Enable signal from U45-3 will be high. This will cause the channel relay which had been selected to be deenergized. Also when U50-5 becomes set (high out), the 4 bit counter U51 will be enabled to count up to 1111 (15 count). At a count of 1111, U51-15 will provide a positive pulse which will clock the inputs of U48 and U50-9 into these registers. U45-6 should now provide a compare (low level). U50-5 will be reset with the next positive edge 2400Hz clock signal and thus clear and disable counter U51. The enable signal at U45-3 will now be low to allow the new relay to be selected. The circuitry just described provides approximately 12 milliseconds of relay deenergizing time before a new relay can be selected in the 7601-R.

The four bits of the least significant digit of the channel number out of register U48 are applied to decoder U55 to select (Logic 0) one of the 10 output lines corresponding to the selected channel number. The selected output energizes a relay for the selected channel on the Relay Board through one of the open-collector drivers U56 and U57.

The UP and DOWN bits at pins 7 and 10 of register U39 are applied to two open-collector drivers on U44. When not in local mode, these drivers are enabled, and select (Low Level) UP relay coil K1 (if the UP bit is high) or DOWN relay coil K2 (if the DOWN bit is high). When LOCAL MODE switch S3 is depressed, pins 2 and 7 of U44 are grounded to disable the drivers. The relays are then operated by the 7601-R front panel UP/ON or DOWN/OFF switches S1 and S2. The relay contacts are connected to the Relay Board through J1 to furnish UP or DOWN contact closures for the selected channel.



#### 4.4.1 Receiver Circuits Continued.

The TELE FAIL bit at pin 5 of U39 is applied to a driver on U58 to provide a +12V output at rear panel terminals when there is a failure of the downlink telemetry. U58 also drives a relay to provide contact closure at rear panel terminals when the 7601-R is in local mode.



When there is channel comparison, the end-of-word sync pulse at pin 8 of U61 is applied through amplifiers Q10 and Q9. As long as pulses are received, C42 will remain discharged and thus K4 will remain energized. If there is a failure in channel comparison or a failure to receive sync pulses for longer than 20 to 55 seconds (R58 Adjustable) K4 will deenergize and open its contacts, which are connected to the rear panel CONTL FAILSAFE terminals.

Basic 9600 Hz timing for the 7601-R is generated by U42. Its output is divided by counter U43 to give 4800 Hz, which is connected by a jumper from pad F to pad B to supply the UART receive clock. The UART's transmit (SEL) clock is normally jumpered to the 9600 Hz line.

#### 4.4.2 Transmit Circuits.

The selected telemetry analog voltage to be transmitted to the 7601-C enters the Mother Board at pins 1 and 14 of J1 or pins 2 and 14 of J3 (Figure 6-2-3, Sheet 3), and is fed to the input of U19 (Figure 6-2-3, sheet 2). U19 is the analog portion of an analog-to-digital converter (ADC), the digital portion of which is U12. Although the voltage across the TELE inputs is not more than 4 volts DC, the lines may be at a high voltage with respect to ground; so the circuitry associated with U19 operates against floating ground that is not connected to chassis or normal signal ground, and the inputs and outputs are made through optical isolators (U9, U10, and U11).

#### NOTE

Floating Ground is indicated by  rather than .

There are two control signals feeding U19, which come from U12--measurement cycle/zero cycle (M/Z) and UP/DOWN (U/D). The Analog to Digital Converter goes through a cycle in which it zeros itself out. Then it goes into a measurement cycle. U12 performs all the control. A 20,480 Hz clock from U13 is fed into U12. The UP/DOWN output of U12 controls a FET switch in U19 which switches between ground and a reference voltage set by Q5 and Q6. The output from the FET within U19 is summed with the analog input voltage and is applied to an integrator within U19. The output of the integrator is compared to a stored voltage from the previous zero cycles by a comparator with U19. The output of the comparator (U19-5) is used by a time base counter within U12 to accumulate a count proportional to the input voltage.

#### 4.4.2 Transmit Circuits Continued.

U15 through U17 constitute the output register from the A-D converter. U15 stores the least significant digit, the most significant digit. After a measurement cycle, U12 will have accumulated a net count in internal latches. U12 then multiplexes the BCD information out one digit at a time. The BCD data strobed into the four registers by outputs D1 through D3 of U12, in the following order: D1, D3, and D2. Data at the output of the registers stays the same until input data changes. The register outputs are supplied to shift registers U24 and U25, and are also fed to the 7601-R Display Board and will be displayed when the 7601-R is in local mode.

The M/Z output of U12, whose frequency is the clock frequency of 20,480 Hz divided by 6144 or 3.33 Hz, is also fed through Q1, U22-4, and a jumper from A to B to clear flip-flop U29 and to load UART U28. B is jumpered to C for a special option. The pulse is also used to load the parallel data from registers U15 through U17 into shift registers U24 and U25, and to load STATUS shift registers, when used. Shift register U26, which is also loaded by the resulting M/Z pulse, is used to convert the channel verification data from multiplexers U40 and U41 and the UP/DOWN verification data from U65-2 and U65-4 to serial data for the UART (Figure 6-2-3, Sheet 2) (Channel 1 verification actually goes to U25). The three shift registers feed TX1, TX2, and TX3 or the UART. TX4 through TX7 are fed by the STATUS Option, when used. U27 generates the sync pulse for TX8. Operation of the UART is described in Sections 4.1.1 and 4.1.2. Its serial output from pin 25 is routed through the closed second switch of switch assembly S1 (Figure 6-2-3, Sheet 1) to the FSK Modem Board.

#### 4.4.3 Communication Link Switching.

U8 is the output amplifier for the TELCO link or for the input to an optional SCA Generator. T1 is the TELCO line transformer, for both transmitting and receiving.

#### 4.4.4 Power Supply.

The primary of power transformer T2 is normally wired for 115 volt operation as shown in Figure 6-2-3, Sheet 1, but can be wired for 230 volts on special order. Full-wave rectifiers with regulators provide all the outputs, except that one 12 volt output (+12 VX, for the relays) and a +9V output are regulated. The floating outputs (+5 VF, +12 VF, and -12VF) are for the floating A-D circuitry shown on Sheet 2 of Figure 6-2-3.

#### 4.5 7601-R Display Board. (Figure 6-2-4)

DS3 through DS5 are the 7-segment displays. They are driven by BCD data from the 7601-R Mother Board via decoders U2 through U4. The decoders are enabled by a +5V level at pin 9 of J2 when the 7601-R front panel LOCAL MODE switch is depressed.

#### 4.6 7601-R Relay and Barrier Strip Boards. (Figure 6-2-5)

The Relay Board contains the ten relays for the ten channels to be selected. All relay coils are supplied with +12 volts, and the selected coil is effectively grounded in the 7601-R Mother Board. Each relay has three pairs of contacts -- one for UP/ON control, one for DOWN/OFF control, and one for telemetry analog voltage input. R1 through R10 are the analog voltage calibration potentiometers.

The Barrier Strip Board plugs into the Relay Board and furnishes the rear panel terminals for output control contact closures and input telemetry analog voltages.

#### 4.7 Modem Block Diagram Discussion (Figure 6-1-8)

The transmit logic divides the 1-MHz crystal oscillator output down to the transmit mark and space frequencies. Selection of mark or space is made by the TTL transmit data input from the UART located on the associated mother board. The output of the transmit logic is a square wave at either the mark or space frequency. A low-pass filter attenuates the harmonics and so converts the square wave to a sine wave, which is fed to the hybrid circuit.

The receive bandpass filter attenuates the local transmit tones and all out-of-band signals. The in-band received signal from the bandpass filter is checked for proper level and then converted to pulses for the digital discriminator. The discriminator checks for carrier and proper tones. The TTL output of the discriminator is fed into the UART on the mother board.

The discriminator can operate on an SNR of 10 dB or better. The carrier detection feature of the digital discriminator prevents triggering on noise or random pulses.

The output levels of both the remote and control modems are -6dBm across 600 ohms. This lower output level prevents overload of the TELCO line. Sensitivity is 30 dB below the -6 dBm transmit level.

U19, Y1, and R61 form a 1-MHz crystal oscillator. The square-wave output goes from U19-11 to divider U20. The divider outputs marked A ( $\div 1$ ), B ( $\div 4$ ), C ( $\div 16$ ) and D ( $\div 32$ ) are ANDed in U15-3, -10, and -4 to divide the 1-MHz clock by 53, producing a pulse train with a PRF of 18,868 Hz.

When the TTL transmit data from the 7610/7601R UART is low at the base of Q1, the level at pin 12 of U15 will be high, gating the 18,868-Hz signal through to pin 12 of U14. The other input of U14 is a 15,625-Hz pulse from the E ( $\div 64$ ) output of divider U20. So when the TTL input from the UART is high, the output at U14-10 will be the 15,625-Hz pulse, and when the TTL level is low, the U14-10 signal will be the 18,868-Hz pulse.

The U14-10 output sets the latch consisting of U14-4 and U14-3. The latch is set every 53rd or 64th clock pulse, depending on the TTL input, and is immediately reset by the next 1-MHz clock pulse from U19-11. The resulting short pulse from the latch is used to reset divider U20, and also to toggle divider U13, which divides the latch pulse frequency by 16 to give either a 1180-Hz (TTL input low) or 980-Hz (TTL input high) square-wave output. A low applied to J1-3 will cause Q2 to apply a high to pin 1 or U13 to disable it and thus turn off the FSK generator.

The output at U4-10 will be a negative pulse for each transition of the received square-wave. The pulses are inverted by U7-4, and gated out of U6-11 as long as the received signal level is satisfactory. These pulses, occurring every half cycle of the received FSK signal are called CLP.

The CLP pulses are applied to a digital discriminator consisting of U1, U2, U3, U4, and U7-6. The 1 MHz clock from U19-11 is divided by counters U1 and U2. The A' ( $\div 16$ ), C' ( $\div 64$ ) and D' ( $\div 128$ ) outputs are ANDed in U3-10 and U3-11 to provide a set pulse to pin 2 of flip-flop U4-3/U4-11 every 208 counts. The A' ( $\div 16$ ), B' ( $\div 32$ ), and E' ( $\div 512$ ) outputs are ANDed by U3-4 and U3-3 to provide a reset pulse to pin 12 of the flip-flop every 560 counts. The reset pulse also resets counters U1 and U2. Thus, in the absence of a received FSK signal, the flip-flop will generate a window (high output) starting at 208 counts after counter reset and ending at 512 counts.

If a CLP input is received at pin 6 of U4 during the window, it will reset the flip-flop and the counters. This will start the generation of the window at 208 counts after reset. If the received FSK signal is 2315 Hz, the next CLP pulse will be received at 216 counts after reset, so that it will be 8 counts into the window when it resets the counters and flip-flop. If the received FSK signal is 1736 Hz, the CLP will reset the counters and flip-flop 80 counts into the window. Thus the 2315-Hz signal will produce a short (8-us) pulse at U4-11, and the 1736-Hz signal will produce a long (80-us) pulse.

If the CLP is received outside the window, no output pulse is produced. When the CLP pulse is received, it also clocks flip-flop U5 to give a carrier indication which enables the output.

The FSK square wave out of U13 is converted to a sine wave by the low-pass filters consisting of U8-7, U8-1 and associated components, and this FSK signal is delivered to the line amplifier on the 7610R/7601R mother board, from where it is fed through a line transformer to the telco line. Since the same line is used for transmitting and receiving, the hybrid consisting of U8-8, U8-14, and associated components is used to separate the received signal from the transmitted signal. The received signal at the line transformer together with the transmitted signal is brought into pin 9 of U8. The generated signal at the same level as the transmitted signal at pin 8 of U8 also appears at pin 14 of U8, but 180 degrees out of phase. Thus the level of the transmitted signal at the junction of R13 and R14 is zero, and only the received signal is fed out of U9-7.

The received signal at one-half the FSK input level is applied to the bandpass filter consisting of U10, U12, U16-1, and associated components to eliminate any unwanted signals. It is then fed through amplifier U16-7, having a gain of 27, to the level detector consisting of U17-7, Q3, U7-12, and associated components. The output at U7-12 will be a low if the received signal is not present or is too low for satisfactory operation.

The received signal sinewave output from U16-7 is also fed to the squaring amplifier consisting of U18-6, U7-8, U7-10, and associated components. The outputs at pins 8 and 10 of U7 are complementary square waves with the same frequency as the received signal. The square wave from U7-8 is applied through differentiating circuit C18/R44 to produce a short pulse at pin 8 of NOR gate U4 on every positive-going transition of the square wave. C19 and R45 perform the same function for the inverted square wave. Therefore the output of U4-11 is fed to an integrator (U11 with associated components), which converts the short (2315-Hz) pulses to a high dc level. The integrator output is fed to pin 10 of U11, a comparator. The other input to the comparator is normally at ground. The comparator output will be a negative voltage when the integrator output is low, and a positive voltage when the integrator output is high. These outputs are double-inverted to TTL levels by Q5 and Q4 to feed the UART. A 1736-Hz signal provides a logic 1 output; a 2315-Hz signal provides a logic 0.

This board operates in essentially the same way as the Modem Board R except that full-cycle detection is used on the C Board rather than half-cycle detection.

The 1-MHz crystal oscillator (U1-4, U1-3, Y1) is divided in U2 to provide the following outputs: A2 ( $\div 1$ ), B2 ( $\div 2$ ), C2 ( $\div 4$ ), D2 ( $\div 8$ ), E2 ( $\div 16$ ), and F2 ( $\div 32$ ). The input at U3-13 is a 37,037-Hz pulse which is gated through U3-11 when the TTL transmit input from the UART at J1-10 is low. The output of U3-3 is a 27,778-Hz pulse. So latch U4-4/U4-3 is set by whichever output is present at U4-10, and is immediately reset by the next 1-MHz clock pulse.

The pulsed output of U4-3 is divided by 16 and converted to a square wave by flip-flop U5. The square wave is fed through the bandpass filter consisting of U6-7, U6-1, and associated components, and is then fed to the line amplifier and line transformer on the 7601C/7610C mother board. The FSK output frequencies are 2315 Hz when the transmit TTL input is logic 0, and 1736 Hz for a logic 1 input.

The hybrid (U16-14, U6-8, U7-7, and associated components) operates the same as the modem R hybrid.

The received FSK signal out of U7-7 goes through a bandpass filter (U8-1, U9-1, U9-7 and U10-1) and an amplifier (U10) with a gain of 75. U18 is a comparator that converts the sine wave form U10-7 into a square wave. Differentiating circuit C23/R40 produces a pulse for every positive-going transition of the square wave (full-cycle detection). After double inversion by U11-4 and U11-12, this pulse is fed into the window detector, which operates the same as the modem R window detector except for clock divide ratios.

The integrator (U17-7, R53, C31, and associated components), the comparator (U17-8), and the level translator (Q3/Q4) are the same as those in the modem R. The TTL output at the collector of Q4 is logic 1 for a 980-Hz received FSK signal and logic 0 for a 1180-Hz signal.

#### 4.10 SCA Generator and Detector Board. (Figure 6-1-6)

This board is used with both the 7601-C and 7601-R. All frequencies-determining components are factory selected for the customer's SCA frequencies in accordance with the table at the bottom of Figure 6-1-6. The upper portion of the schematic is the SCA detector. The SCA input at pin 12 of J1 is fed through a high-pass filter to the demodulator, U1. R3 adjusts the center frequency of the demodulator. The FSK output of U1 is fed through low-pass filter U2 to remove any high-frequency components of the SCA signal, and through amplifier U3 to the FSK Modem via pin 11 of J1.

The FSK input at pin 8 of J1 is applied to the SCA generator, U4, through R1, which sets the amount of frequency deviation (normally  $\pm 6\text{KHz}$ ). The FSK-modulated FM triangular wave signal from U4 is fed through low-pass harmonic filter U5 and amplifier U6 to the Mother Board, where it is routed to the rear panel CONTROL OUT connector (7601-C) or TELEMETRY OUT connector (7601-R). Potentiometer R2 allows adjustment of the output between 0 and 800 mv rms.

SECTION 5  
MAINTENANCE

WARNING

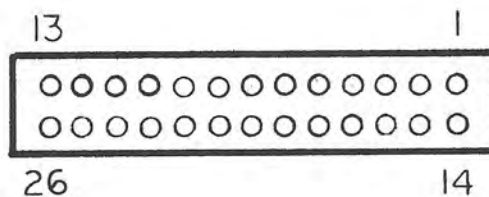
High voltages may be present when the 7601-R is connected to transmitter metering circuits. Disconnect the unit from the transmitter and use extreme caution when servicing.

5.1 General.

Since the Model 7601 uses solid-state circuitry and their power requirements are low, no maintenance problems due to high temperature should be encountered, provided the units are installed and well away from vacuum-tube and other heat-generating equipment. Likewise, because the operating voltages are low, excessive dust accumulation associated with high-voltage devices should not occur.

All integrated circuits and most other components are accessible by removing the top cover of the 7601.

Table 5-1 lists pin assignments for the 26-pin. The pin layout is shown below. A stripe on the flat cable identifies pin-1.



26-Pin Connector Head-On  
to Mother Board



## 5.2 Periodic Maintenance.

The only periodic maintenance required is cleaning. Once a year, or more often in dusty locations, blow off the dust from printed-circuit boards with compressed air.

## 5.3 7601-C Calibration Procedures. (If Required)

### 5.3.1 UART Clock Frequency.

The UART clock frequency can be checked by connecting a frequency counter to pin 17 of U17 on the 7601-C Mother Board. The frequency should be 9600 Hz  $\pm$ 100 Hz. If it is not, adjust R2.

### 5.3.2 TELCO Output Level.

The FSK generator output level from the 7601-C TELCO terminals on the rear panel should be 0 dBm (2.2 volts p-p) when terminated with either a 600-ohm load or the phone line. If there is minimal attenuation over the phone line between the 7601-C and 7601-R, measurement of output level should be made with the 7601-R end output disabled. Disabling may be accomplished by removing the phone line at one end and connecting a 600-ohm resistor across the output to be adjusted.

If it is not desirable to disconnect the phone line in order to disable the output from the 7601-R Mother Board, an alternate method of disabling is to remove the 7601-R FSK Modem Board.

The TELCO output level can be adjusted by means of R29 on the 7601-C Mother Board.

## 5.4 7601-R Calibration Procedures. (If Required)

### 5.4.1 UART Clock Frequency

The UART clock frequency can be checked by connecting a frequency counter to pin 2 of U43 on the 7601-R Mother Board. The frequency should be 9600 Hz  $\pm$ 100 Hz. If it is not, adjust R47.

### 5.4.2 ADC Clock Frequency.

The ADC clock frequency can be checked by connecting a frequency counter to pin 3 of U13 on the 7601-R Mother Board. The frequency should be 20,480 Hz  $\pm$  150 Hz. If it is not, adjust R32.

### 5.4.3 ADC (Analog to Digital Converter) Full-Scale Reading.

a. Connect a voltage of not more than 3 volts dc to an unused pair of terminals on the TELE barrier strip at the 7601-R rear panel.

b. Connect an accurate voltmeter across the same pair of terminals.

5.4.3 ADC (Analog to Digital Converter) Full-Scale Reading.  
(Continued)

c. On the 7601-R front panel, turn the calibration potentiometer fully clockwise for the channel being used for the measured input.

d. With the 7601-R in local mode, observe the TELEMETRY DATA display. It should agree with the voltmeter reading,  $\pm 3$  count (3mv). If it does not, adjust R21 on the 7601-R Mother Board.

5.4.4 Control Failsafe Delay.

To check the operation of the control failsafe circuit, remove any connection to the FAILSAFE CONTL terminals on the rear panel and connect an ohm meter across the two terminals. A short should be indicated. Then disconnect the telephone line at the rear panel TELCO terminals. The ohm meter should indicate an open circuit after a delay of 10 to 55 seconds. The time delay can be adjusted within the range of approximately 10 to 55 seconds as desired by means of R58 on the 7601-R Mother Board.

5.4.5 TELCO Output Level.

The FSK generator output level from the 7601-R TELCO terminals on the rear panel should be 0 dBm (2.2 volts p-p) when terminated with either a 600-ohm load or the phone line. If there is minimal attenuation over the phone line, between the 7601-R and 7601-C, measurement of output level should be made with the 7601-C end output disabled. Disabling may be accomplished by removing the phone line at one end and connecting a 600-ohm resistor across the output to be adjusted.

If it is not desirable to disconnect the phone line in order to disable the output from the 7601-C Mother Board, an alternate method of disabling is to remove the 7601-C FSK Modem Board.

The TELCO output level can be adjusted by means of R4 on the 7601-R.

5.5 FSK Modems.

5.5.1 7601-R FSK Modems.

Evaluation in the field to determine if the modems are failing can be made by using a high impedance Voltmeter and an oscilloscope.

Modem"R"

U19-11

1MHz square wave  $\geq 11V$  peak to peak

Transmit Section

U13-1

$\leq .5$  Volt DC

5.5.1.1 Modem "R" Continued

U8-1 Approx. 1.2 V Peak to Peak Sine Wave with 600 ohm resistor across Telco output.

U9-7  $\leq 100$  mV peak to peak of local transmit signal. Adjust R4 on 7601R/7610R mother board for minimum signal.

Receive Section

U7-13  $\leq 1$  volt DC

U7-10  $\geq 11$  volt square wave (FSK tones)

U7-2  $\leq .5$  volts DC when receiving data

J1-8 TTL DATA to UART receive data

If any of these parameters do not comply with data given here please contact the factory for further assistnace.

5.5.2 Modem C

U1-11 1 MHz square wave 11 volts p-p

Transmit Section

U5-1  $\leq .5$  volts dc

U6-1 Approx. 1.2 volts peak to peak sine wave with 600 ohm resistor across Telco output.

U7-7  $\leq 100$  mV peak to peak of local transmit signal. Adjust R29 7601C/7610C mother board for minimum signal.

Receive Section

U11-2  $\leq 1$  volts dc

U11-8  $\geq 11$  volts square wave (FSK tones)

U11-2  $\leq .5$  volts dc when receiving data

J1-8 TTL data to UART receive data

If any of these parameters do not comply with data given here please contact the factory for furthur assistance.

## 5.6 SCA Generator and Detector.

### 5.6.1 SCA Deviation (7601-C/7601-R) .

The FM deviation is set by R1 on the SCA Generator and Detector Board. This is a factory adjustment and should not be readjusted in the field unless appropriate FM deviation-measuring equipment is available. Specified deviation is normally  $\pm 6\text{kHz}$ .

### 5.6.2 7601-C SCA Detector Frequency

This frequency is adjusted with the SCA Generator/Detector Board operating in the system. Proceed as follows:

- a. Remove jumper S1-2 on the 7601-C Mother Board. (See Figure 6.1.2)
- b. Ground pin 12 of the SCA generator and Detector Board to a nearby ground.
- c. Connect a frequency counter to pin 4 of U1 on the SCA Generator and Detector Board, and adjust R3 for the specified center frequency.
- d. Remove the ground and replace jumper S1-2.

### 5.6.3 7601-C SCA Generator Frequency and Output Level.

To adjust the frequency and output level with the SCA Generator/Detector Board operating in the system, proceed as follows:

- a. Remove U14 on the 7601-C Mother Board.
- b. Ground pin 8 of the SCA Generator and Detector Board to nearby ground.
- c. Connect a frequency counter to pin 4 of U4, and adjust R4 for the specified center frequency.
- d. Adjust output level potentiometer R2 to meet the requirements of the external equipment, as measured at pin 9 of the SCA Generator and Detector Board or at rear panel SUBCARRIER CONTROL OUT connector, J13.
- e. Remove ground and reinstall U14.

### 5.6.4 7601-R SCA Detector Frequency

This frequency is adjusted with the SCA Generator/Detector Board operating in the system. Proceed as follows:

- a. Remove the BNC cable connected to 7601-R rear panel J18.

5.6.4 7601-R SCA Detector Frequency Cont.

- b. Ground pin 12 of the SCA Generator and Detector Board to a nearby ground.
- c. Connect a frequency counter to pin 4 of U1 on the SCA Generator and Detector Board, and adjust R3 for the specified center frequency.
- d. Remove the ground and reconnect the BNC cable to 7601-R rear panel J18.

5.6.5 7601-R SCA Generator Frequency and Output Level.

To adjust the frequency and output level with the SCA Generator/Detector Board operating in the system, proceed as follows:

- a. Remove jumper S1-5 on the 7601-R Mother Board.  
(See Figure 6.2.2)
- b. Ground pin 8 of the SCA Generator and Detector Board to nearby ground.
- c. Connect a frequency counter to pin 4 of U4, and adjust R4 for the specified center frequency.
- d. Adjust output level potentiometer R2 to meet the requirements of the external equipment, as measured at pin 9 of the SCA Generator and Detector Board or at rear panel SUBCARRIER TELEMETRY OUT BNC connector.
- e. Remove ground and replace jumper on S1-5 on the 7601-R Mother Board.

**WARNING:**

There may be high voltage differences between voltages applied to the 7601-R rear barrier strip assembly and signals within the 7601-R itself. Care also must be taken in troubleshooting the system in its normal configuration because certain external control or monitoring functions may be activated or interrupted.

Before starting troubleshooting procedures, visually inspect the suspected unit, making sure all connectors and integrated circuits are securely in their sockets.

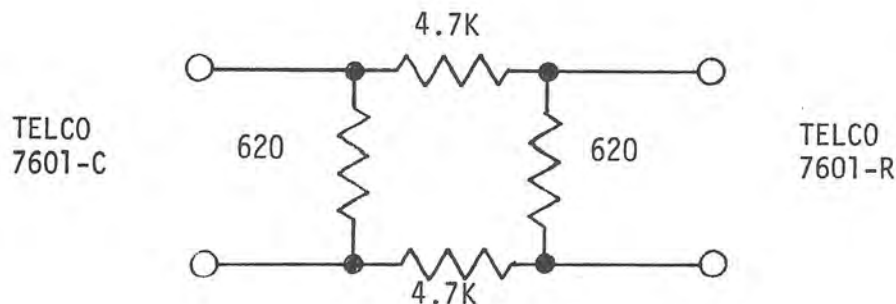
The following guide assumes that the 7601-C and 7601-R are connected together as a pair on the bench. This guide assumes that there are no external control or status connections made to the rear panels. Discretion should be used to whether connections should be removed from all pieces of equipment or to troubleshoot the equipment in place as installed. It certainly is desirable to isolate the problem to a general area before removal from the installation for further checkout on the bench. The problem in the 7601-R, for example, may be simple enough to repair in place.

**7601-C - 7601-R Interconnect Procedure**

The equipment to be analyzed for trouble should be interconnected as follows:

For Telephone Wireline (TELCO) Operation:

- a) Connect a twisted wire pair between the TELCO terminals on the Model 7601-C rear panel terminal strip J12 and the Telco terminals Model 7601-R rear panel terminal strip J17. If the telephone interface is questionable connect a 30db/600 ohm attenuator between the 7601-C and 7601-R as follows:



7601C - 7601R Interconnect Procedure Cont.

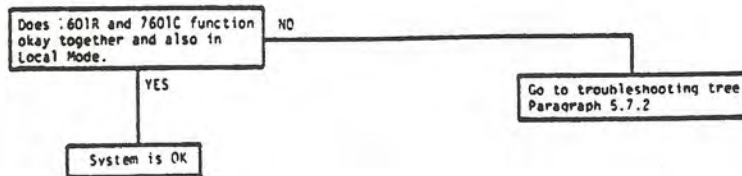
Downlink (SCA) operation and FM radio operation:

- a). Interconnect the CONTROL OUT connector J13 on the Model 7601-C to the Model 7601-R CONTROL IN connector J18.
- b). Interconnect the TELEMETRY IN connector J14 on the Model 7601-C to the TELEMETRY OUT connector J19 on the Model 7601-R.

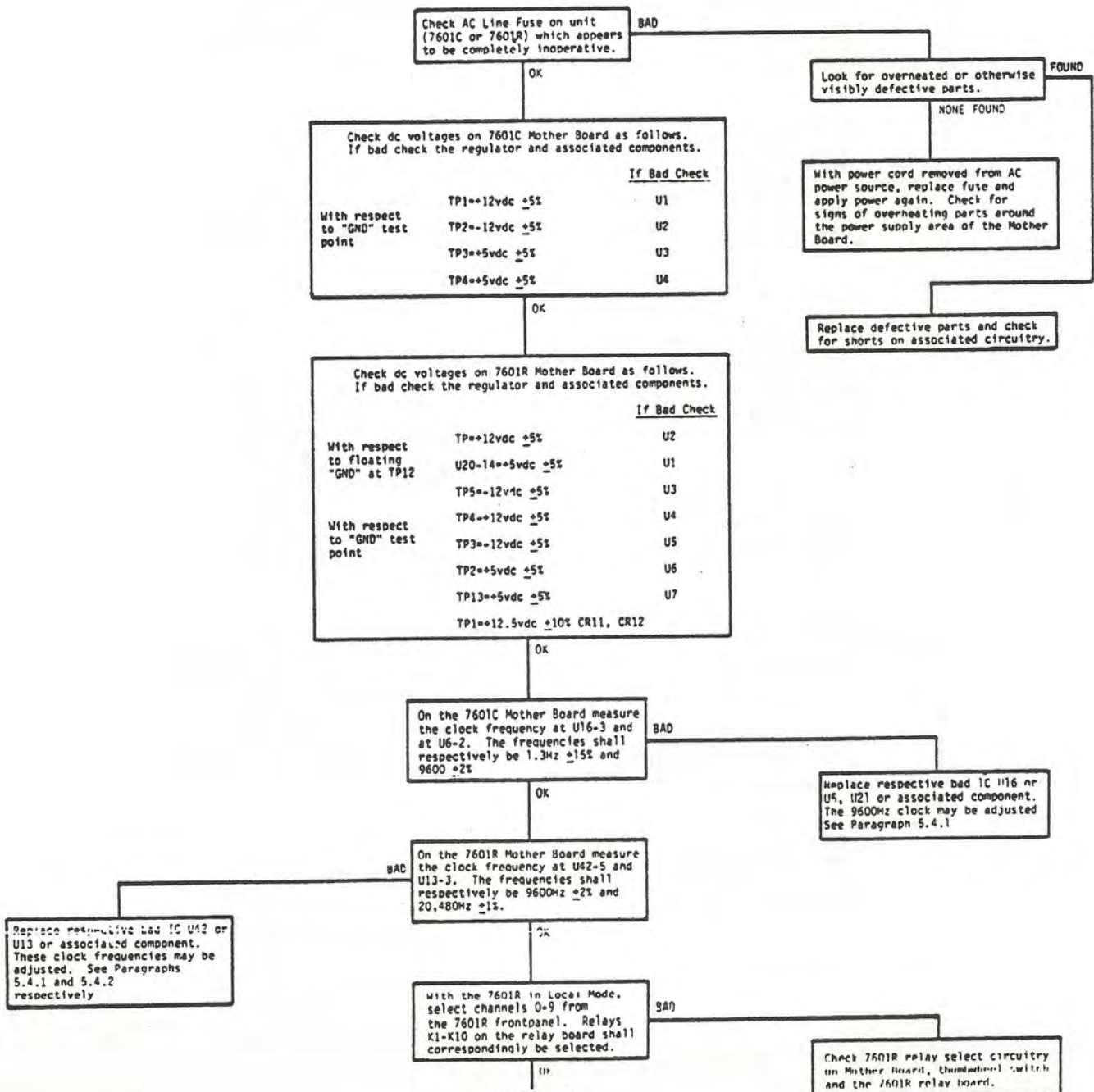
NOTE:

Communication link requires a SCA generator (modulator) and a corresponding SCA detector (demodulator) either included in the 7601 C/R or external to the 7601 C/R.

5.7.1 7601 C/R Does Not Work

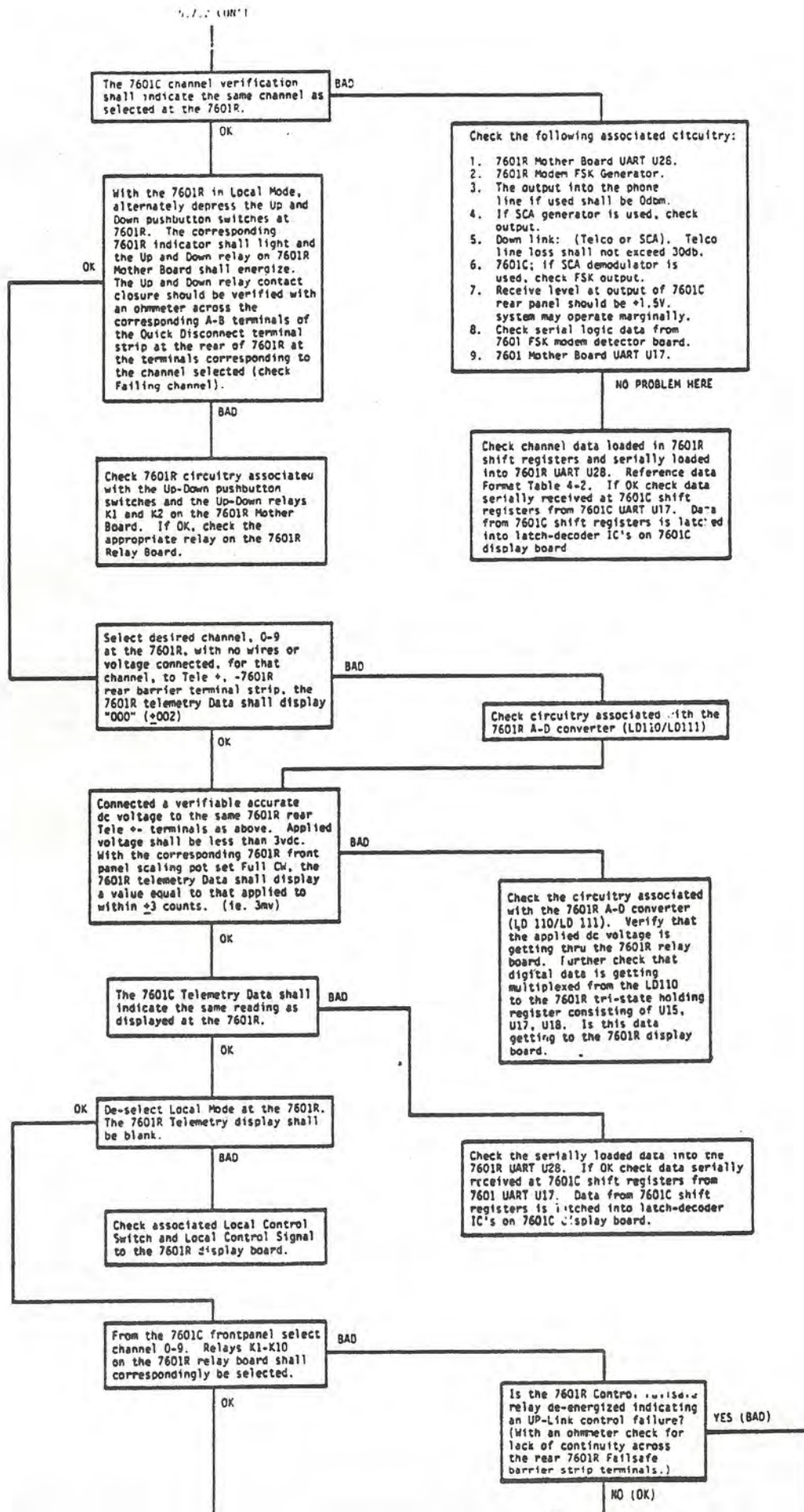


5.7.2 7601R and/or C Fails to Function Properly  
(Power Supply Checks)



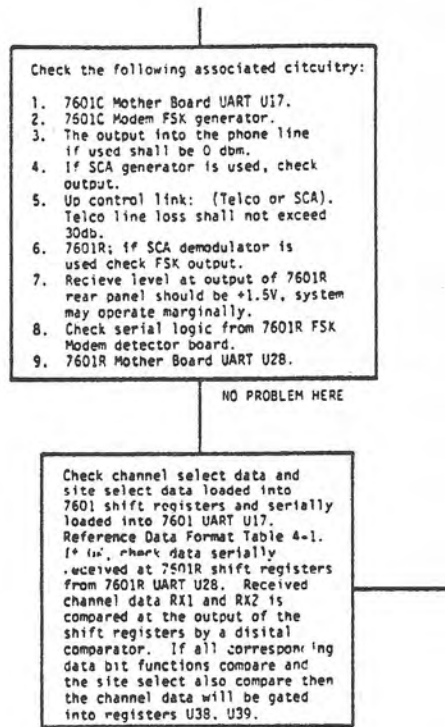
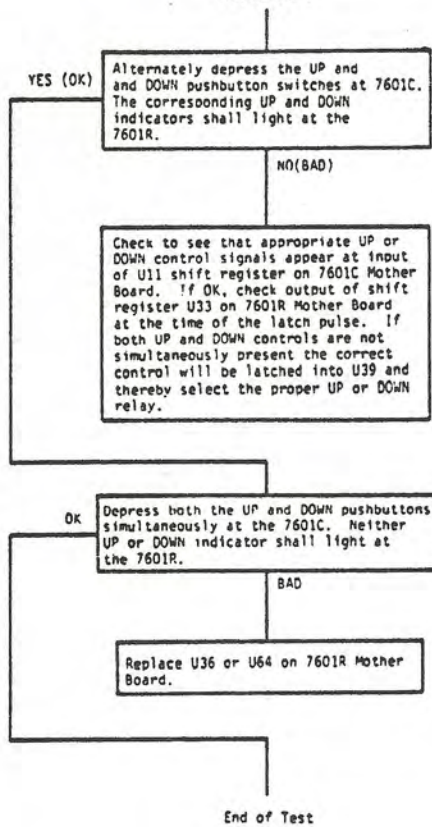
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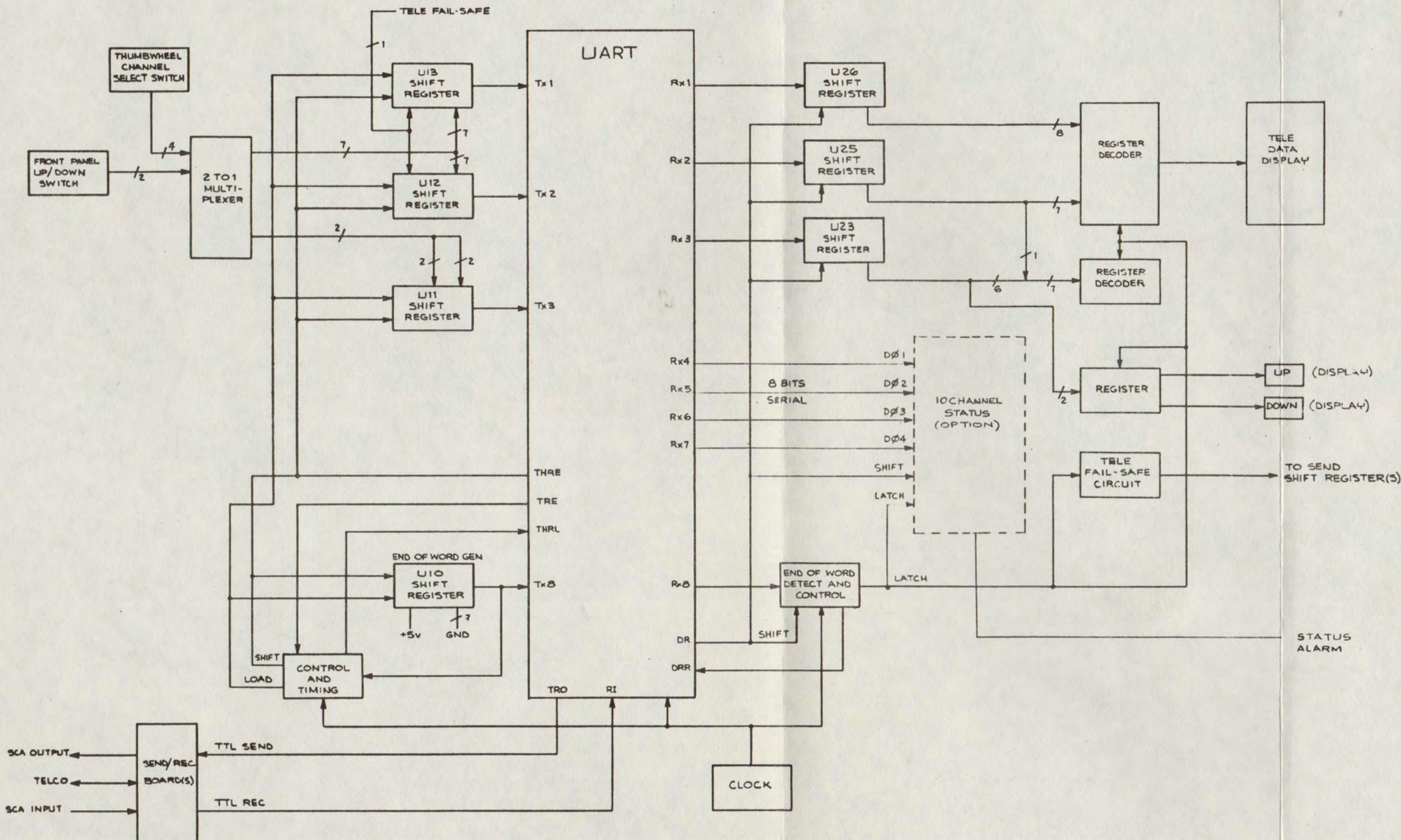


SEE NEXT PAGE

5.7.2 CONT



REV. NO.	DATE	DESCRIPTION	BY	CHEK	AUTH	DATE
1	4/17/77	REL FOR PUBLICATION	JT	JT		



SEE FIGURE 6-3  
BLOCK DIAGRAM  
7601 COMMUNICATION  
OPTIONS

FIGURE 6.1.1

ITEM NO.	QTY PER ASSY	SYM	DESCRIPTION	REF DES
			REMOVE ALL BURRS AND SHARP EDGES	
			TOLERANCES UNLESS OTHERWISE SPECIFIED	
			XXX ±	
			ANGULAR	
			DO NOT SCALE THIS PRINT	

DRAWN BY <i>Dr. Ray</i>	DATE 4/17/77	<b>TET</b> TIME & FREQUENCY TECHNOLOGY INC. 3000 Chant Dr. Santa Clara, California 95050 (408) 248-0300
CHK BY <i>JT</i>		
PROJ. ENGR.		TITLE BLOCK DIAGRAM MODEL 7601-C
SAFETY ENGR.		SIZE DRAWING NO. D 6600-1450
APPD <i>WVE</i>	DATE 4/17/77	REV A
SEC NO.		SCALE

NEXT ASSY		USED ON		REVISIONS			
SYM	DESCRIPTION	DR	CHK	AUTH	DATE		
3004-7601	7601C	A		Jdu	388	1/7/77	
B	J12 CONNECTION ADDED	JT	JTm	807	7/4/77		

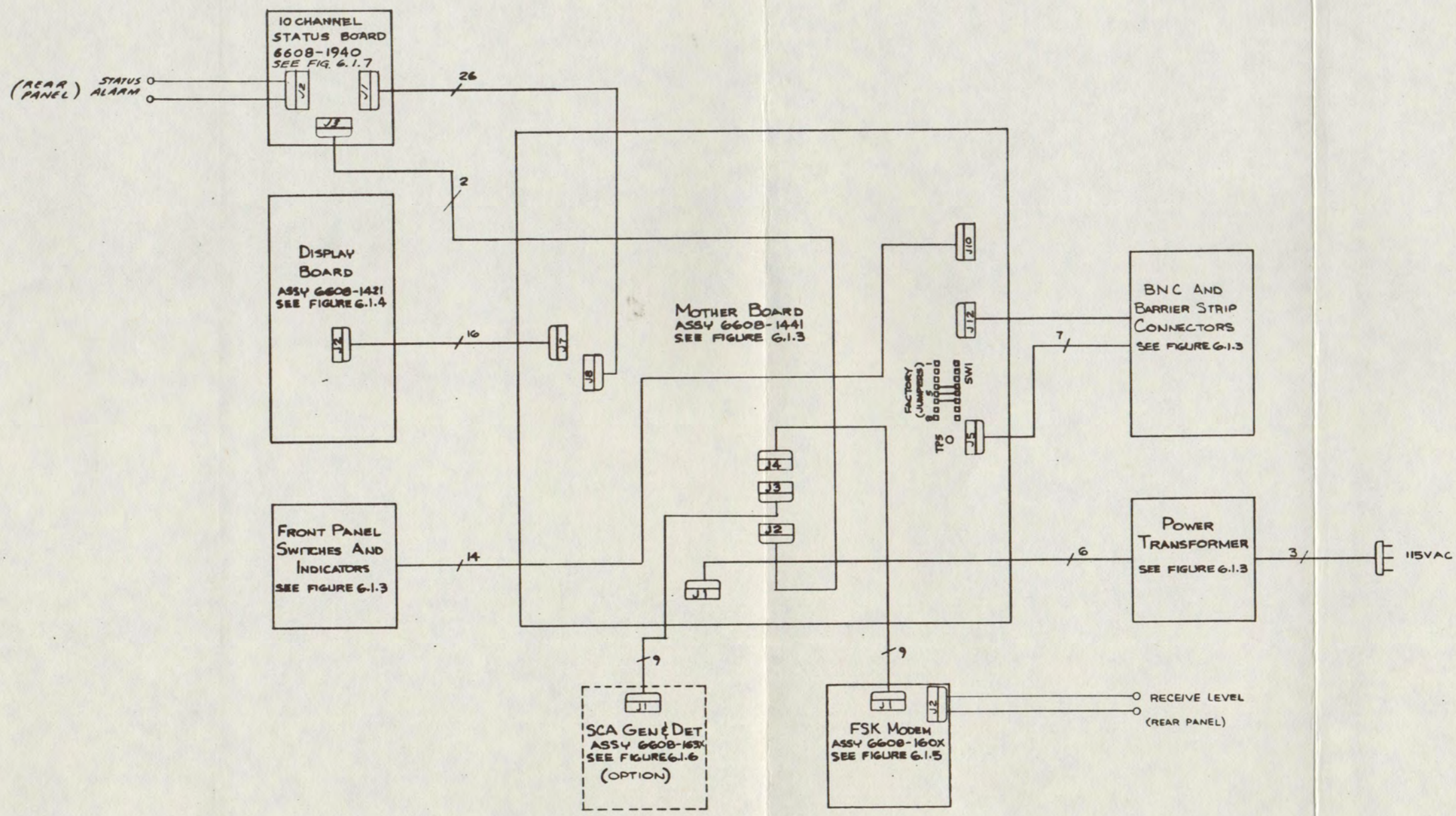
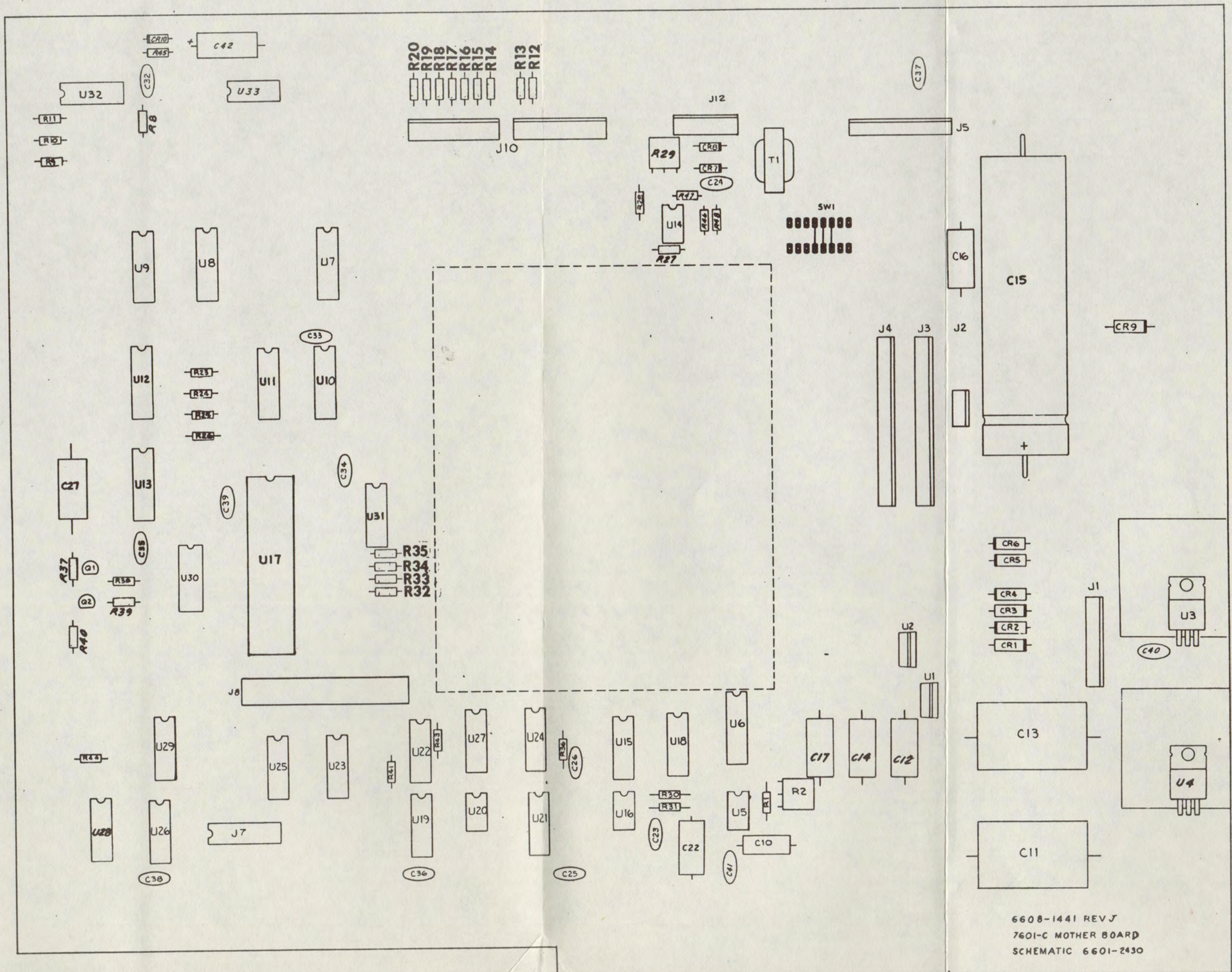


FIGURE 6.1.2

ITEM NO.	QTY PER ASSY	EN NO.	PART NO.	DESCRIPTION	REF DES
LIST OF MATERIALS					
REMOVE ALL BURRS AND SHARP EDGES					
TOLERANCES UNLESS OTHERWISE SPECIFIED		DRAWN BY: Jdu DATE: 1/7/77			
.XX ±		CHK BY: Jdu DATE: 1/7/77			
.XXX ±		PROJ. ENG:			
ANGULAR ±		MFG. ENG:			
DO NOT SCALE THIS PRINT		APPR. W.E. DATE: 1/7/77			
		TITL: WIRE DIAGRAM			
		SIZE: D			
		DRAWING NO: 6600-1460			
		SCALE: 1:1			
		SHT. OF: 1			



6608-1441 REV J  
 7601-C MOTHER BOARD  
 SCHEMATIC 6601-2430

CKT REF	DESCRIPTION	TFT STOCK NO.
C10	Cap Poly Carb .022MFD 100V	1006-0220
C11	Cap Elect 500MFD 25V	1010-0511
C12	Cap Tan 10MFD 20V 10%	1008-0101
C13	Cap Elect 500MFD 25V	1010-0511
C14	Cap Tan 10MFD 20V 10%	1008-0101
C15	Cap Elect 8000UF 25V	1010-8000
C16	Cap Tan 10MFD 20V 10%	1008-0101
C17	Cap Tan 10MFD 20V 10%	1008-0101
C22	Cap Poly Carb .22 MFD 100V	1002-0220
C23	Cap Cer Disc .01MFD	1005-1039
C24	Cap Cer Disc .01MFD	1005-1039
C25	Cap Cer Disc .01MFD	1005-1039
C26	Cap Cer Disc .01MFD	1005-1039
C27	Cap Tan 10MFD 20V 10%	1008-0101
C32	Cap Cer Disc .1UF 12V	1005-0100
C33	Cap Cer Disc .1UF 12V	1005-0100
C34	Cap Cer Disc .1UF 12V	1005-0100
C35	Cap Cer Disc .1UF 12V	1005-0100
C36	Cap Cer Disc .1UF 12V	1005-0100
C37	Cap Cer Disc .1UF 12V	1005-0100
C38	Cap Cer Disc .1UF 12V	1005-0100
C39	Cap Cer Disc .05MFD	1005-5039
C40	Cap Cer Disc .1UF 12V	1005-0100
C41	Cap Cer Disc .1UF 12V	1005-0100
C42	Cap Tan 10MFD 20V 10%	1008-0101
CR1	Dio Rect 1N4002	1284-4002
CR2	Dio Rect 1N4002	1284-4002
CR3	Dio Rect 1N4002	1284-4002
CR4	Dio Rect 1N4002	1284-4002
CR5	Dio MR501	1281-0501
CR6	Dio MR501	1281-0501
CR7	Dio IN4737	1283-4737
CR8	Dio IN4737	1283-4737
CR9	Dio MPTE5	1283-0005
CR10	Dio 1N3064	1281-3064
J1	Plug 6 Pin	2250-6006
J3	Conn 12 Pin Molex	2250-6012
J4	Conn 12 Pin Molex	2250-6012
J5	Plug 7 Pin Molex	2250-6007
J7	Socket, I/C 16 Pin	2250-1016
J8	Conn 26 Pin M Header	2250-6512
J10A	Plug 7 Pin Molex	2250-6007
J10B	Plug 7 Pin Molex	2250-6007
Q1	Xister 2N5089	1271-5089
Q2	Xister 2N5089	1271-5089
R1	Res MT FLM 1/8W 1% 3.57K	1061-3571

CKT REF	DESCRIPTION	TFT STOCK NO.
R2	Pot PC MT 500 Ohm 1T	1072-0500
R8	Res Car Comp 1/4W 5% 1.2K	1065-1201
R9	Res Car Comp 1/4W 5% 1.2K	1065-1201
R10	Res Car Comp 1/4W 5% 1.2K	1065-1201
R11	Res Car Comp 1/4W 5% 1.2K	1065-1201
R12	Res Car Comp 1/4W 5% 4.7K	1065-4701
R13	Res Car Comp 1/4W 5% 4.7K	1065-4701
R14	Res Car Comp 1/4W 5% 4.7K	1065-4701
R15	Res Car Comp 1/4W 5% 4.7K	1065-4701
R16	Res Car Comp 1/4W 5% 4.7K	1065-4701
R17	Res Car Comp 1/4W 5% 4.7K	1065-4701
R18	Res Car Comp 1/4W 5% 4.7K	1065-4701
R19	Res Car Comp 1/4W 5% 4.7K	1065-4701
R20	Res Car Comp 1/4W 5% 4.7K	1065-4701
R21	NOT USED	
R23	Res Car Comp 1/4W 5% 1.2K	1065-1201
R24	Res Car Comp 1/4W 5% 1.2K	1065-1201
R25	Res Car Comp 1/4W 5% 1.2K	1065-1201
R26	Res Car Comp 1/4W 5% 1.2K	1065-1201
R27	Res Car Comp 1/4W 5% 4.7K	1065-4701
R28	Res Car Comp 1/4W 5% 10K	1065-1002
R29	Pot 10K 1T	1072-1002
R30	Res MT FLM 1/8W 1% 1.21 MEG F.S.	1061-1214
R31	Res MT FLM 1/8W 1% 4.99K	1061-4991
R32	Res Car Comp 1/4W 5% 1.2K	1065-1201
R33	Res Car Comp 1/4W 5% 1.2K	1065-1201
R34	Res Car Comp 1/4W 5% 1.2K	1065-1201
R35	Res Car Comp 1/4W 5% 1.2K	1065-1201
R36	Res Car Comp 1/4W 5% 2.2K	1065-2201
R37	Res Car Comp 1/4W 5% 22K	1065-2202
R38	Res Car Comp 1/4W 5% 1.2M	1065-1204
R39	Res Car Comp 1/4W 5% 470	1065-0470
R40	Res Car Comp 1/4W 5% 33K	1065-3302
R41	Res Car Comp 1/4W 5% 4.7K	1065-4701
R42	NOT USED	
R44	Res Car Comp 1/4W 5% 4.7K	1065-4701
R45	Res Car Comp 1/4W 5% 4.7K	1065-4701
R46	Res Car Comp 1/4W 5% 820	1065-0820
R47	Res Car Comp 1/4W 5% 820	1065-0820
R48	Res Car Comp 1/4W 5% 180	1065-0180
U1	I/C Reg 1/2 Amp +12V LM342 P-12	1100-4212
U2	I/C Reg 1/2 Amp 12V LM320 MP-12	1100-2012
U3	I/C LM340T-05	1100-7805
U4	I/C LM340T-05	1100-7805
U5	I/C LM567CN	1100-0567
U6	I/C MM74C161N	1102-0161

CKT REF	DESCRIPTION	TFT STOCK NO.
U7	I/C MM74C157N	1102-0157
U8	I/C MM74C157N	1102-0157
U9	I/C MM74C157N	1102-0157
U10	I/C MM74C165	1102-0165
U11	I/C MM74C165	1102-0165
U12	I/C MM74C165	1102-0165
U13	I/C MM74C165	1102-0165
U14	I/C LM741CN	1100-0741
U15	I/C MM74C74N	1102-7474
U16	I/C LM555CN	1100-0555
U17	I/C MM5303	1100-5303
U18	I/C MM74C08N	1102-7408
U19	I/C MM74C74N	1102-7474
U20	I/C MM75452N	1100-5452
U21	I/C MM74C04	1102-7404
U22	I/C MM74LS74N	1101-7474
U23	I/C MM74LS164N	1101-0164
U24	I/C MM74C08N	1102-7408
U25	I/C MM74LS164N	1101-0164
U26	I/C MM74LS164N	1101-0164
U27	I/C MM74C00N	1102-7400
U28	I/C SN74LS04N	1101-7404
U29	I/C MM74C08N	1102-7408
U30	I/C SN74LS04N	1101-7404
U31	I/C SN74LS04N	1101-7404
U32	I/C MM74C04	1102-7404
U33	I/C MM74C04	1102-7404
	PC BD 7601-C Mother	1600-1440
	Heatsink 6071B	2010-6071
	Heatsink 6072B	2010-6072
	Tyton, QWK Tie	2140-0004
	Tie Mounts TC141	2140-0141
	Socket, I/C 8 Pin	2250-1008
	Socket, I/C 14 Pin	2250-1014
	Socket, I/C 16 Pin	2250-1016
	Socket, I/C 40 Pin	2250-1040
J2	Plug 2 Pin	2250-6002

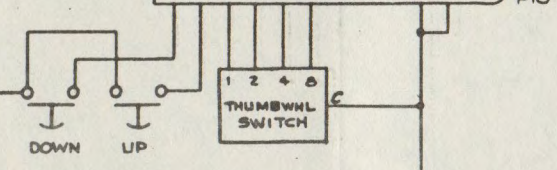
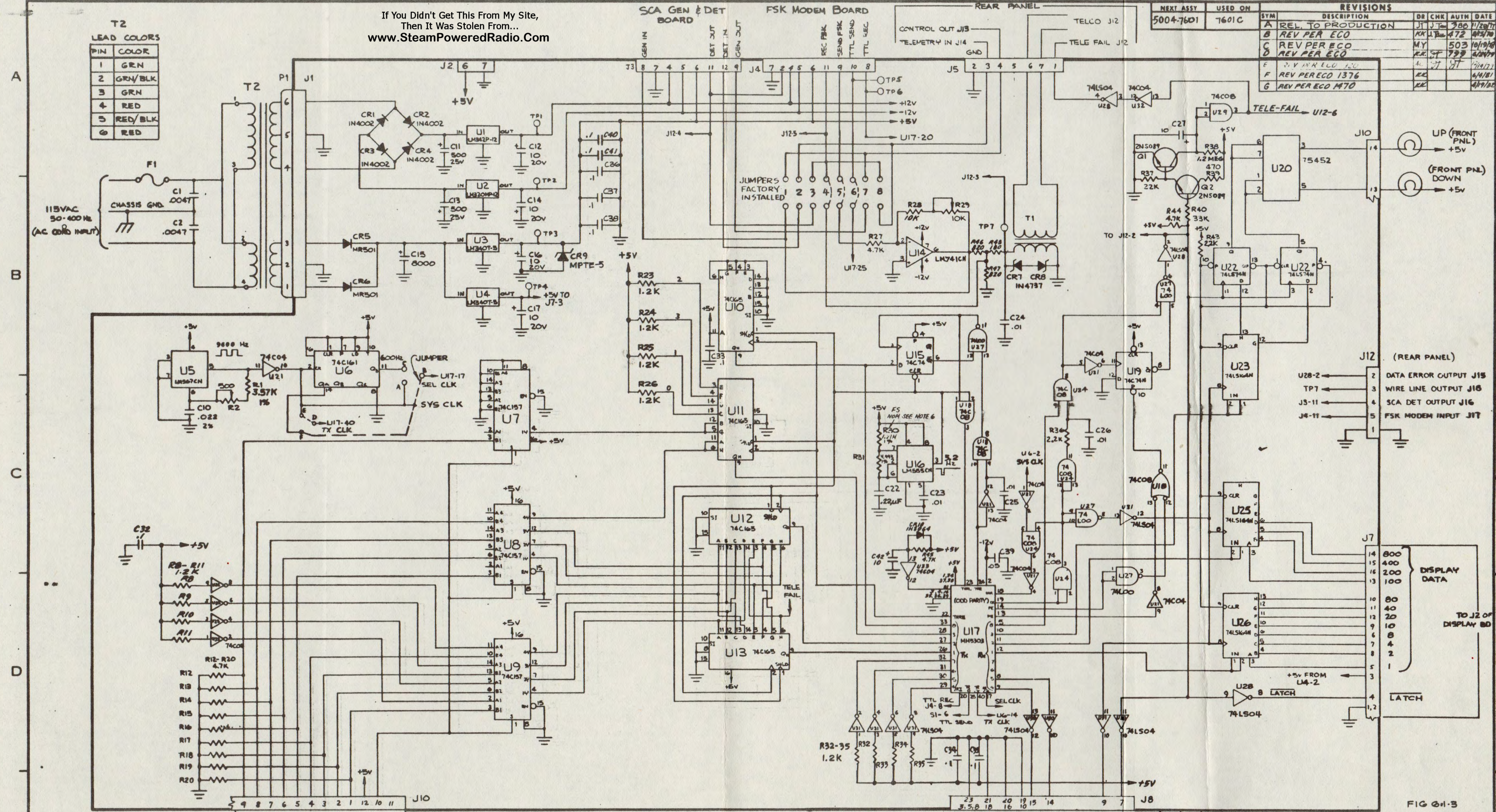


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T2  
LEAD COLORS

PIN	COLOR
1	GRN
2	GRN/BLK
3	GRN
4	RED
5	RED/BLK
6	RED

SYM	DESCRIPTION	DR	CHK	AUTH	DATE
A	REL TO PRODUCTION	JT	JT		780 11/28/77
B	REV PER ECO	KK	JT		472 04/25/78
C	REV PER ECO	MY	JT		503 10/19/78
D	REV PER ECO	KK	JT		799 06/27/77
E	REV PER ECO 130	AL	JT		718/77
F	REV PER ECO 1376	EC	JT		4/4/81
G	REV PER ECO M70	KK	JT		4/19/82



- NOTES, UNLESS OTHERWISE SPECIFIED;
- RESISTOR VALUES ARE IN OHMS, 5%, 1/4 WATT
  - CAPACITOR VALUES ARE IN MICROFARADS.
  - ON THE FOLLOWING DEVICES PIN 14 IS +5VDC AND PIN 7 IS GROUND: 74COO, 74CO4, 74COB, 74C74, 74LS04, 74LS74, 74LS164
  - ON THE FOLLOWING DEVICES PIN 15 IS +5VDC AND PIN 8 IS GROUND: 74C161, 74C157, 74C165
  - P.C. BD ASSY IS 660B-1441, REV J

LAST USED	NOT USED	DOZ	DOZ
C42	3, 4, 5, 6, 7, 8, 9, 10, 19, 20, 21, 28, 29, 30, 31	100	100
C410			
F1			
R48	3, 4, 5, 6, 7, 22, 41, 21		
U33			
Q2			
T2			
J12	6, 9, 11		
P10	2, 3, 4, 5, 6, 7, 8, 9		
TP7			

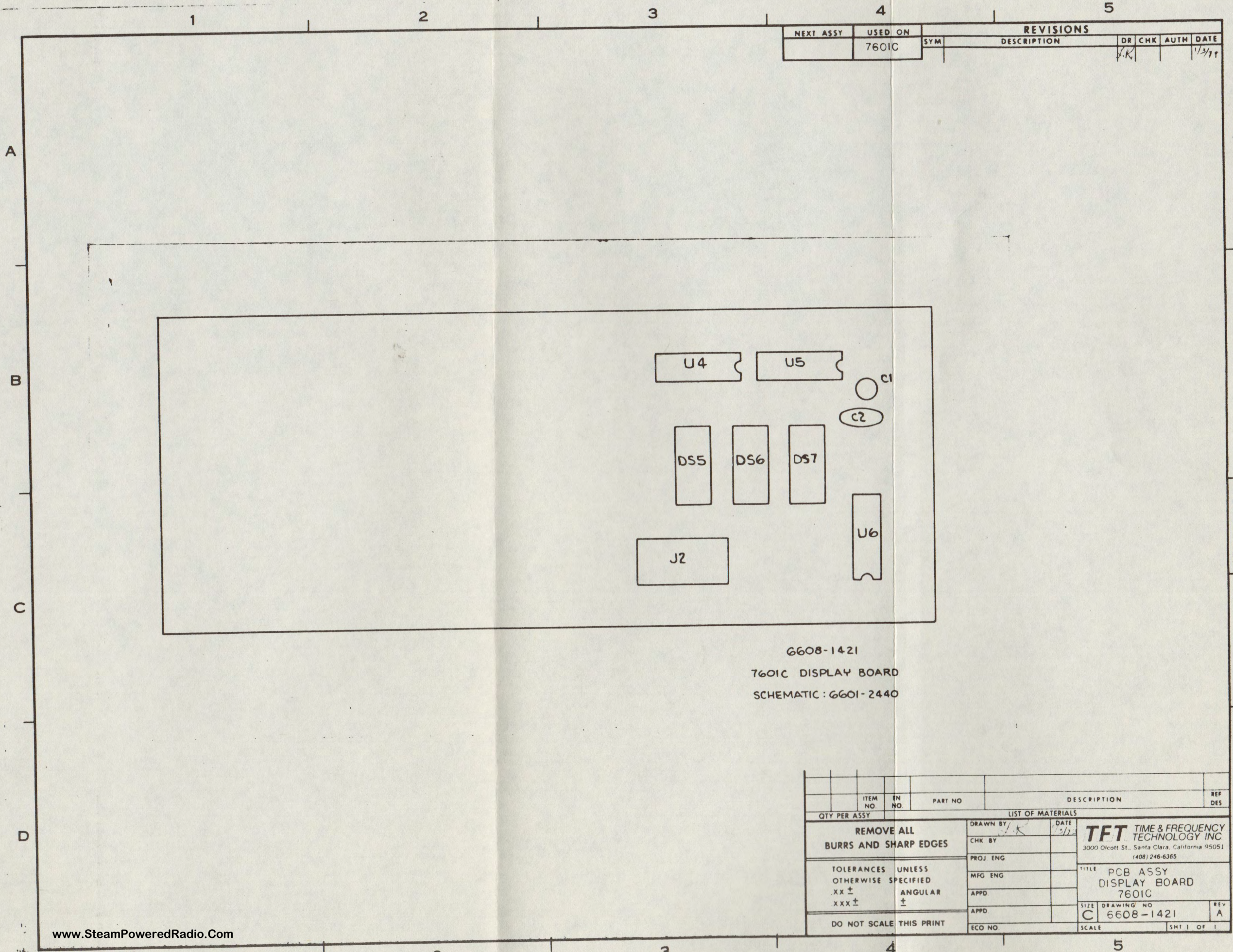
ITEM NO.	QTY	DESCRIPTION	REF
74LS04	10	HEX INVERTER	U1, U2, U3, U4, U5, U6, U7, U8, U9, U10, U11, U12, U13, U14, U15, U16, U17, U18, U19, U20, U21, U22, U23, U24, U25, U26, U27
74LS164	1	8-BIT SERIAL SHIFTER	U12
74LS165	1	8-BIT PARALLEL LOADER	U13
74LS161	1	4-BIT BINARY COUNTER	U14
74LS162	1	DECAD COUNTER	U15
74LS163	1	4-BIT BINARY COUNTER	U16
74LS164	1	8-BIT SERIAL SHIFTER	U17
74LS165	1	8-BIT PARALLEL LOADER	U18
74LS166	1	8-BIT PARALLEL LOADER	U19
74LS167	1	8-BIT PARALLEL LOADER	U20
74LS168	1	8-BIT PARALLEL LOADER	U21
74LS169	1	8-BIT PARALLEL LOADER	U22
74LS170	1	8-BIT PARALLEL LOADER	U23
74LS171	1	8-BIT PARALLEL LOADER	U24
74LS172	1	8-BIT PARALLEL LOADER	U25
74LS173	1	8-BIT PARALLEL LOADER	U26
74LS174	1	4-BIT BINARY COUNTER	U27

6. R30 FS VALUE RANGE FROM 1.05M TO 1.4 M

FIG 01-3

6601-2430

6



6608-1421  
 7601C DISPLAY BOARD  
 SCHEMATIC: 6601-2440

NEXT ASSY	USED ON	SYM	REVISIONS				
	7601C		DESCRIPTION	DR	CHK	AUTH	DATE
				J.R.			1/3/11

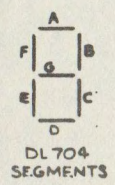
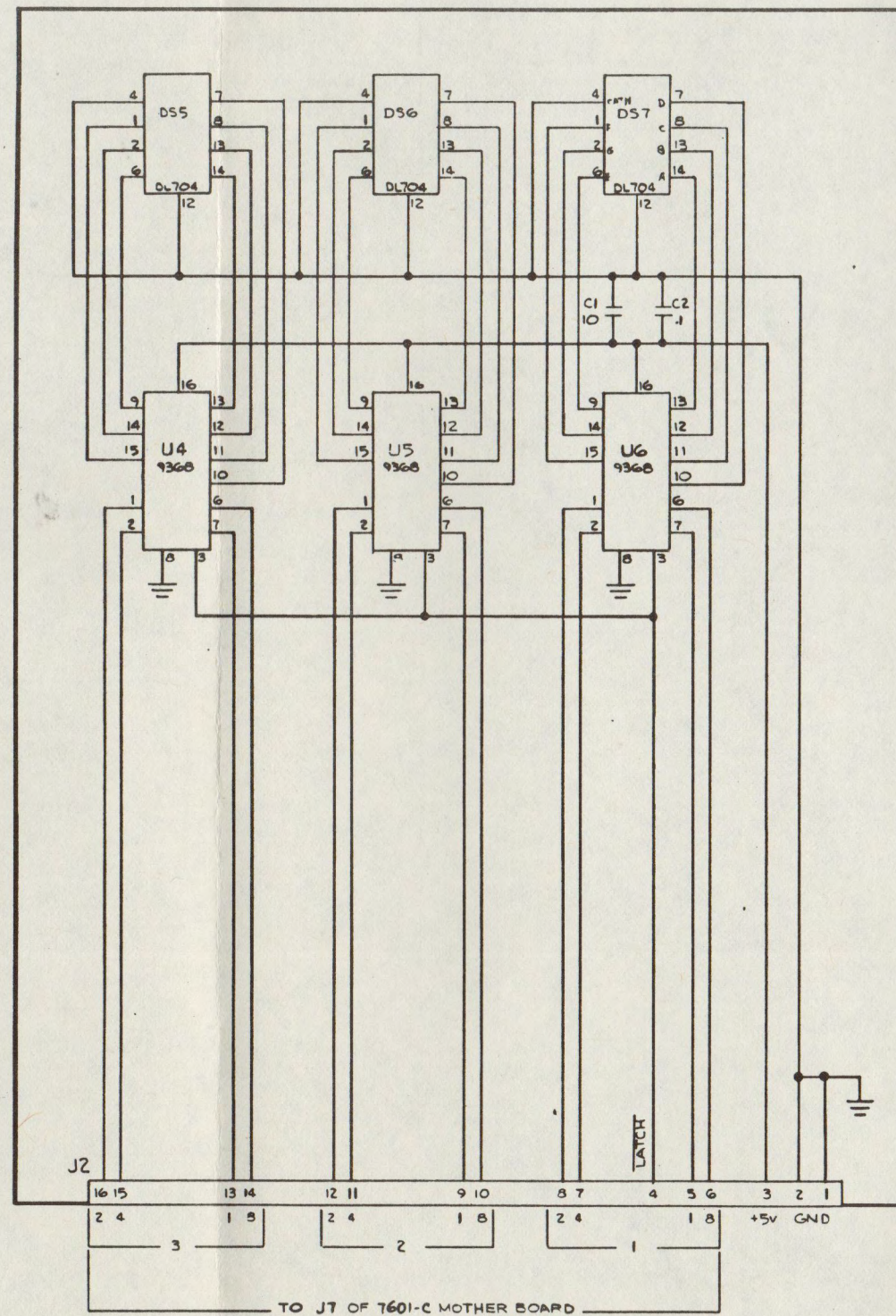
QTY PER ASSY	ITEM NO.	EN NO.	PART NO.	DESCRIPTION	REF DES
LIST OF MATERIALS					
REMOVE ALL BURRS AND SHARP EDGES				DRAWN BY: J.R.	DATE: 1/3/11
TOLERANCES UNLESS OTHERWISE SPECIFIED				<b>TFT</b> TIME & FREQUENCY TECHNOLOGY INC 3000 Olcott St., Santa Clara, California 95051 (408) 246-6365 TITLE: PCB ASSY DISPLAY BOARD 7601C SIZE: C DRAWING NO: 6608-1421 REV: A SCALE: SMT 1 OF 1	
.xx ±					
.xxx ±					
± ANGULAR ±					
DO NOT SCALE THIS PRINT				ECO NO.	

Display BD 7601-C

Assembly # 6608-1421A

Ckt. Ref.	Description	TFT Stock No.
C1	Cap Tan 10MFD 20V 10%	1008-0100
C2	Cap Cer Disc .1UF 12V	1005-0100
DS5	Led DL704 8	1285-0704
DS6	Led DL704 8	1285-0704
DS7	Led DL704 8	1285-0704
U4	I/C 9368PC	1100-9368
U5	I/C 9368PC	1100-9368
U6	I/C 9368PC	1100-9368
	PC BD 7610-C Display	1600-1420
	Socket, I/C 14 Pin	2250-1014
	Socket, I/C 16 Pin	2250-1016

NEXT ASSY		USED ON		REVISIONS			
SYM	DESCRIPTION	DR	CHK	DATE	BY	DATE	DATE
5004-7601	7601C	A	REL TO PRODUCTION	TG	JW	988	

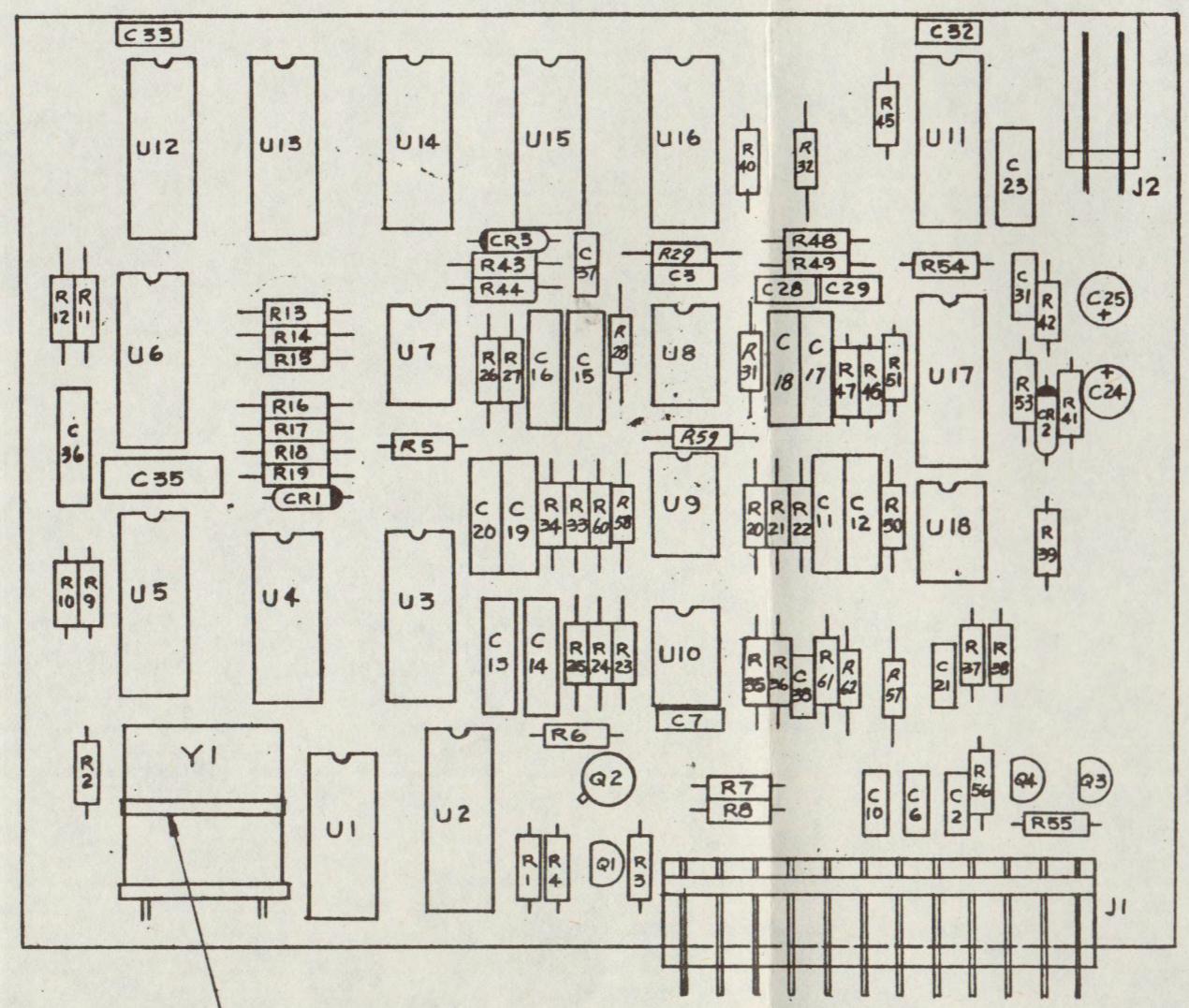


- 4 P.C. BD. ASSY: 6608-1421
  - 3 INDUCTORS - VALUES ARE IN MICROHENRY ± 10%
  - 2 CAPACITORS - VALUES ARE IN MICROFARADS
  - 1 RESISTORS - VALUES ARE IN OHMS ± 5%, 1/4 WATT
- NOTES, UNLESS OTHERWISE SPECIFIED;

ITEM NO.	EN NO.	PART NO.	DESCRIPTION	QTY PER ASSY	DR	DATE
LIST OF MATERIALS						
REMOVE ALL BURRS AND SHARP EDGES						
DRAWN BY: <i>Jim Boy</i>			DATE: <i>9/77</i>			
CHK. BY: <i>Joe</i>			TET TIME & FREQUENCY TECHNOLOGY INC.			
PROJ. ENG.			3000 Otwell St. Santa Clara California 95050			
MFG. ENG.			(408) 248-8208			
APPD. <i>LEE</i>			TITLE: FIGURE G.1.4			
APPD.			SCHEMATIC: 7601-C			
SCD NO.			DISP. AN. BOARD			
SCALE			D 6601-2440			
SHT 1 OF 1			REV. A			

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REVISIONS					
ZONE	REV.	DESCRIPTION	DR.	DATE	APPROVED
	A	RELEASE PRODUCT	M.Y	4/14/79	<i>[Signature]</i>
	B	REVISED PER ECO	E.F.	7/20/79	<i>[Signature]</i>
	C	REVISED PER ECO			<i>[Signature]</i>
	D	REVISED PER ECO 804	M.Y	10/12/79	<i>[Signature]</i>
	E	REV PER ECO 1205	A.C.	8/7/80	<i>[Signature]</i>
	F	REV PER ECO 1491	KL	4/5/82	



TIE WRAP

DWG NO. 6608-3209  
 SH 1  
 REV F

FIG 6-7

NOTE:  
1. REF SCHEMATIC 6601-3209

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CONTRACT NO.		MEM TIME & FREQUENCY TECHNOLOGY INC.	
5102-2081	7601C	APPROVALS	DATE
5102-2080	7610C	<i>[Signature]</i>	5-9-79
5102-3220	7815C	<i>[Signature]</i>	4/14/79
NEXT ASSY USED ON		ISSUED	5-14-79
		FOR ENGR	5-14-79
		FOR ENGR	5-14-79
		SCALE	1/1
		DWG. NO.	6608-3209
		REV.	F
		SHEET	1 OF 1

Model 7601C  
7610C  
7815C

FSK "C" Modem Bd Assy

Assembly #6608-3209

Rev F

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
C1	Not Used		
C2	Cap Cer CK05 .1 MF	1	1015-0001
C3	Cap Cer 1MF	1	1005-0001
C4	Not Used		
C5	Not Used		
C6	Cap Cer CK05 .1MF	1	1015-0001
C7	Cap Cer 1MF	1	1005-0001
C8	Not Used		
C9	Not Used		
C10	Cap Cer CK05 .1MF	1	1015-0001
C11	Cap Poly 2.5% .01MF	1	1006-0002
C12	Cap Poly 2.5% .01MF	1	1006-0002
C13	Cap Poly 2.5% .01MF	1	1006-0002
C14	Cap Poly 2.5% .01MF	1	1006-0002
C15	Cap Poly 2.5% .01MF	1	1006-0002
C16	Cap Poly 2.5% .01MF	1	1006-0002
C17	Cap Poly 2.5% .01MF	1	1006-0002
C18	Cap Poly 2.5% .01MF	1	1006-0002
C19	Cap Poly 2.5% .01MF	1	1006-0002
C20	Cap Poly 2.5% .01MF	1	1006-0002
C21	Cap Cer CK06 .22MF	1	1015-0003
C22	Not Used		
C23	Cap Mica 270PF	1	1001-0271
C24	Cap Tan 10MFD 20V 10%	1	1008-0100
C25	Cap Tan 10MFD 20V 10%	1	1008-0100
C26	Not Used		
C27	Not Used		
C28	Cap Cer CK05 .1MF	1	1015-0001
C29	Cap Cer CK05 .0033MF	1	1015-0014
C30	Not Used		
C31	Cap Cer CK05 .1MF	1	1015-0001
C32	Cap Cer 1MF	1	1005-0001
C33	Cap Cer 1MF	1	1005-0001
C34	Not Used		
C35	Cap Poly 2.5% .01MF	1	1006-0002
C36	Cap Poly 2.5% .01MF	1	1006-0002
C37	Cap Cer CK06 .22MF	1	1015-0003
C38	Cap Cer CK06 .22MF	1	1015-0003
CR1	IN3064 Diode	1	1281-3064
CR2	IN3064 Diode	1	1281-3064
CR3	IN3064 Diode	1	1281-3064
J1	Plug Molex RT/A 12 Pins	1	2250-8812
J2	Plug Molex RT/A 2 Pins	1	2250-6702

Model 7601C  
7610C  
7815C

FSK "C" Modem Bd Assy

Assembly #6608-3209  
Rev F

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
Q1	Transistor 2N4275	1	1271-4275
Q2	Transistor 2N2222	1	1271-2222
Q3	Transistor 2N4275	1	1271-4275
Q4	Transistor 2N4275	1	1271-4275
R1	Res Car Comp 1/4W 5% 10	1	1065-0010
R2	Res Car Comp 1/4W 5% 4.7K	1	1065-4701
R3	Res Car Comp 1/4W 5% 10K	1	1065-1002
R4	Res Car Comp 1/4W 5% 47K	1	1065-4702
R5	Res Car Comp 1/4W 5% 22K	1	1065-2202
R6	Res Car Comp 1/4W 5% 10K	1	1065-1002
R7	Res Car Comp 1/4W 5% 4.7K	1	1065-4701
R8	Res Car Comp 1/4W 5% 10	1	1065-0010
R9	Res MT FLM 1/8W 1% 26.1K	1	1061-2612
R10	Res MT FLM 1/8W 1% 20.5K	1	1061-2052
R11	Res MT FLM 1/8W 1% 53.6K	1	1061-5362
R12	Res MT FLM 1/8W 1% 54.9K	1	1061-5492
R13	Res MT FLM 1/8W 1% 10.5K	1	1061-1052
R14	Res MT FLM 1/8W 1% 10K	1	1061-1002
R15	Res MT FLM 1/8W 1% 10K	1	1061-1002
R16	Res MT FLM 1/8W 1% 10K	1	1061-1002
R17	Res MT FLM 1/8W 1% 10K	1	1061-1002
R18	Res MT FLM 1/8W 1% 10K	1	1061-1002
R19	Res MT FLM 1/8W 1% 10K	1	1061-1002
R20	Res MT FLM 1/8W 1% 56.2K	1	1061-5622
R21	Res MT FLM 1/8W 1% 590	1	1061-0590
R22	Res MT FLM 1/8W 1% 249K	1	1061-2493
R23	Res MT FLM 1/8W 1% 25.5K	1	1061-2552
R24	Res MT FLM 1/8W 1% 698	1	1061-0698
R25	Res MT FLM 1/8W 1% 2493	1	1061-2493
R26	Res MT FLM 1/8W 1% 39.2K	1	1061-3922
R27	Res MT FLM 1/8W 1% 866	1	1061-0866
R28	Res MT FLM 1/8W 1% 316K	1	1061-3163
R29	Res MT FLM 1/8W 1% 76.8K	1	1061-7682
R30	Not Used		
R31	Res Car Comp 1/8W 1% 221K	1	1061-2213
R32	Res Car Comp 1/8W 1% 976	1	1061-0976
R33	Res MT FLM 1/8W 1% 845	1	1061-0845
R34	Res MT FLM 1/8W 1% 383K	1	1061-3833
R35	Res MT FLM 1/8W 1% 10K	1	1061-1002
R36	Res Car Comp 1/4W 5% 1M	1	1065-1004
R37	Res Car Comp 1/4W 5% 560K	1	1065-5603
R38	Res Car Comp 1/4W 5% 18K	1	1065-1802
R39	Res Car Comp 1/4W 5% 56K	1	1065-5602
R40	Res Car Comp 1/4W 5% 22K	1	1065-2202

Model 7610C  
7610C  
7815C

FSK "C" Modem Bd Assy

Assembly #6608-3209  
Rev F

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
R41	Res Car Comp 1/4W 5% 10K	1	1065-1002
R42	Res Car Comp 1/4W 5% 100K	1	1065-1003
R43	Res MT FLM 1/8W 1% 200K	1	1061-2003
R44	Res MT FLM 1/8W 1% 86.6K	1	1061-8662
R45	Res Car Comp 1/4 5% 56K	1	1065-5602
R46	Res Car Comp 1/4W 5% 100K	1	1065-1003
R47	Res Car Comp 1/4W 5% 100K	1	1065-1003
R48	Res MT FLM 1/8W 1% 4.87K	1	1061-4871
R49	Res MT FLM 1/8W 1% 215K	1	1061-2153
R50	Res MT FLM 1/8W 1% 100K	1	1061-1003
R51	Res MT FLM 1/8W 1% 13.3K	1	1061-1332
R52	Not Used		
R53	Res MT FLM 1/8W 1% 8.25K	1	1061-8251
R54	Res Car Comp 1/4W 5% 56K	1	1065-5602
R55	Res Car Comp 1/4W 5% 4.7K	1	1065-4701
R56	Res Car Comp 1/4W 5% 4.7K	1	1065-4701
R57	Res Mt FLM 1/8W 1% 10K	1	1061-1002
R58	Res MT FLM 1/8W 1% 56.2K	1	1061-5622
R59	Res MT FLM 1/8W 1% 100K	1	1061-1003
R60	Res MT FLM 1/8W 1% 210	1	1061-0210
R61	Res MT FLM 1/8W 1% 100K	1	1061-1003
R62	Res MT FLM 1/8W 1% 267	1	1061-0267
U1	IC CD4001AE	1	1102-4001
U2	IC CD4520BE	1	1102-4520
U3	IC CD4081BE	1	1102-4081
U4	IC CD4001AE	1	1102-4001
U5	IC CD4520BE	1	1102-4520
U6	IC LM324	1	1100-0324
U7	IC MC1458N	1	1101-1458
U8	IC MC1458N	1	1101-1458
U9	IC MC1458N	1	1101-1458
U10	IC MC1458N	1	1101-1458
U11	IC CD4069	1	1102-4069
U12	IC CD4520BE	1	1102-4520
U13	IC CD4520BE	1	1102-4520
U14	IC CD4081BE	1	1102-4081
U15	IC CD4001AE	1	1102-4001
U16	IC CD4013BE	1	1102-4013
U17	IC LM324	1	1100-0324
U18	IC LM741CN	1	1100-0741
Y1	1.00MHz Crystal	1	2400-1001
	IC Socket 8 Pin	5	2250-1008
	IC Socket 14 Pin	9	2250-1014
	IC Socket 16 Pin	4	2250-1016
	PC Board Fsk C Modem	1	1600-3209
	Tie Wrap	1	2140-0005



NOTES: UNLESS OTHERWISE SPECIFIED:  
 1. RESISTORS - VALUES ARE IN OHMS  $\pm 5\%$ , 1/4 WATT  
 2. CAPACITORS - VALUES ARE IN MICROFARADS  
 3. P.C. BD ASSY 6608-3209

NEXT ASSY		USED ON		REVISIONS			
SYM	DESCRIPTION	DR	CHK	AUTH	DATE		
5102-2081	7601 C	A	RELEASE	M.Y.	6/6	1970	
5102-2080	7610 C	B	REVISED PER ECO 818	E.C.	4/4	1970	
5102-3220	7815 C	C	REVISED PER ECO 864	M.Y.	4/4	1970	
		D	REV PER ECO 1206	A.G.	8/7	1970	
		E	REV PER ECO 1973	K.L.		1970	
		F	REV PER ECO 1491	K.C.		1970	

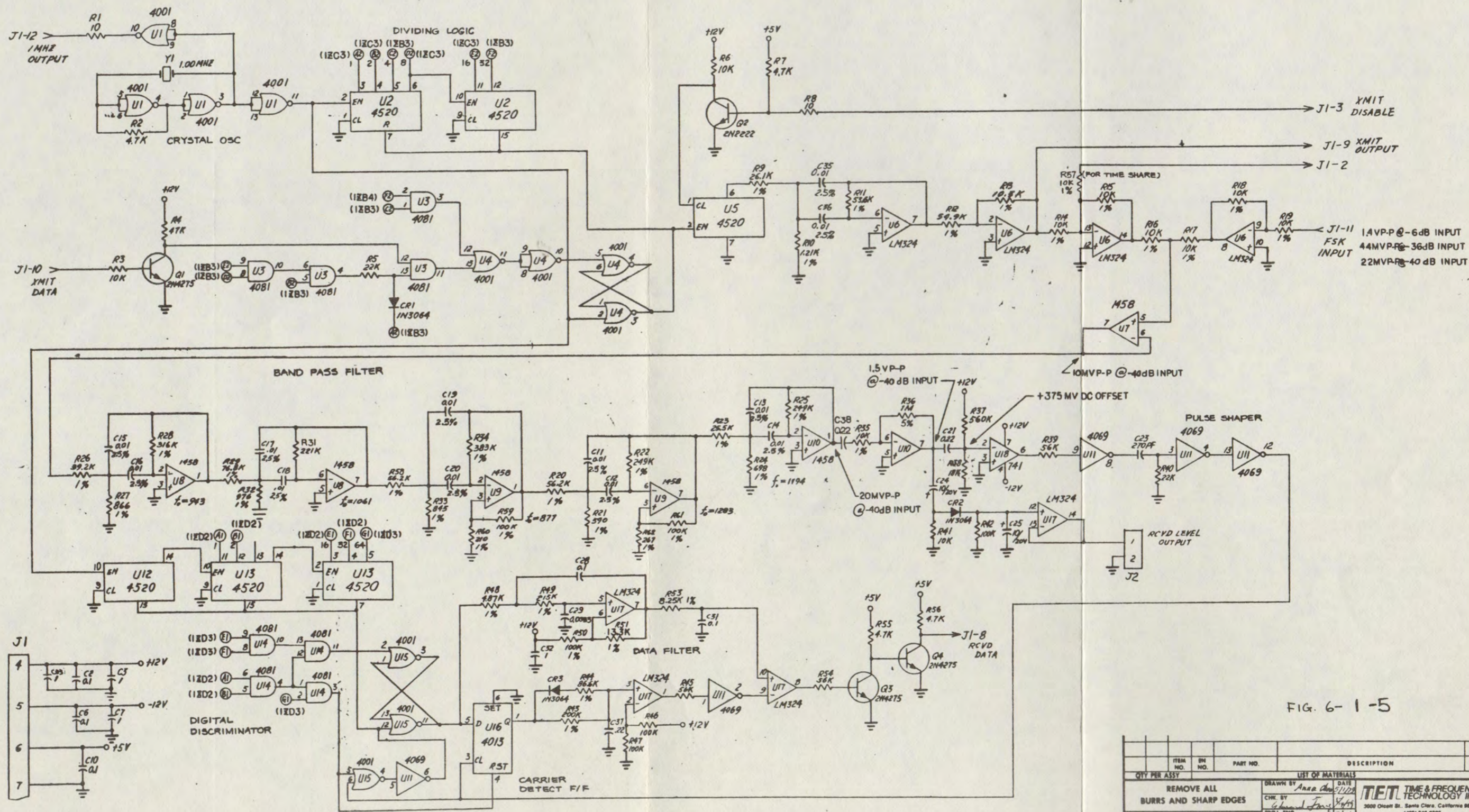


FIG. 6-1-5

ITEM NO.	QTY PER ASSY	SH NO.	PART NO.	DESCRIPTION	REF DES
REMOVE ALL BURRS AND SHARP EDGES				DRAWN BY: Anna...	
TOLERANCES UNLESS OTHERWISE SPECIFIED: .XX $\pm$ ~ ANGULAR .XXX $\pm$ ~				CHEK BY: Edward...	
DO NOT SCALE THIS PRINT				DATE: 3/1/70	

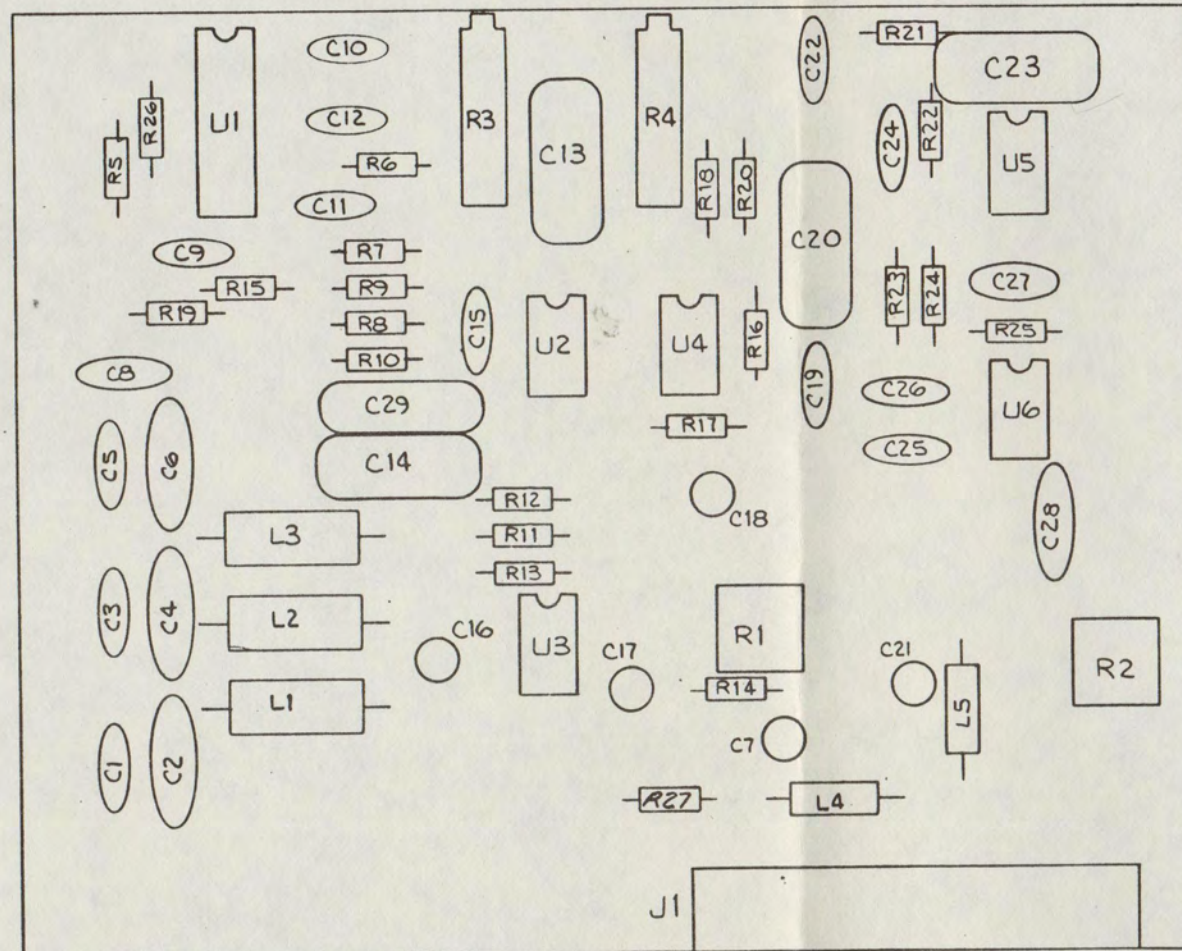
  

ITEM NO.	QTY PER ASSY	SH NO.	PART NO.	DESCRIPTION	REF DES
LIST OF MATERIALS					
TIME & FREQUENCY TECHNOLOGY INC.					
3000 Ocean St. Santa Clara, California 95050					
(408) 246-0208					
TITLE		SCHEMATIC			
PART NO.		F.S.K. MODEM BOARD "C"			
SIZE	BRWING NO.	REV.			
D	6601-3209	F			
SCALE	NONE	SHEET		1 OF 1	

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DWG. NO. 6601-3209

NEXT ASSY		USED ON		REVISIONS				
SYM	DESCRIPTION	DR	CHK	AUTH	DATE			
A							11/14/18	
B	REVISED PER ECO (R27 ADDED)	KK	GT	786	6/21/19			



6608-1630  
SCA DET & GEN. BOARD  
SCHEMATIC: 6601-1890

QTY PER ASSY	ITEM NO	EN NO	PART NO	DESCRIPTION	REF DES
LIST OF MATERIALS					
REMOVE ALL BURRS AND SHARP EDGES			DRAWN BY L. REYES	DATE 11/14/18	<b>TFT</b> TIME & FREQUENCY TECHNOLOGY INC 3000 Olcott St., Santa Clara, California 95051 (408) 246-6365  TITLE SCA GENERATOR & DETECTOR BOARD  SIZE DRAWING NO C 6608-16 30 SCALE ~ SMT 1 OF 1
TOLERANCES UNLESS OTHERWISE SPECIFIED			CHK BY <i>J. Ten</i>	PROJ ENG	
.XX ± ~ ANGULAR			MFG ENG	APPD	
.XXX ± ~ ± ~			APPD	ECO NO 786	
DO NOT SCALE THIS PRINT					

Model 7610

SCA Gen &amp; Det BD Opt 4

Assembly # 6608-1630

Rev B

Ckt. Ref.	Description	TFT Stock No.
C1	Factory Select	
C2	Factory Select	
C3	Factory Select	
C4	Factory Select	
C5	Factory Select	
C6	Factory Select	
C7	Cap Tan 10MFD 20V 10%	1008-0100
C8	Cap Cer Disc .1UF 12V	1005-0100
C9	Cap Tan 1UF 3KV	1008-0011
C10	Cap Cer Disc .05MFD	1005-5039
C11	Cap Cer Disc 001UF	1005-1049
C12	Factory Select	
C13	Cap Poly .018MFD 100V	1002-0181
C14	Cap Poly .1MFD 100V	1002-0010
C15	Cap Mica 430pF	1001-0431
C16	Cap Tan 10MFD 20V 10%	1008-0100
C17	Cap Tan 10MFD 20V 10%	1008-0100
C18	Cap Tan 10MFD 20V 10%	1008-0100
C19	Cap Mica 100pF	1001-0102
C20	Factory Select	
C21	Cap Cer Disc .05MFD	1005-5039
C22	Cap Mica 910pF	1001-0911
C23	Cap Poly .0056MFD 100V	1002-0562
C24	Cap Mica 22pF	1001-0220
C25	Cap Tan 1UF 3KV	1008-0011
C26	Cap Mica 150pF	1001-0151
C27	Cap Mica 39pF	1001-0390
C28	Cap Cer Disc .1UF 12V	1005-0100
C29	Cap Poly .0022MFD 100V	1002-0221
L1	Factory Select	
L2	Factory Select	
L3	Factory Select	
L4	Choke 150UH	1530-0151
L5	Choke 150UH	1530-0151
R1	Pot PC MT 1K 1T	1072-1001
R2	Pot PC MT 2K 1T	1070-2001
R3	Res Var PC MT 2K 10T	1069-2001
R4	Res Var PC MT 1K 10T	1069-2001
R5	Res Car Comp 1/4W 5% 4.7K	1065-2001
R6	Res MT FLM 1/8W 1% 3.16K	1061-3161
R7	Res Car Comp 1/4W 5% 18K	1065-1802
R8	Res Car Comp 1/4W 5% 8.2K	1065-8201

Model 7610

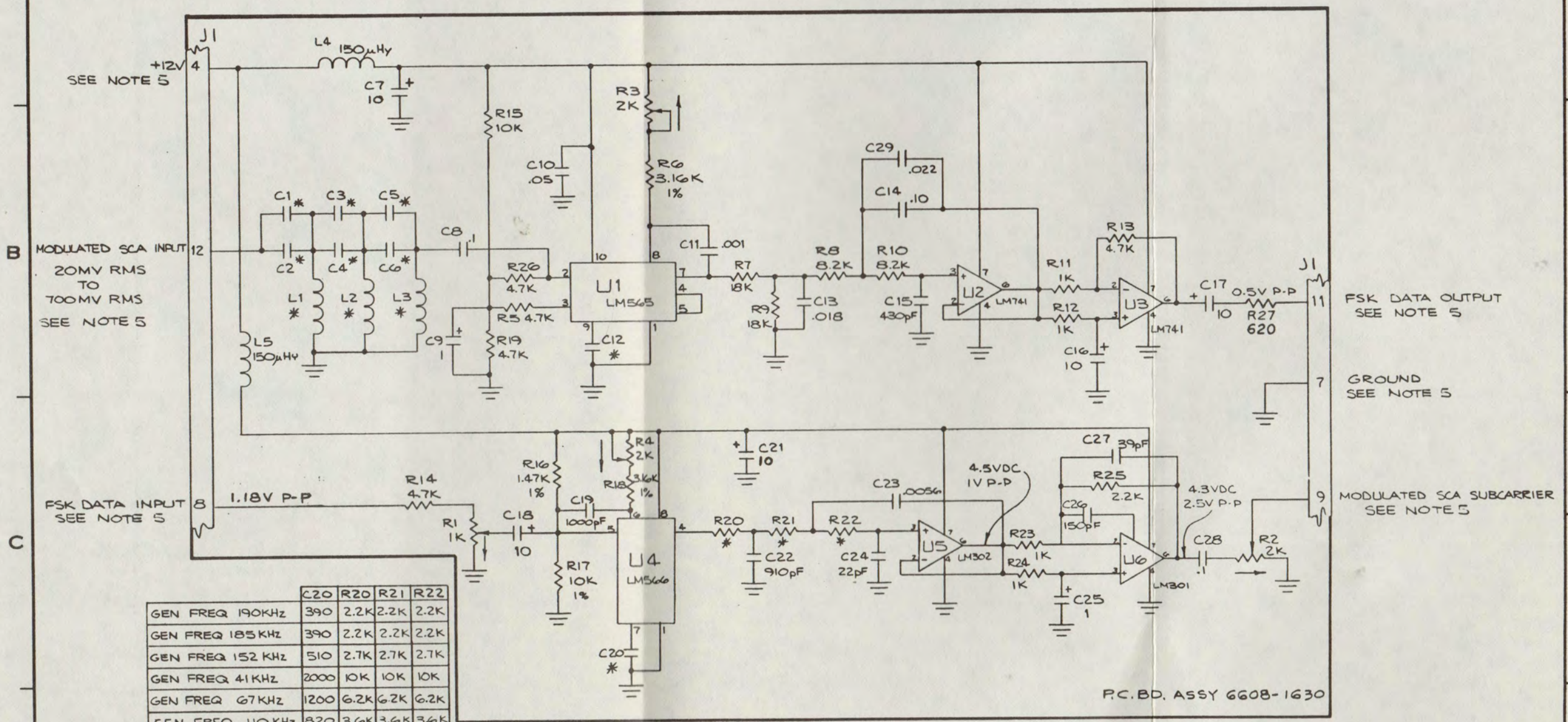
SCA Gen &amp; Det BD Opt 4

Assembly # 6608-1630  
Rev B

Ckt. Ref.	Description	TFT Stock No.
R9	Res Car Comp 1/4W 5% 18K	1065-1802
R10	Res Car Comp 1/4W 5% 8.2K	1065-8201
R11	Res Car Comp 1/4W 5% 1K	1065-1001
R12	Res Car Comp 1/4W 5% 1K	1065-1001
R13	Res Car Comp 1/4W 5% 4.7K	1065-4701
R14	Res Car Comp 1/4W 5% 4.7K	1065-4701
R15	Res Car Comp 1/4W 5% 10K	1065-1002
R16	Res MT FLM 1/8W 1% 1.47K	1061-1471
R17	Res MT FLM 1/8W 1% 10K	1061-1002
R18	Res MT FLM 1/8W 1% 3.16K	1061-3161
R19	Res Car Comp 1/4W 5% 4.7K	1065-4701
R20	Factory Select	
R21	Factory Select	
R22	Factory Select	
R23	Res Car Comp 1/4W 5% 1K	1065-1001
R24	Res Car Comp 1/4W 5% 1K	1065-1001
R25	Res Car Comp 1/4W 5% 2.2K	1065-2201
R26	Res Car Comp 1/4W 5% 4.7K	1065-4701
R27	Res Car Comp 1/4W 5% 620	1065-0620
U1	I/C NE565A	1100-0565
U2	I/C LM 741CN	1100-0741
U3	I/C LM 741CN	1100-0741
U4	I/C LM 741CN	1100-0566
U5	I/C LM 302	1100-0302
U6	I/C LM 301	1100-0301
	PC BD 7610 SCA Modem	1600-1630
	Socket, I/C 8 Pin	2250-1008
	Socket, I/C 14 Pin	2250-1014

NEXT ASSY		USED ON		REVISIONS				
SYM	DESCRIPTION	DR	CHK	AUTH	DATE			
A	REL TO PRODUCTION	TS	JT	388	12/7/77			
B	REVISED PER ECO (R27)	CC	JT	785	4/11/79			

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	C20	R20	R21	R22
GEN FREQ 190KHZ	390	2.2K	2.2K	2.2K
GEN FREQ 185KHZ	390	2.2K	2.2K	2.2K
GEN FREQ 152 KHZ	510	2.7K	2.7K	2.7K
GEN FREQ 41KHZ	2000	10K	10K	10K
GEN FREQ 67KHZ	1200	6.2K	6.2K	6.2K
GEN FREQ 110 KHZ	820	3.6K	3.6K	3.6K
GEN FREQ 26 KHZ	3000	15K	15K	15K
GEN FREQ 39 KHZ	2000	10K	10K	10K

	C1	C2	C3	C4	C5	C6	C12	L1	L2	L3
DET FREQ 190 KHZ	560	1000	39	750	33	750	560	390uH	330uH	390uH
DET FREQ 185 KHZ	560	1000	39	750	33	750	560	390uH	330uH	390uH
DET FREQ 152 KHZ	910	1000	56	910	47	910	750	470uH	390uH	470uH
DET FREQ 110KHZ	—	2700	360	1000	360	1000	1000	680uH	560uH	680uH
DET FREQ 26 KHZ	2000	10000	—	56000	—	56000	4700	2.7MH	2.2MH	3.3MH
DET FREQ 39 KHZ	—	10000	—	5100	—	5100	3000	2.2MH	2.2MH	2.7MH
DET FREQ 41 KHZ	—	10000	—	5100	—	5100	3000	2.2MH	2.2MH	2.2MH
DET FREQ 67 KHZ	1000	3300	—	2200	—	2200	1700	1MH	1MH	1MH

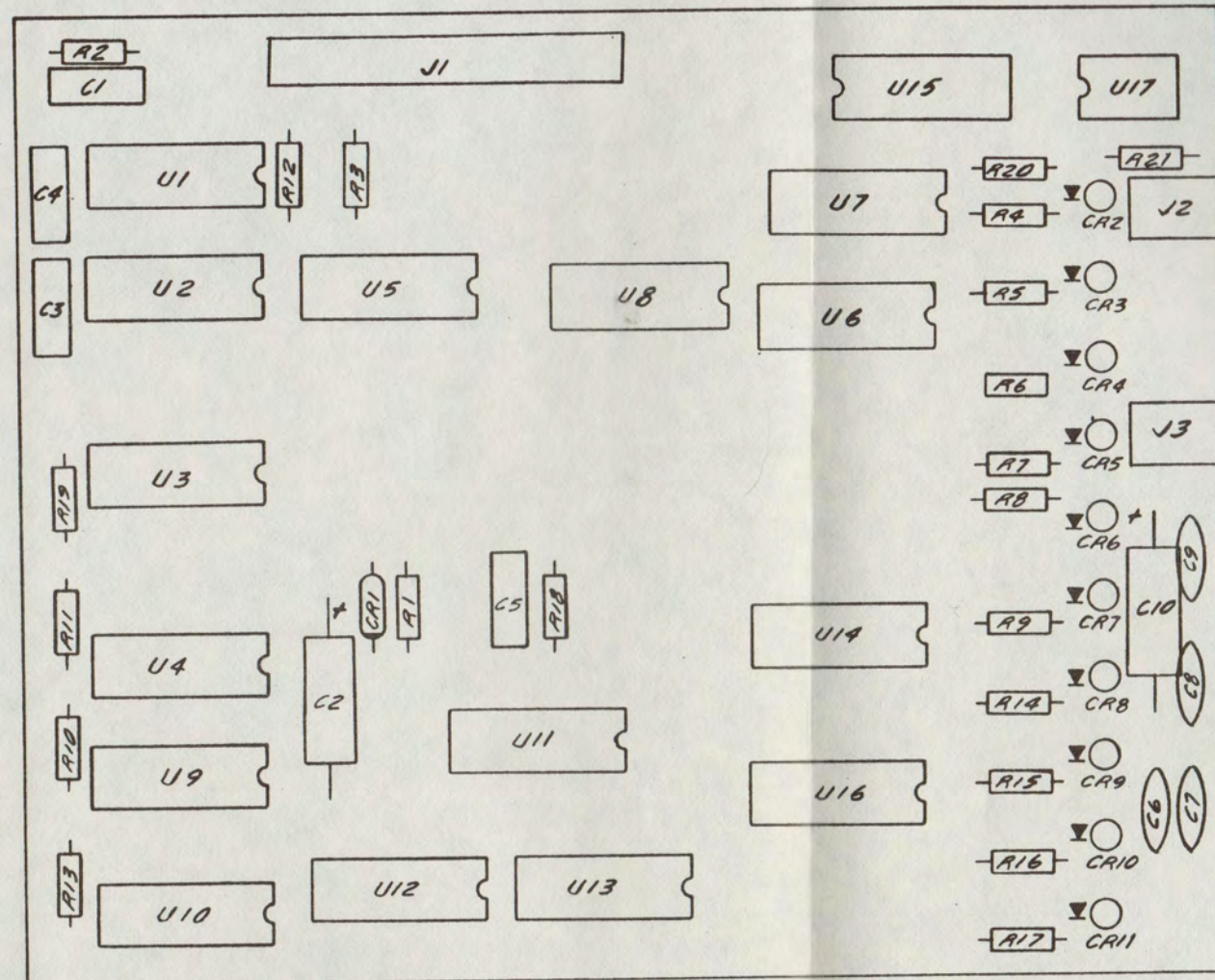
1. CAPACITOR VALUES ARE MICROFARADS, UNLESS OTHERWISE SPECIFIED;
2. RESISTOR VALUES ARE IN OHMS, 1/4W, 5%
3. ARROW INDICATES CLOCKWISE ROTATION ON POT.
4. CAPACITOR VALUES IN TABLE AT LEFT ARE IN PICOFARADS
5. 76XX C: J1 CONNECTS THRU A CABLE TO J3 OF MOTHER BD. 76XX R: J1 CONNECTS TO J9 MOTHER BD.

ITEM NO.	EN NO.	PART NO.	DESCRIPTION	REF DES.
QTY PER ASSY				
LIST OF MATERIALS				
REMOVE ALL BURRS AND SHARP EDGES			DRAWN BY: <i>Jim Bay</i> DATE: 1-11-77 CHK BY: <i>JTB</i> DATE: 6/4/77 PROJ. ENG.: <i>JTB</i> DATE: 4/7/77 MFG. ENG.: <i>JTB</i> DATE: 4/7/77 APPD.: <i>JTB</i> DATE: 4/7/77	<b>TET</b> TIME & FREQUENCY TECHNOLOGY INC 3000 D'cott St. Santa Clara, California 95050 (408) 246-6365
TOLERANCES UNLESS OTHERWISE SPECIFIED			TITLE: FIG. 6-1-6 SCA GEN & DET 7601C/R, 7602C/R	
DO NOT SCALE THIS PRINT			SIZE: C DRAWING NO: 6601-1890 ECO NO.:	REV: B SHT. 1 OF 1

DWG. NO. 6601-1890

P.C. BD. ASSY 6608-1630

NEXT ASSY		USED ON		REVISIONS			
SYM	DESCRIPTION	DR	CHK	AUTH	DATE		
7100-2970	7601-C	B					
C	REVISED PER ECO 1299	KL			11/20/81		



6608-1940  
 10 CHANNEL STATUS BD, 7601-C  
 SCHEMATIC 6601-2990

ITEM NO.	EN NO.	PART NO.	DESCRIPTION	REF DES
QTY PER ASSY				
LIST OF MATERIALS				
REMOVE ALL BURRS AND SHARP EDGES			DRAWN BY	DATE
TOLERANCES UNLESS OTHERWISE SPECIFIED			CHK BY	
.XX ±			PROJ. ENG.	
XXX ±			MFG ENG.	
DO NOT SCALE THIS PRINT			APPD.	
			APPD.	
			ECO NO.	

**TFT** TIME & FREQUENCY TECHNOLOGY INC.  
 3000 Olcott St., Santa Clara, California 95051  
 (408) 246-6365

TITLE PCB ASSY  
 10 CHANNEL STATUS BD  
 7601-C

SIZE C DRAWING NO. 6608-1940  
 SCALE SH1 OF C

Model 7601-C

10 Channel Status Board

Assembly # 6608-1940  
Rev C

Ckt. Ref.	Description	TFT Stock No.
C1	Cap Mica 470 pf, 500V	1001-0471
C2	Cap Tant 10 uf, 20V	1008-0101
C3	Cap Mica 120 pf, 500V	1001-0121
C4	Cap Mica 470 pf, 500V	1001-0471
C5	Cap Mica 120 pf, 500V	1001-0121
C6	Cap Cer Disc .01 uf, 12V	1005-1039
C7	Cap Cer Disc .01 uf, 12V	1005-1039
C8	Cap Cer Disc .01 uf, 12V	1005-1039
C9	Cap Cer Disc .01 uf, 12V	1005-1039
C10	Cap Tant 10 uf, 20V	1008-0101
CR1	Diode IN3064	1281-3064
CR2	Diode LED HP 5082-4487	1285-4487
CR3	Diode LED HP 5082-4487	1285-4487
CR4	Diode LED HP 5082-4487	1285-4487
CR5	Diode LED HP 5082-4487	1285-4487
CR6	Diode LED HP 5082-4487	1285-4487
CR7	Diode LED HP 5082-4487	1285-4487
CR8	Diode LED HP 5082-4487	1285-4487
CR9	Diode LED HP 5082-4487	1285-4487
CR10	Diode LED HP 5082-4487	1285-4487
CR11	Diode LED HP 5082-4487	1285-4487
J1	Conn 26 Pin M Header	2250-6512
J2	Plug 2 Pin	2250-6002
J3	Plug 2 Pin	2250-6002
R1	Resistor, Car Comp 1/4W +5% 4.7K	1065-4701
R2	Resistor, Car Comp 1/4W +5% 1.2K	1065-1201
R3	Resistor, Car Comp 1/4W +5% 4.7K	1065-4701
R4	Resistor, Car Comp 1/4W +5% 330	1065-0330
R5	Resistor, Car Comp 1/4W +5% 330	1065-0330
R6	Resistor, Car Comp 1/4W +5% 330	1065-0330
R7	Resistor, Car Comp 1/4W +5% 330	1065-0330
R8	Resistor, Car Comp 1/4W +5% 330	1065-0330
R9	Resistor, Car Comp 1/4W +5% 330	1065-0330
R10	Resistor, Car Comp 1/4W +5% 2.4K	1065-2401
R11	Resistor, Car Comp 1/4W +5% 4.7K	1065-4701
R12	Resistor, Car Comp 1/4W +5% 1.2K	1065-1201
R13	Resistor, Car Comp 1/4W +5% 4.7K	1065-4701
R14	Resistor, Car Comp 1/4W +5% 330	1065-0330
R15	Resistor, Car Comp 1/4W +5% 330	1065-0330
R16	Resistor, Car Comp 1/4W +5% 330	1065-0330
R17	Resistor, Car Comp 1/4W +5% 330	1065-0330
R18	Resistor, Car Comp 1/4W +5% 2.4K	1065-2401
R19	Resistor, Car Comp 1/4W +5% 4.7K	1065-4701

Model 7601-C

10 Channel Status Board

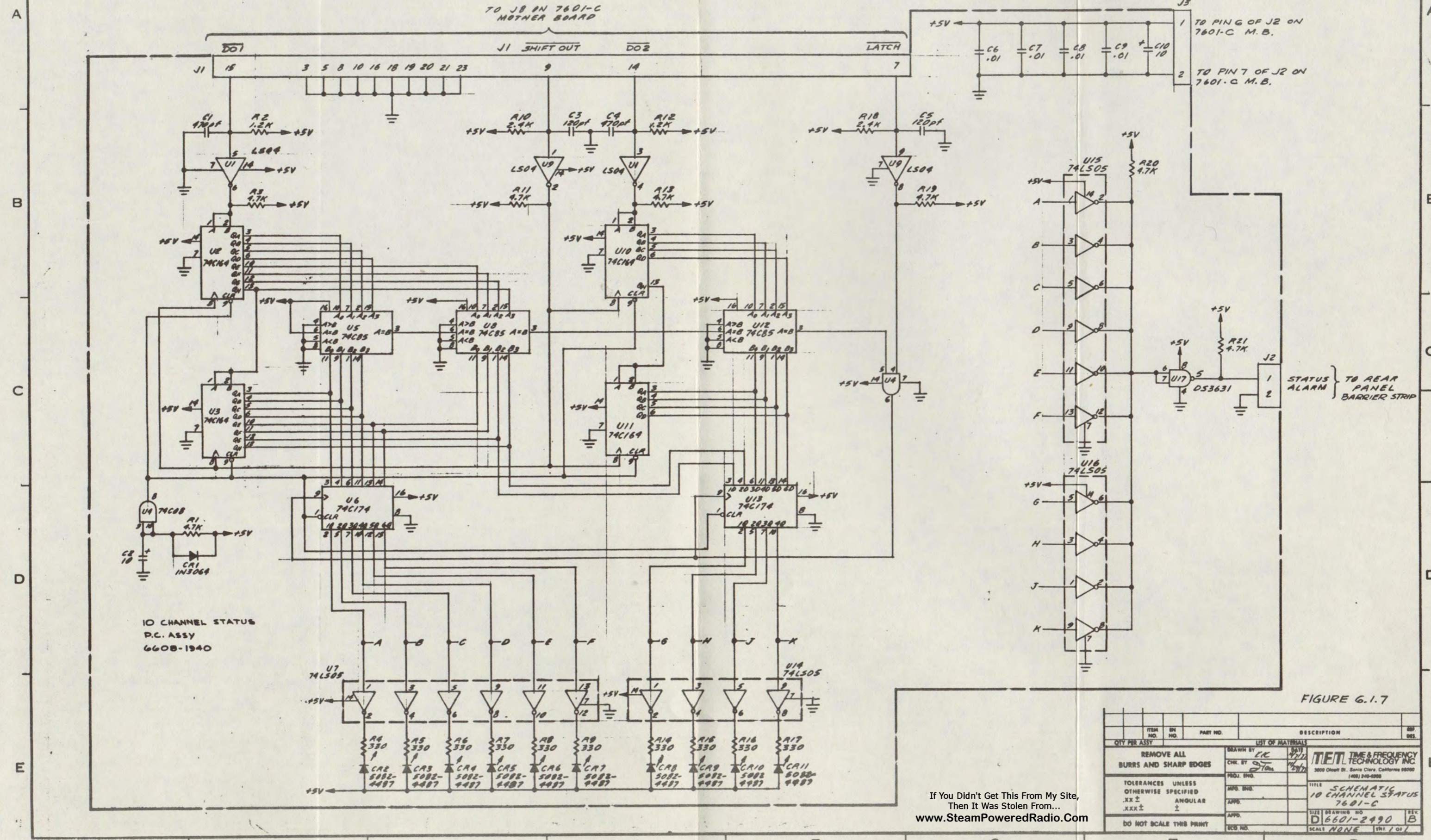
Assembly # 6608-1940

Rev C

Ckt. Ref.	Description	TFT Stock No.
R20	Resistor, Car Comp 1/4W <u>+5%</u> 4.7K	1065-4701
R21	Resistor, Car Comp 1/4W <u>+5%</u> 4.7K	1065-4701
U1	IC SN74LS04N	1101-7404
U2	IC MM74C164	1102-0164
U3	IC MM74C164	1102-0164
U4	IC MM74C08	1102-7408
U5	IC MM74C85	1102-7485
U6	IC MM74C174	1102-0174
U7	IC 74LS05	1101-7405
U8	IC 74C85	1102-7485
U9	IC SN74LS04N	1101-7404
U10	IC MM74C164	1102-0164
U11	IC MM74C164	1102-0164
U12	IC 74C85	1102-7485
U13	IC MM74C174	1102-0174
U14	IC 74LS05	1101-7405
U15	IC 74LS05	1101-7405
U16	IC 74LS05	1101-7405
U17	IC DS3631	1102-3631
	Socket, IC 14 Pin	2250-1014
	Socket, IC 16 Pin	2250-1016
	Socket, IC 8 Pin	2250-1008
	P.C. Board	1600-1940



REV	SYMBOL	DESCRIPTION	DR	CHK	AUTH	DATE
A		RELEASED TO PROD	KL			11/81
B		U13 WAS 74C168, C6-C9 WAS 0.1	JT		456	7/87



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ITEM NO.	QTY PER ASSY	IN NO.	PART NO.	DESCRIPTION	REF. DES.
REMOVE ALL BURRS AND SHARP EDGES					
TOLERANCES UNLESS OTHERWISE SPECIFIED					
.XX ± ANGULAR ±					
DO NOT SCALE THIS PRINT					

DATE	BY	CHKD BY	PRD. ENG.	APP. ENG.	REV.
11/81	KL	KL			
7/87	JT				B

MET TIME & FREQUENCY TECHNOLOGY INC	
3000 Clute Dr. Santa Clara, California 95050 (408) 249-8300	
TITLE	SCHEMATIC 10 CHANNEL STATUS 7601-C
SIZE	D 6601-2490
SCALE	NONE
SHEET	1 OF 1

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
A	RELEASED FOR PRINTING	7/16/79	JTan

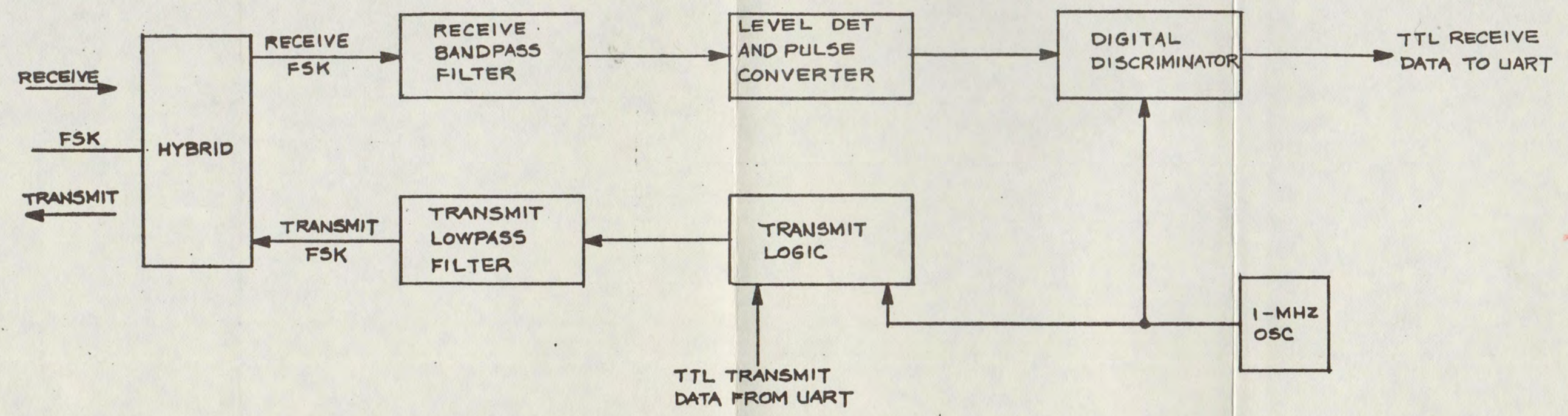
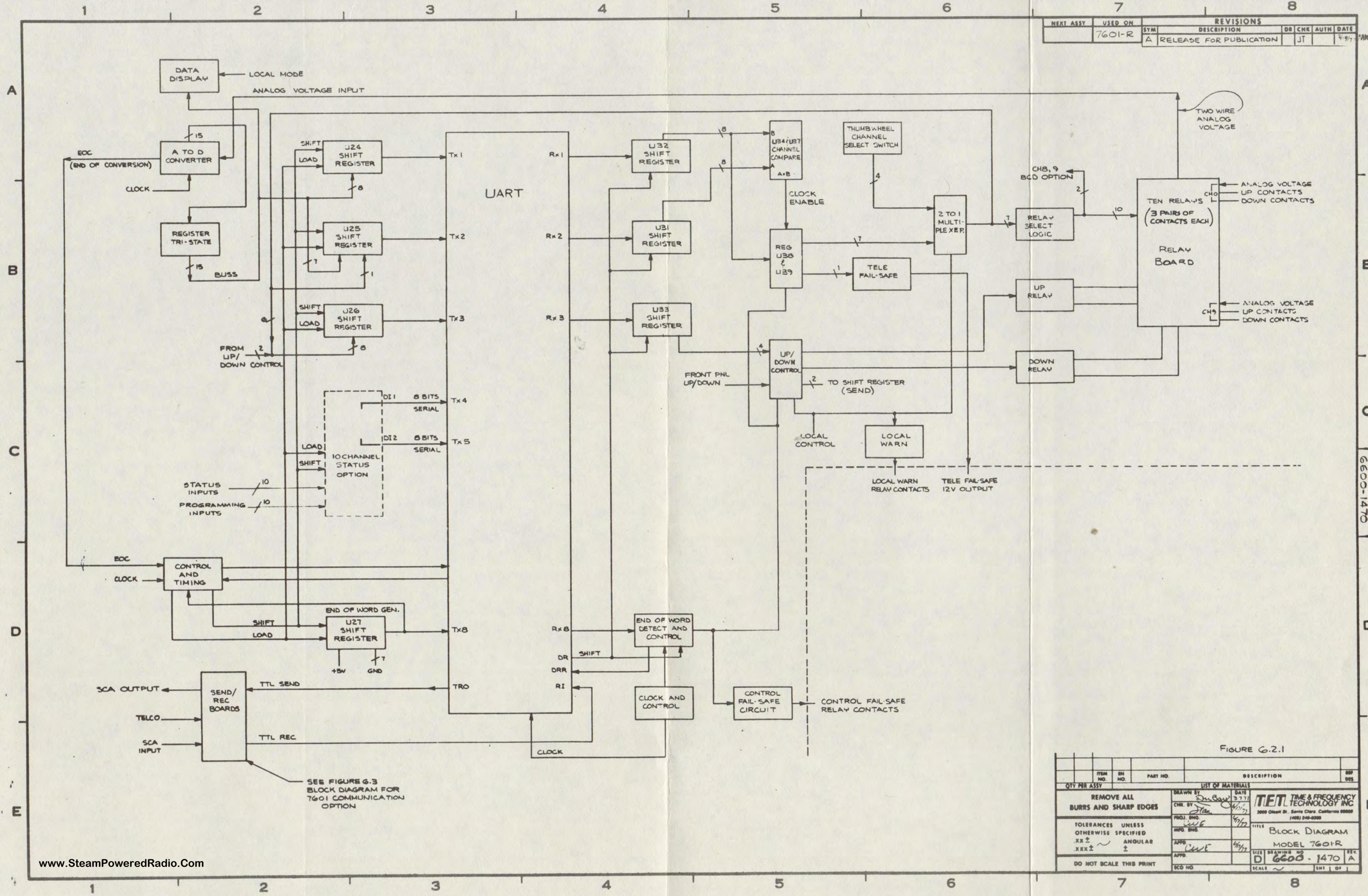


FIG 6-1-8

QTY REGD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION
PARTS LIST				
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES ± ~ .XX ± ~ ± ~ .XXX ± ~			<b>TIME &amp; FREQUENCY TECHNOLOGY INC.</b>	
MATERIAL ~			CONTRACT NO.	
FINISH ~			APPROVALS DATE	
NEXT ASSY USED ON			DRAWN <i>m. Jee</i> 7/16/79	
APPLICATION			CHECKED <i>JTan</i> 7/16/79	
DO NOT SCALE DRAWING			ISSUED <i>JTan</i> 7/16/79	
			SCALE NONE	
			SHEET 1 OF 1	

NEXT ASSY		USED ON		REVISIONS			
SYM	DESCRIPTION	DR	CHK	AUTH	DATE		
	7601-R	A			RELEASE FOR PUBLICATION	JT	4/9/77



SEE FIGURE G.3  
BLOCK DIAGRAM FOR  
7601 COMMUNICATION  
OPTION

FIGURE G.2.1

ITEM NO.	QTY PER ASSY	SYM	DESCRIPTION	REF DES
LIST OF MATERIALS				
REMOVE ALL BURRS AND SHARP EDGES				
TOLERANCES UNLESS OTHERWISE SPECIFIED				
.XX ± ~ ANGULAR ±				
DO NOT SCALE THIS PRINT				
DRAWN BY: <i>Jim Cow</i>		DATE: 3/77		
CHK. BY: <i>JT</i>		DATE: 4/77		
PROJ. ENG. <i>WLF</i>		DATE: 4/77		
APP. <i>WLF</i>		DATE: 4/77		
TITLE: BLOCK DIAGRAM				REV: A
MODEL: 7601-R				REV: A
DRAWING NO: D 6600-1470				REV: A
SCALE: ~				SHT 1 OF 1

DRAW. NO. 6600-1470

NEXT ASSY		USED ON		REVISIONS			
ITEM NO.	EN. NO.	SYM	DESCRIPTION	DR	CHK	AUTH	DATE
5004-7601	7601R	A	REL TO PRODUCTION	FD	JT	388	12/77

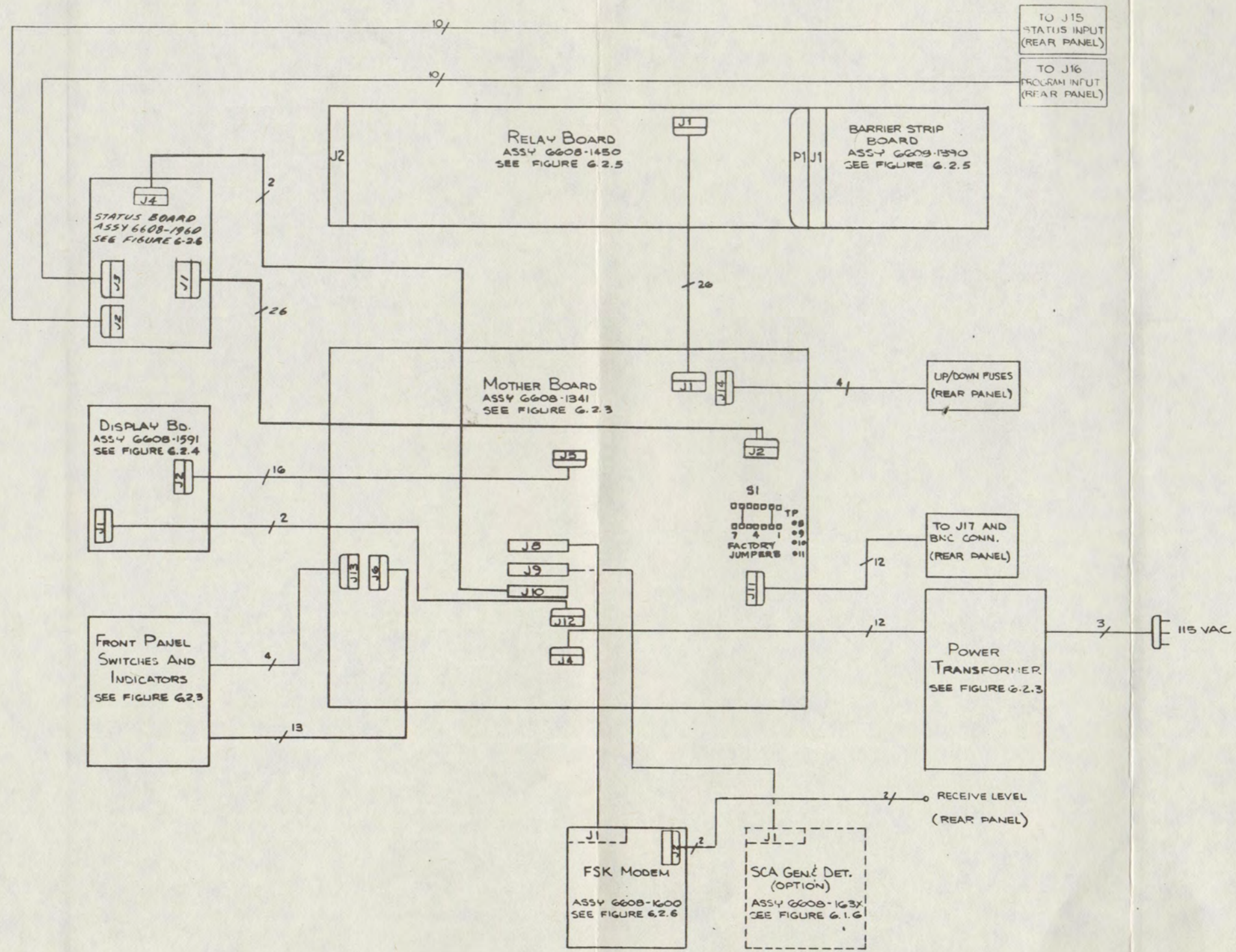


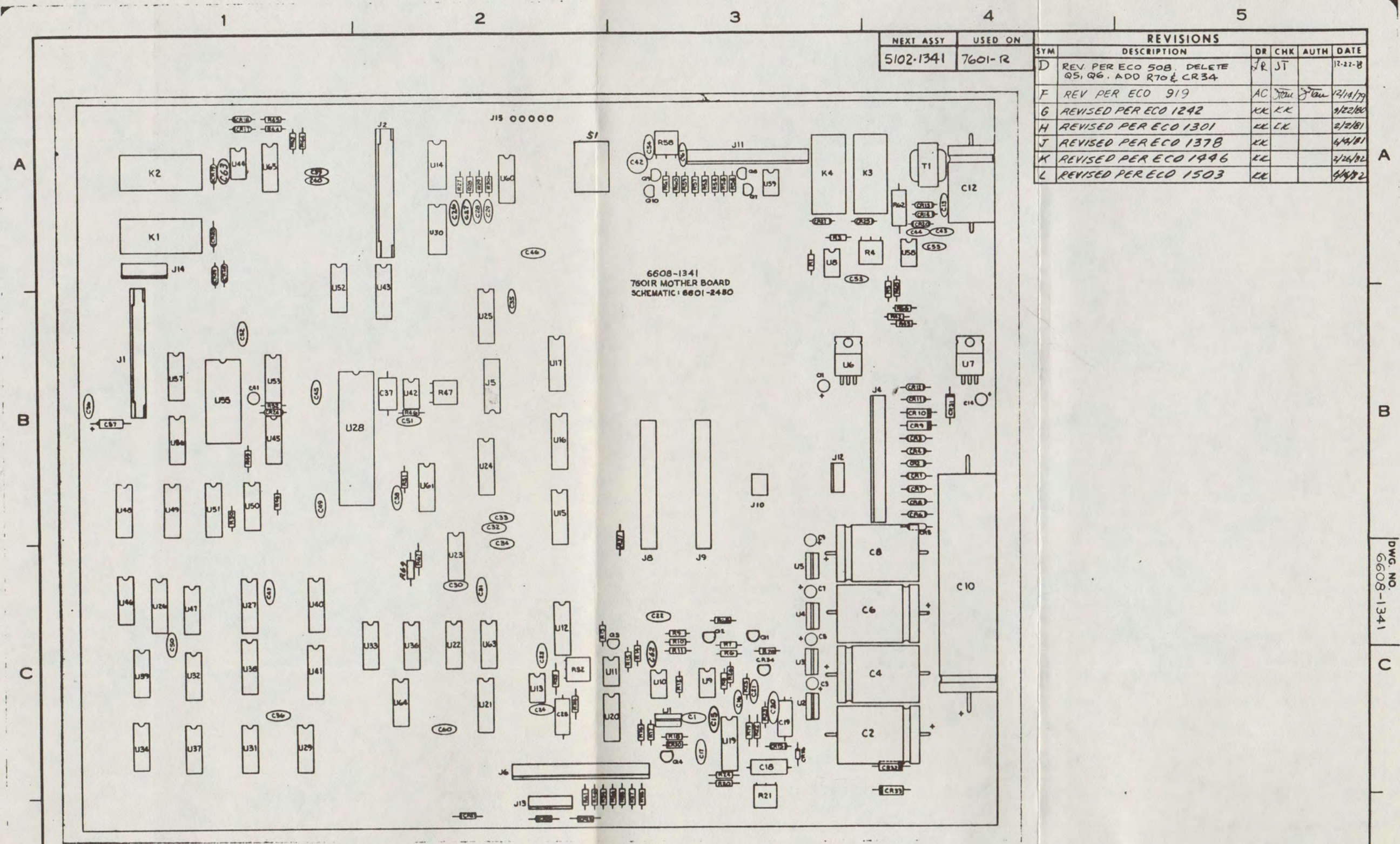
FIGURE G.2.2

ITEM NO.	EN. NO.	PART NO.	DESCRIPTION	REF. DES.
LIST OF MATERIALS				
REMOVE ALL BURRS AND SHARP EDGES				
TOLERANCES UNLESS OTHERWISE SPECIFIED				
XX ±	~	ANGULAR	±	
XXX ±	~	±		
DO NOT SCALE THIS PRINT				

DRAWN BY <i>De Bay</i>	DATE 75	<b>TET</b> TIME & FREQUENCY TECHNOLOGY INC 3000 Olcott St. Santa Clara, California 95050 (408) 248-8200
CHK BY <i>De Bay</i>		
PROJ. ENG.		
MFG. ENG.		
APPD. <i>Curt</i>		TITLE WIRE DIAGRAM
APPD.		SIZE D 6600-1480
ECO NO.		SCALE —
		SHT. OF

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NEXT ASSY	USED ON
5102-1341	7601-R

REVISIONS					
SYM	DESCRIPTION	DR	CHK	AUTH	DATE
D	REV PER ECO 508. DELETE Q5, Q6. ADD R70 & CR34	JR	JT		12-22-88
F	REV PER ECO 919	AC	Jam	Jam	12/14/89
G	REVISED PER ECO 1242	KK	KK		1/22/90
H	REVISED PER ECO 1301	KK	KK		2/2/91
J	REVISED PER ECO 1378	KK			4/4/91
K	REVISED PER ECO 1446	KK			2/26/92
L	REVISED PER ECO 1503	KK			11/9/92

6608-1341  
7601R MOTHER BOARD  
SCHEMATIC: 6601-2480

DWG. NO. 6608-1341 U

ITEM NO	EN NO	PART NO	DESCRIPTION	REF DES
QTY PER ASSY				
LIST OF MATERIALS				
REMOVE ALL BURRS AND SHARP EDGES			DRAWN BY <i>Refer</i> DATE <i>12/10/88</i>	<b>TFT</b> TIME & FREQUENCY TECHNOLOGY INC 3000 Olcott St., Santa Clara, California 95051 (408) 246-6365 TITLE 7601R MOTHER BOARD ASSY SIZE DRAWING NO C 6608-1341 REV 4 DO NOT SCALE THIS PRINT
TOLERANCES UNLESS OTHERWISE SPECIFIED			CHK BY <i>Jam</i> DATE <i>12/6/88</i>	
.XX ±			PROJ ENG	
.XXX ±			MFG ENG	
ANGULAR ±			APPD	
DO NOT SCALE THIS PRINT			APPD	ECO NO
			SCALE	SHT   OF

Model 7601-R

Mother Board

Assembly # 6608-1341

Rev L

Ckt. Ref.	Description	TFT Stock No.
C1	Cap Cer Disc .1MFD 12V	1005-0100
C2	Cap Elect 500MFD 25V	1010-0511
C3	Cap Tan 10MFD 20V 10%	1008-0100
C4	Cap Elect 500MFD 25V	1010-0511
C5	Cap Tan 10MFD 20V 10%	1008-0100
C6	Cap Elect 500MFD 25V	1010-0511
C7	Cap Tan 10MFD 20V 10%	1008-0100
C8	Cap Elect 500MFD 25V	1010-0511
C9	Cap Tan 10MFD 20V 10%	1008-0100
C10	Cap Elect 8000UF 25V	1010-8000
C11	Cap Tan 10MFD 20V 10%	1008-0100
C12	Cap Elect 500MFD 25V	1010-0511
C13	Cap Cer Disc .01MFD	1005-1039
C14	Cap Tan 10MFD 20V 10%	1008-0100
C15	Cap Mica 10pF	1001-0100
C16	Cap Cer Disc .05MFD	1005-5039
C17	Cap Cer Disc .05MFD	1005-5039
C18	Cap Poly Carb .022MFD 50V	1006-0220
C19	Cap Tan 10MFD 20V 10%	1008-0101
C20	Cap Poly .1MFD 100V	1002-0010
C21	Cap Cer Disc .001MFD	1005-1049
C22	Cap Cer Disc .05MFD	1005-5039
C23	Cap Cer Disc .1MFD 12V	1005-0100
C24	Cap Cer Disc .01MFD	1005-1039
C25	Cap Poly Carb .0013MFD 50V	1006-0013
C26	Cap Cer Disc 500pF 5%	1005-0501
C27	Cap Cer Disc 500pF 5%	1005-0501
C28	Cap Cer Disc 500pF 5%	1005-0501
C29	Cap Cer Disc 500pF 5%	1005-0501
C30	Cap Cer Disc .01MFD	1005-1039
C31	Cap Cer Disc .01MFD	1005-1039
C32	Cap Cer Disc .01MFD	1005-1039
C33	Cap Cer Disc .01MFD	1005-1039
C34	Cap Cer Disc .01MFD	1005-1039
C35	Cap Cer Disc .01MFD	1005-1039
C36	Cap Cer Disc .1MFD	1005-0100
C37	Cap Poly Carb .022MFD 50V	1006-0220
C38	Cap Cer Disc .01MFD	1005-1039
C39	Cap Cer Disc .1 MFD 12V	1005-0100
C40	Not Used	
C41	Cap Tan 10MFD 20V 10%	1008-0100
C42	Cap Elect 100MFD 25V VERT MT	1010-0110

Model 7601-R

Mother Board

Assembly #6608-1341  
Rev L

Ckt. Ref.	Description	TFT Stock No.
C43	Cap Cer Disc .05MFD	1005-5039
C44	Cap Cer Disc .05MFD	1005-5039
C45	Cap Cer Disc .05MFD	1005-5039
C46	Not Used	
C47	Cap Cer Disc .0MFD 12V	1005-0100
C48	Cap Cer Disc .1MFD 12V	1005-0100
C49	Cap Cer Disc .1MFD 12V	1005-0100
C50	Cap Cer Disc .1MFD 12V	1005-0100
C51	Cap Cer Disc .1MFD 12V	1005-0100
C52	Cap Cer Disc .1MFD 12V	1005-0100
C53	Cap Cer Disc 500pF 5%	1005-0501
C54	Cap Cer Disc .05MFD	1005-5039
C55	Cap Cer Disc 500pF 5%	1005-0501
C56	Cap Cer Disc .05MFD	1005-5039
C57	Cap Tan 10MFD 20V 10%	1008-0101
C58	Not Used	
C59	Not Used	
C60	Cap Cer Disc .01MFD	1005-1039
C61	Cap cer Disc .2MFD	1005-2029
C62	Cap Cer Disc .1UF 12V	1005-0100
C63	Cap Cer Disc .1UF 12V	1005-0100
CR1	Dio Rect IN4002	1284-4002
CR2	Dio Rect IN4002	1284-4002
CR3	Dio Rect IN4002	1284-4002
CR4	Dio Rect IN4002	1284-4002
CR5	Dio Rect IN4002	1284-4002
CR6	Dio Rect IN4002	1284-4002
CR7	Dio Rect IN4002	1284-4002
CR8	Dio Rect IN4002	1284-4002
CR9	Dio MR501	1281-0501
CR10	Dio MR501	1281-0501
CR11	Dio Rect IN4002	1284-4002
CR12	Dio Rect IN4002	1284-4002
CR13	Dio ZNR IN4737	1283-4737
CR14	Dio ZNR IN4737	1283-4737
CR15	Dio ZNR IN4739	1283-4739
CR16	Dio IN3064	1281-3064
CR17	Dio IN281	1280-0281
CR18	Dio IN281	1280-0281
CR19	Dio Rect IN4002	1284-4002
CR20	Dio Rect IN4002	1284-4002
CR21	Dio Rect IN4002	1284-4002
CR22	Dio Rect IN4002	1284-4002
CR23	Dio Rect IN4002	1284-4002
CR24	Dio IN3064	1281-3064

Model 7601-R

Mother Board

Assembly # 6608-1341  
Rev L

Ckt. Ref.	Description	TFT Stock No.
CR25	Dio Rect IN4002	1284-4002
CR26	Dio Rect IN4002	1284-4002
CR27	Dio Rect IN4002	1284-4002
CR28	Dio IN281	1280-0281
CR29	Dio IN281	1280-0281
CR30	Dio IN3064	1281-3064
CR31	Dio Volt Sup MPTE 5	1283-0005
CR32	Dio Volt Sup 1.5KE 400A	1283-0400
CR33	Dio Volt Sup 1.4KE 400A	1283-0400
CR34	Dio LM329 DZ Ref	1281-0329
J1	Conn 26 Pin M Header	2250-6512
J2	Conn 26 Pin M Header	2250-6512
J4	Conn 12 Pin Molex	2250-6012
J6A	Plug 6 Pin	2250-6006
J6B	Plug 7 Pin Molex	2250-6007
J8	Conn 12 Pin Molex	2250-6412
J9	Conn 12 Pin Molex	2250-6412
J10	Plug 2 Pin	2250-6002
J11	Conn 12 Pin Molex	2250-6012
J12	Plug 2 Pin	2250-6002
J13	Plug 4 Pin	2250-6004
K1A	Socket Relay	2250-0006
K1B	Relay 12V 4 Pole	1880-0006
K2A	Socket Relay	2250-0005
K2B	Relay 12V 4 Pole	1880-0006
K3	Relay A2 AZ530-08-1	1880-0003
K4	Relay A2 AZ530-08-1	1880-0003
Q1	Xistor 2N4275	1271-4275
Q2	Xistor 2N4275	1271-4275
Q3	Xistor 2N4121	1271-4121
Q4	Xistor 2N4275	1271-4275
Q7	Xistor 2N5089	1271-5089
Q8	Xistor 2N4121	1271-4121
Q9	Xistor 2N5089	1271-5089
Q10	Xistor 2N5089	1271-5089
R1	Res Car Comp 1/4W 5% 4.7K	1065-4701
R3	Res Car Comp 1/4W 5% 10K	1065-1002
R4	Pot 10K 1T	1072-1002
R5	Res Car Comp 1/4W 5% 820	1065-0820
R6	Res Car Comp 1/4W 5% 10K	1065-1002
R7	Res Car Comp 1/4W 5% 150	1065-0150
R8	Res Car Comp 1/4W 5% 4.7K	1065-4701
R9	Res Car Comp 1/4W 5% 6.8K	1065-6801



Model 7601-R

Mother Board

Assembly # 6608-1341

Rev L

Ckt. Ref.	Description	TFT Stock No.
R10	Res Car Comp 1/4W 5% 10K	1065-1002
R11	Res Car Comp 1/4W 5% 150	1065-0150
R12	Res Car Comp 1/4W 5% 4.7K	1065-4701
R13	Res Car Comp 1/4W 5% 5.6K	1065-5601
R14	Res Car Comp 1/4W 5% 4.7K	1065-4701
R15	Res Car Comp 1/4W 5% 4.7K	1065-4701
R16	Res Car Comp 1/4W 5% 10K	1065-1002
R17	Res Car Comp 1/4W 5% 27K	1065-2702
R18	Res Car Comp 1/4W 5% 68K	1065-6802
R19	Res MT FLM 1/8W 1% 100K	1061-1003
R20	Res MT FLM 1/8W 1% 75.0K	1061-7502
R21	Pot PC MT 20K 1T	1072-2002
R22	Res Car Comp 1/4W 5% 120K	1065-1203
R23	Res Car Comp 1/4W 5% 33K	1065-3302
R24	Res MT FLM 1/8W 1% 100K	1061-1003
R25	Res Car Comp 1/4W 5% 1M	1065-1004
R26	Res Car Comp 1/4W 5% 470K	1065-4703
R27	Res Car Comp 1/4W 5% 1.2K	1065-1201
R28	Res Car Comp 1/4W 5% 1.2K	1065-1201
R29	Res Car Comp 1/4W 5% 1.2K	1065-1201
R30	Res Car Comp 1/4W 5% 1.2K	1065-1201
R31	Res Car Comp 1/4W 5% 470K	1065-4703
R32	Pot PC MT 5K 1T	1072-5001
R33	Res MT FLM 1/8W 1% 24.3K F.S.	1061-2432
R34	Res MT FLM 1/8W 1% 12.1K	1061-1212
R35	Res Car Comp 1/4W 5% 4.7K	1065-4701
R36	Res Car Comp 1/4W 5% 4.7K	1065-4701
R37	Res Car Comp 1/4W 5% 4.7K	1065-4701
R38	Res Car Comp 1/4W 5% 4.7K	1065-4701
R39	Res Car Comp 1/4W 5% 4.7K	1065-4701
R40	Res Car Comp 1/4W 5% 4.7K	1065-4701
R41	Res CAr Comp 1/4W 5% 4.7K	1065-4701
R42	Res Car Comp 1/4W 5% 4.7K	1065-4701
R43	Res CAr Comp 1/4W 5% 4.7K	1065-4701
R44	Res Car Comp 1/4W 5% 15K	1065-1502
R45	Res Car Comp 1/4W 5% 15K	1065-1502
R46	Res MT FLM 1/8W 1% 3.57K	1061-3571
R47	Pot PC MT 500 OHM 1T	1072-0500
R48	Res Car Comp 1/4W 5% 4.7K	1065-4701
R49	Res Car Comp 1/4W 5% 2.2K	1065-2201
R50	Res Car Comp 1/4W 5% 4.7K	1065-4701
R51	Res Car Comp 1/4W 5% 2.2K	1065-2201
R52	Res Car Comp 1/4W 5% 4.7K	1065-4701
R53	Res Car Comp 1/4W 5% 10K	1065-1002
R54	Res Car Comp 1/4W 5% 4.7K	1065-4701

Model 7601-R

Mother Board

Assembly # 6608-1341

Rev L

Ckt. Ref.	Description	TFT Stock No.
R55	Res Car Comp 1/4W 5% 7.5K	1065-7501
R56	Res Car Comp 1/4W 5% 5.6K	1065-5601
R57	Res Car Comp 1/4W 5% 330K	1065-3303
R58	Pot PC MT 500K	1072-5003
R59	Res Car Comp 1/4W 5% 470	1065-0470
R60	Res Car Comp 1/4W 5% 22K	1065-2202
R61	Res Car Comp 1/4W 5% 33K	1065-3302
R62	Res Car Comp 1W 5% 100	1067-1525
R63	Res Car Comp 1/4W 5% 15K	1065-1502
R64	Res Car Comp 1/4W 5% 15K	1065-1502
R65	Res Car Comp 1/4W 5% 6.8K	1065-6801
R66	Res Car Comp 1/4W 5% 820	1065-0820
R67	Res Car Comp 1/4W 5% 4.7K	1065-4701
R68	Res Car Comp 1/4W 5% 180	1065-0180
R69	Res Car Comp 1/4W 5% 4.7K	1065-4701
R70	Res Car Comp 1/4W 5% 4.7K	1065-4701
T1	XFMR 600 OHM 1.1	1500-0600
U1	I/C LM 342P-5.0	1100-4205
U2	I/C Reg 1/2 Amp +12V	1100-4212
U3	I/C Reg 1/2 Amp 12V	1100-2012
U4	I/C Reg 1/2 Amp +12V	1100-4212
U5	I/C Reg 1/2 Amp 12V	1100-2012
U6	I/C LM340T-05	1100-7805
U7	I/C LM340T-05	1100-7805
U8	I/C LM741CN	1100-0741
U9	Optic Isolator 5082-4350	1099-0002
U10	Optic Isolator 5082-4350	1099-0002
U11	Optic Isolator 5082-4350	1099-0002
U12	I/C LD110CJ	1100-0110
U13	I/C LM555CN	1100-0555
U14	I/C SN74LS04N	1101-7404
U15	I/C MM74C173N	1102-4173
U16	I/C MM74C173N	1102-4173
U17	I/C MM74C173N	1102-4173
U18	Not Used	
U19	I/C LD11CJ	1100-0111
U20	I/C SN7404N	1100-7404
U21	I/C MM74C161N	1102-0161
U22	I/C MM74C04	1102-7404
U23	I/C MM74CO0N	1102-7400
U24	I/C MM74C165	1102-0165
U25	I/C MM74C165	1102-0165
U26	I/C MM74C165	1102-0165
U27	I/C MM74C165	1102-0165
U28	I/C MM5303	1100-5303

Model 7601-R

Mother Board

Assembly # 6608-1341  
Rev L

Ckt. Ref.	Description	TFT Stock No.
U29	I/C MM74C74N	1102-7474
U31	I/C MM74C164	1102-0164
U32	I/C MM74C164	1102-0164
U33	I/C MM74C164	1102-0164
U34	I/C MM74C85N	1102-7485
U35	Not Used	
U36	I/C MM74C08N	1102-7408
U37	I/C MM74C85N	1102-7485
U38	I/C MM74C174N	1102-0174
U39	I/C MM74C174N	1102-0174
U40	I/C MM74C157N	1102-0157
U41	I/C MM74C157N	1102-0157
U42	I/C LM567CN	1100-0567
U43	I/C MM74C161N	1102-0161
U44	I/C DS3632N	1102-3632
U45	I/C SN74LS00N	1101-7400
U46	I/C MM74C902	1102-4902
U47	I/C MM74C902	1102-4902
U48	I/C DM74LS174N	1101-7174
U49	I/C DM8160N	1100-8160
U50	I/C MM74LS74N	1101-7474
U51	I/C DM74LS161N	1101-7161
U52	I/C DM74LS86N	1101-7486
U53	I/C DM74LS502N	1101-7402
U55	I/C DM74LS154N	1101-7154
U56	I/C DM7407N	1100-7407
U57	I/C DM7407N	1100-7407
U58	I/C DS3632N	1102-3632
U59	I/C DS3631N	1102-3631
U60	I/C MM74C902	1102-4902
U61	I/C MM74C08N	1102-7408
U63	I/C MM74C08N	1102-7408
U64	I/C MM74C04	1102-7404
U65	I/C MM74C04	1102-7404
	PC BD 7610-R Mother	1600-1340
	Heatsink 6072B	2010-6072
	Nut Kep 4-40	2111-0001
	Tyton, QWK Tie	2140-0004
	Retainer Relay	2140-0026

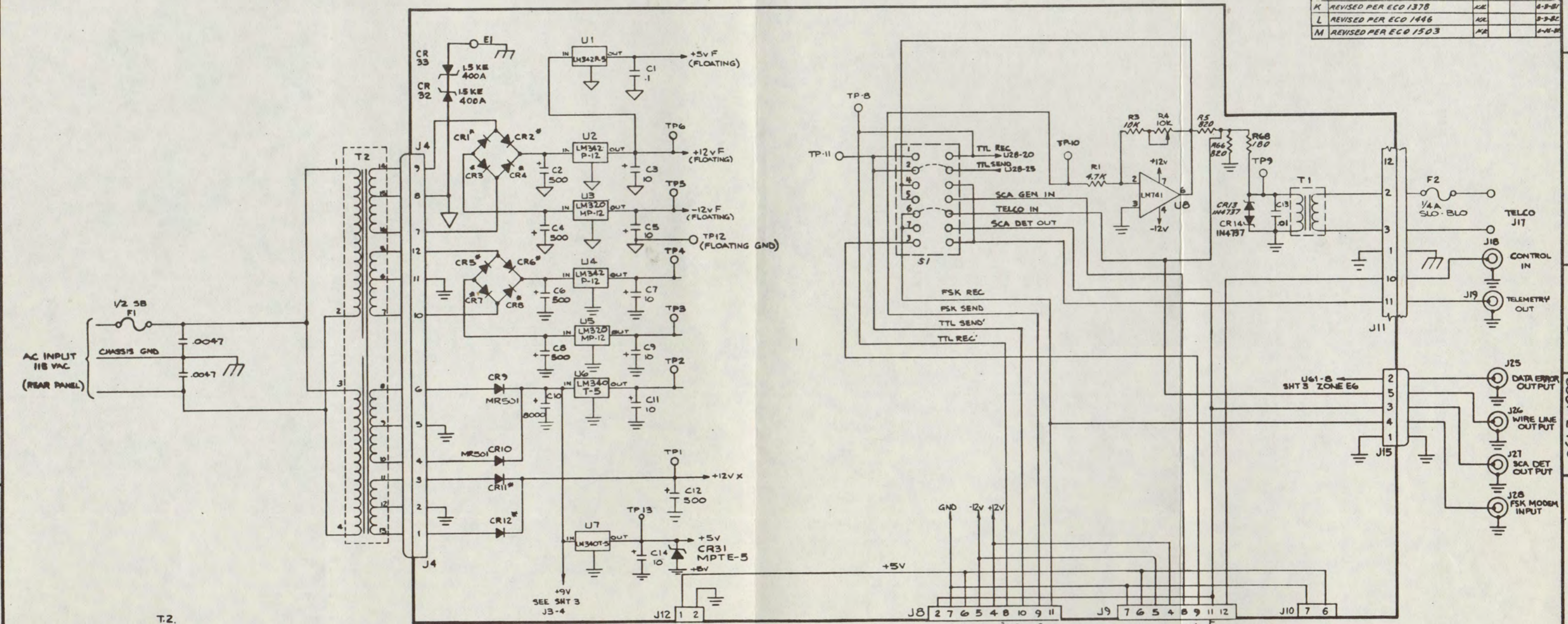
Model 7601-R

Mother Board

Assembly # 6608-1341  
Rev 1

Ckt. Ref.	Description	TFT Stock No.
S1	Tie Mounts TC141 Socket, I/C 8 Pin Socket, I/C 14 Pin Socket, I/C 16 Pin Socket, I/C 24 Pin Socket, I/C 40 Pin Switch 14 Pin Dip	2140-0141 2250-1008 2250-1014 2250-1016 2250-1024 2250-1040 1800-2067

NEXT ASSY		USED ON		REVISIONS			
SYM	DESCRIPTION	DR	CHK	AUTH	DATE		
5004-7601	7601-R						
A	REL TO PRODUCTION	TD	JT	386			
B	REVISED PER ECO	AK	JT	472	8-5-78		MICR
C	REVISED PER ECO	JT	JT	491	9/7/78		
D	REVISED PER ECO	DC	JT	508	10-28-78		MICR
E	REVISED PER ECO	AK	JT	791	4/24/79		A
F	REVISED PER ECO 918	AC	JT		11/1/79		
G	REVISED PER ECO 1241	AK	EE		12/2/79		
H	REVISED PER ECO 1290	AK			11/1/81		
J	REVISED PER ECO 1302	AK			2/2/81		
K	REVISED PER ECO 1378	AK			6-5-81		
L	REVISED PER ECO 1446	AK			9-9-82		
M	REVISED PER ECO 1503	AK			1-11-83		



T.2.

PIN	WIRE COLOR
5	GREEN
6	GREEN/WHITE
7	GREEN
8	RED
9	RED/WHITE
10	RED
11	WHITE
12	BLACK/WHITE
13	WHITE
14	BLUE
15	BLUE/WHITE
16	BLUE

- TO FSK GEN AND DET BOARD
- TO SCA GEN AND DET BOARD
6. P.C. BD ASSY IS 6608-1341
  5. ON THE FOLLOWING DEVICES PIN 6 IS +5VDC AND PIN 7 IS GROUND: 74C85, 74C157, 74C161, 74C165
  4. ON THE FOLLOWING DEVICES PIN 14 IS +5VDC AND PIN 7 IS GROUND: 74C00, 74C04, 74C08, 74C74, 74C07, 74LS00, 74LS02, 74LS04, 74LS14, 74LS86, 74LS64
  3. ALL DIODES ARE IN 4002
  2. CAPACITOR VALUES ARE IN MICRO FARADS
  1. RESISTOR VALUES ARE IN OHMS, 1/4W
- NOTES, UNLESS OTHERWISE SPECIFIED;

T. R33 FS VALUE RANGE FROM 20.5K TO 24.3K

FIGURE 6-2-3

ITEM NO.	QTY PER ASSY	SYM	DESCRIPTION	REF
LIST OF MATERIALS				
REMOVE ALL BURRS AND SHARP EDGES				
TOLERANCES UNLESS OTHERWISE SPECIFIED				
.XX ±				
.XXX ±				
DO NOT SCALE THIS PRINT				

DR	CHK	AUTH	DATE
AK	JT	AK	11/1/79

TFT TIME & FREQUENCY TECHNOLOGY INC  
3000 Chino St. Santa Clara, California 95050  
(408) 240-0000

TITLE: SCHEMATIC: 7601-R MOTHER BOARD

SIZE: DRAWING NO: D 6601-2450

SCALE: 1:1

NEXT ASSY		USED ON		REVISIONS			
ITEM NO.	EN NO.	PART NO.	DESCRIPTION	DR	CHK	AUTH	DATE
7601R							

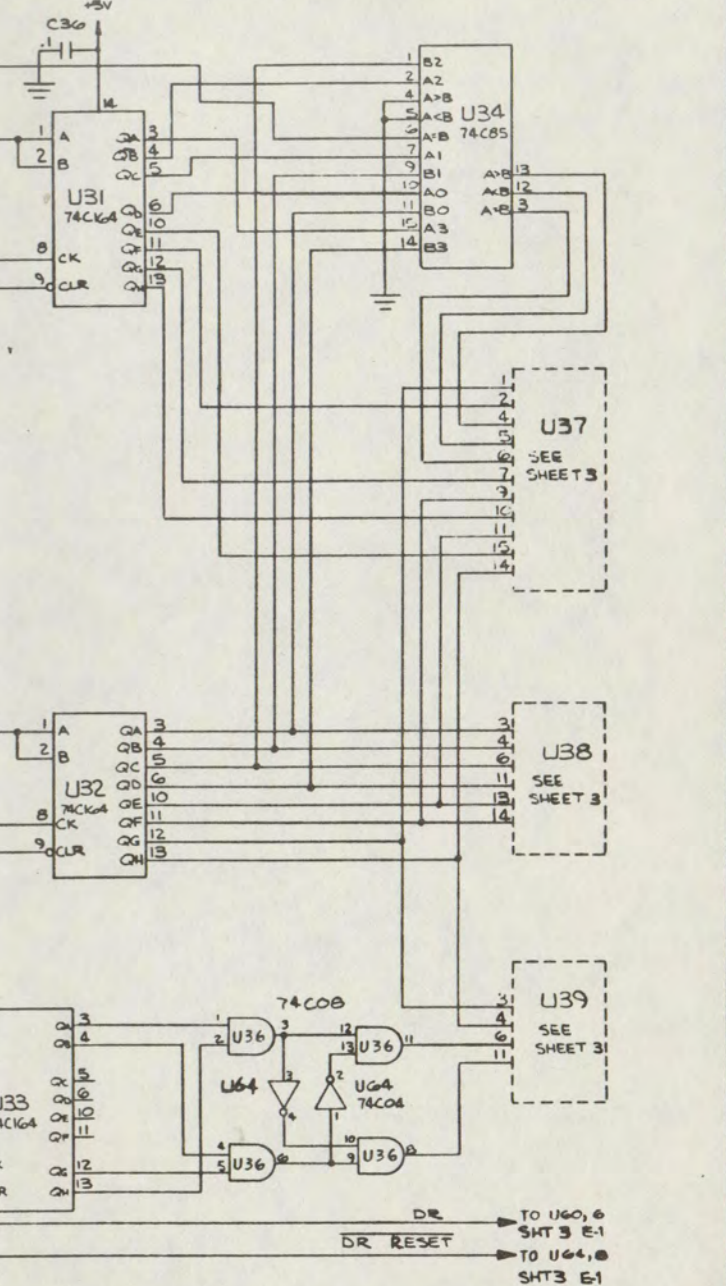
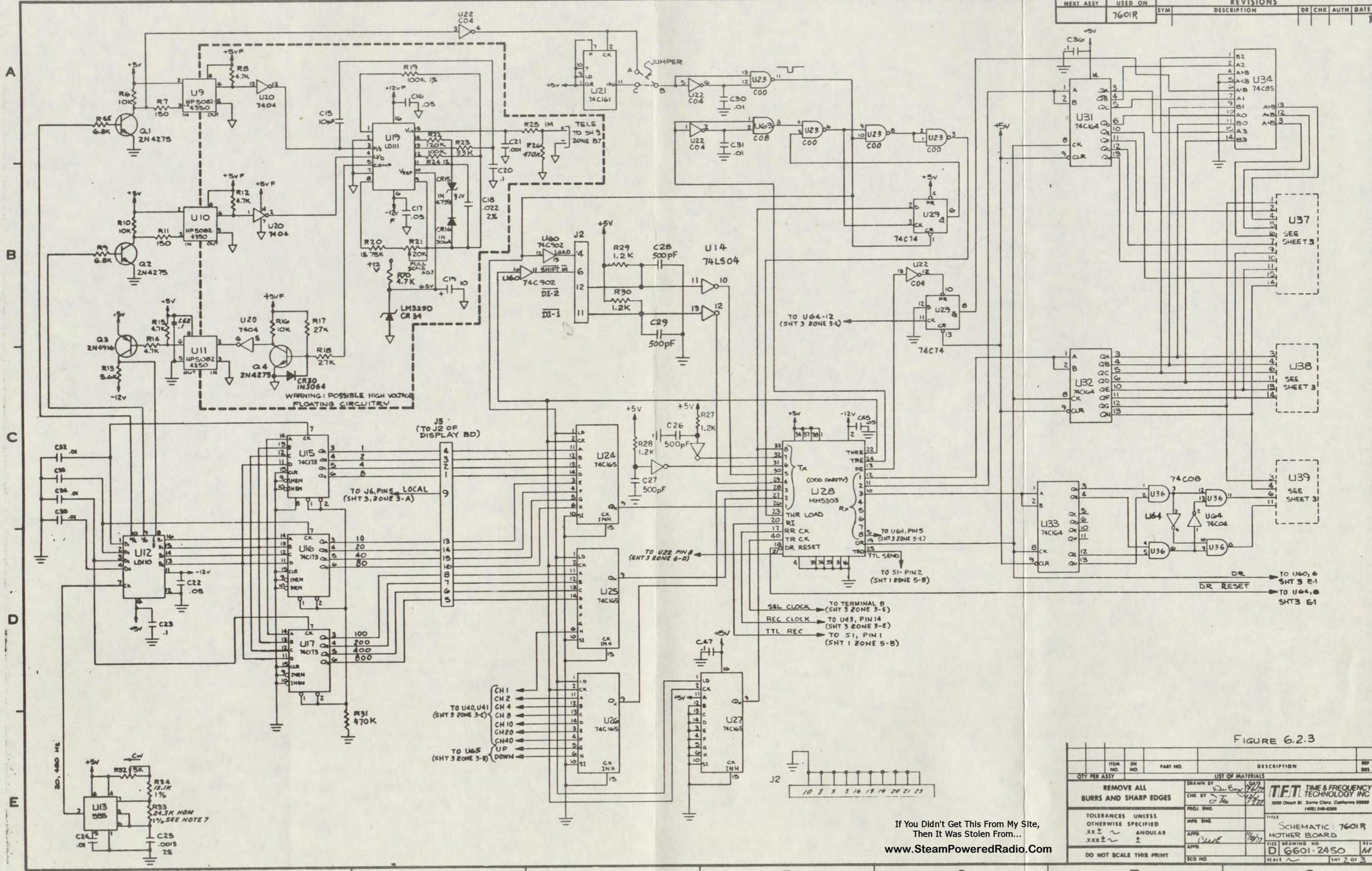


FIGURE 6.2.3

QTY PER ASSY	ITEM NO.	EN NO.	PART NO.	DESCRIPTION	REF DES.
REMOVE ALL BURRS AND SHARP EDGES					
TOLERANCES UNLESS OTHERWISE SPECIFIED					
.XX ± ~ ANGULAR					
.XXX ± ~					
DO NOT SCALE THIS PRINT					

DRAWN BY		DATE		TITLE
CHK BY	PROJ. ENG.	APP'D	DATE	
				SCHEMATIC: 7601R MOTHER BOARD

SIZE	DRAWING NO.	SCALE	SHT 2 OF 3
D	6601-2450		

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NEXT ASSY		USED ON	REVISIONS			
SYM	DESCRIPTION	DR	CHK	AUTH	DATE	

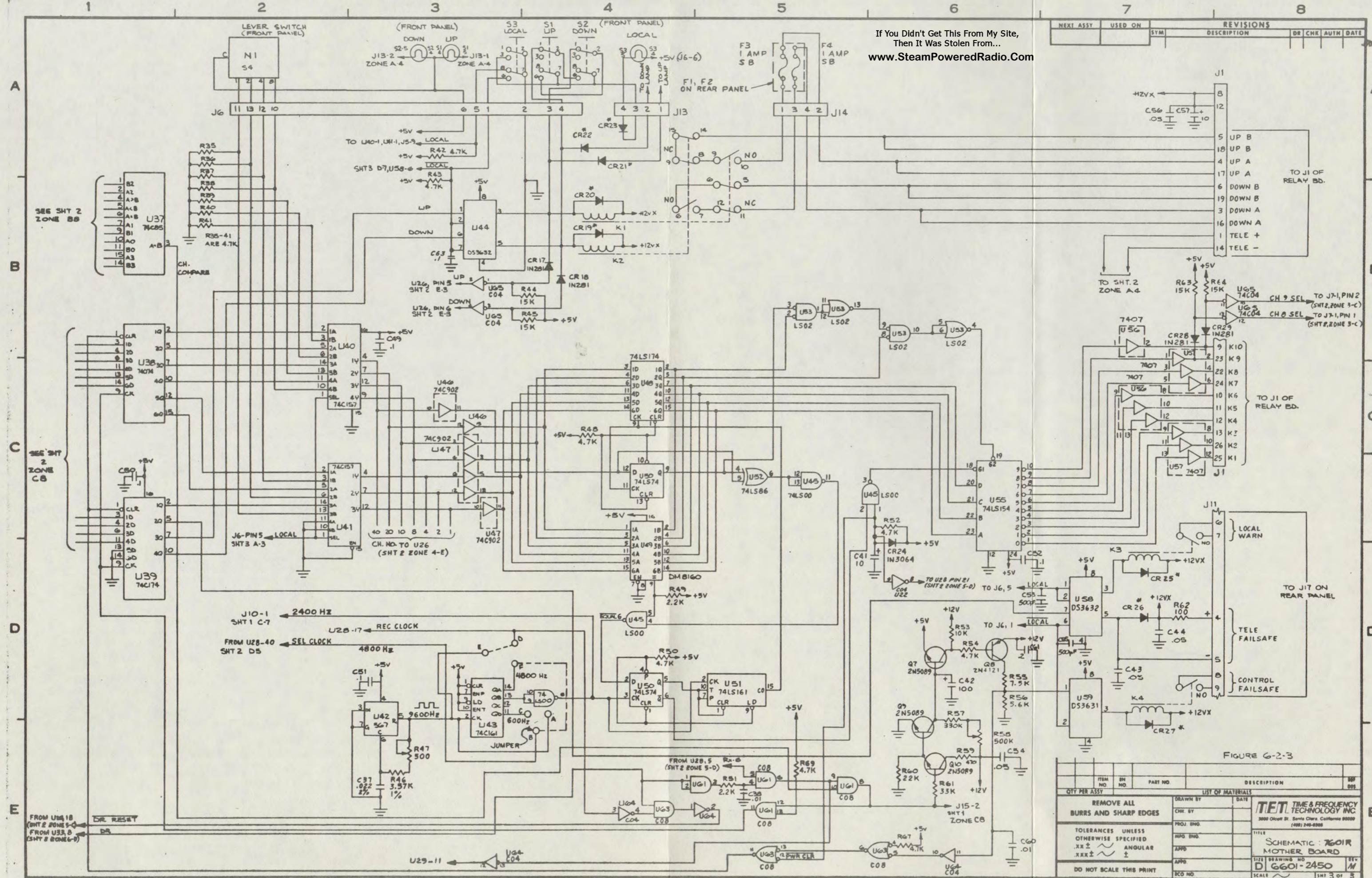


FIGURE 6-2-3

ITEM NO.	QTY PER ASSY	SYM	DESCRIPTION	REF. DES.

REMOVE ALL BURRS AND SHARP EDGES	DRAWN BY	DATE
TOLERANCES UNLESS OTHERWISE SPECIFIED .XX ± ANGULAR .XXX ±	CHK BY	
DO NOT SCALE THIS PRINT	PROJ. ENG.	
	MFG. ENG.	
	APPD.	
	APPD.	
	ECO NO.	

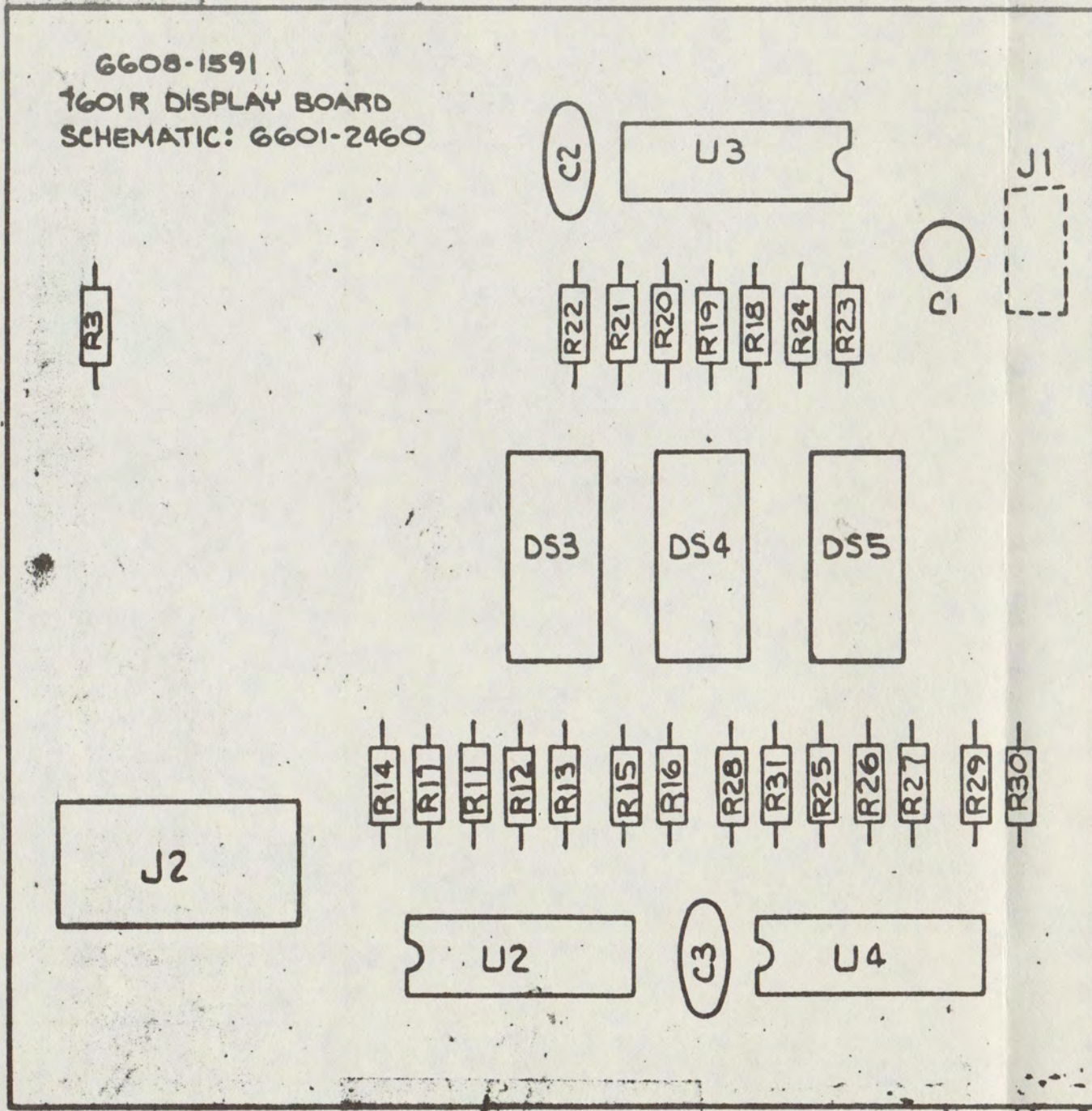

LIST OF MATERIALS


TIME & FREQUENCY TECHNOLOGY INC.  
3000 Olcott St., Santa Clara, California 95050  
(408) 249-0200

TITLE: SCHEMATIC: 7601R MOTHER BOARD  
SIZE: DRAWING NO. D 6601-2450  
SCALE: 1:1 SHT 3 of 5

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
A	RELEASED TO PROD		
B	REVISED PER ECO 1276	1/12/81	

6608-1591  
7601R DISPLAY BOARD  
SCHEMATIC: 6601-2460



QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION
PARTS LIST				
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS    DECIMALS    ANGLES ±                .XX ±                ±			CONTRACT NO.	
MATERIAL			APPROVALS	DATE
FINISH			DRAWN <i>Anna Chou</i> 6-6-79	
NEXT ASSY			CHECKED	ISSUED
USED ON			SIZE <b>B</b>	FSCM NO.
APPLICATION			DWG. NO. 6608-1591	
DO NOT SCALE DRAWING			REV. <b>B</b>	
			SCALE	SHEET 1 OF 1

**MTL** TIME & FREQUENCY TECHNOLOGY INC.

P.C. BD ASSY  
DISPLAY BOARD



Display BD 7601-R

Assembly # 6608-1591B

Ckt. Ref.	Description	TFT Stock No.
C1	Cap Tan 10MFD 20V 10%	1008-0100
C2	Cap Cer Disc .1UF 12V	1005-0100
C3	Cap Cer Disc .1UF 12V	1005-0100
DS3	Led DL704 8	1285-0704
DS4	Led DL704 8	1285-0704
DS5	Led DL704 8	1285-0704
R11	Res Car Comp 1/4W 5% 180	1065-0180
R12	Res Car Comp 1/4W 5% 180	1065-0180
R13	Res Car Comp 1/4W 5% 180	1065-0180
R14	Res Car Comp 1/4W 5% 180	1065-0180
R15	Res Car Comp 1/4W 5% 180	1065-0180
R16	Res Car Comp 1/4W 5% 180	1065-0180
R17	Res Car Comp 1/4W 5% 180	1065-0180
R18	Res Car Comp 1/4W 5% 180	1065-0180
R19	Res Car Comp 1/4W 5% 180	1065-0180
R20	Res Car Comp 1/4W 5% 180	1065-0180
R21	Res Car Comp 1/4W 5% 180	1065-0180
R22	Res Car Comp 1/4W 5% 180	1065-0180
R23	Res Car Comp 1/4W 5% 180	1065-0180
R24	Res Car Comp 1/4W 5% 180	1065-0180
R25	Res Car Comp 1/4W 5% 180	1065-0180
R26	Res Car Comp 1/4W 5% 180	1065-0180
R27	Res Car Comp 1/4W 5% 180	1065-0180
R28	Res Car Comp 1/4W 5% 180	1065-0180
R29	Res Car Comp 1/4W 5% 180	1065-0180
R30	Res Car Comp 1/4W 5% 180	1065-0180
R31	Res Car Comp 1/4W 5% 180	1065-0180
U2	I/C MM74248N	1102-7448
U3	I/C MM74248N	1102-7448
U4	I/C MM74248N	1102-7448
	Socket, I/C 14 Pin	2250-1014
	Socket, I/C 16 Pin	2250-1016
	Plug 2 Pin	2250-6002
	PC BD 7601-R Display	1600-1590 REVA

1

2

3

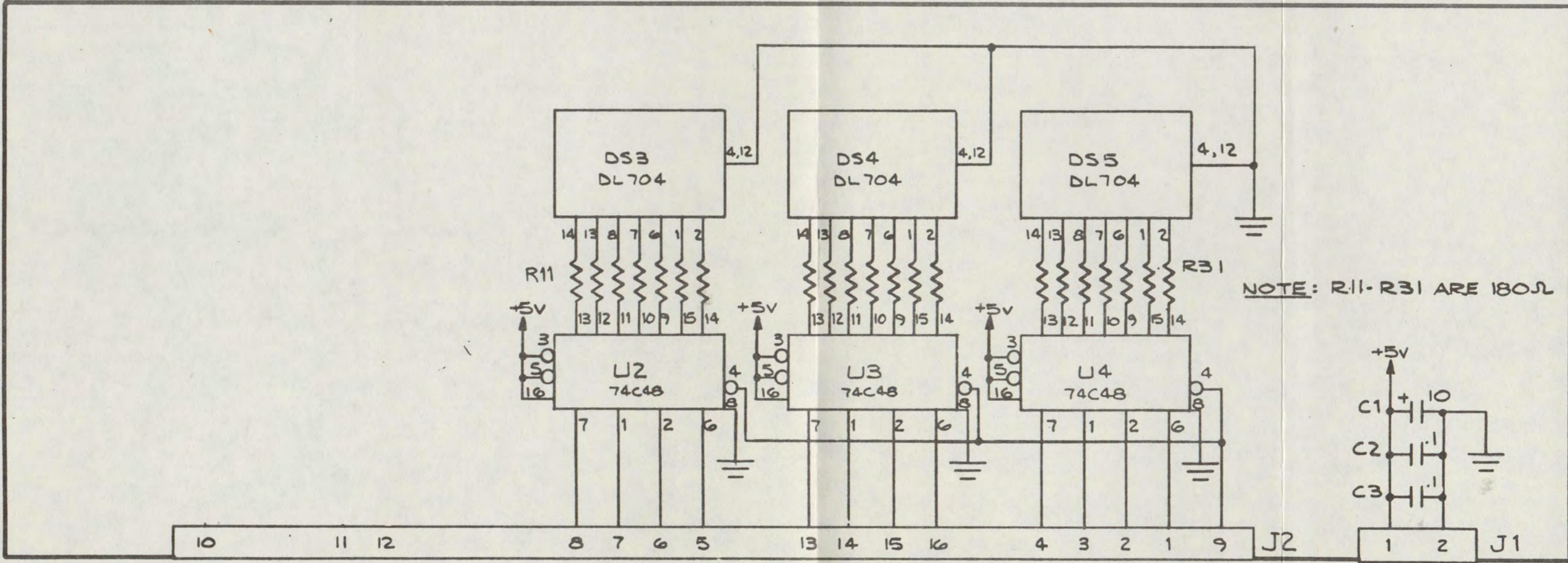
DWG. NO.

4

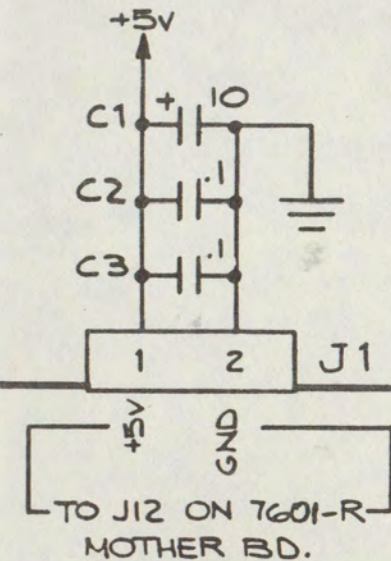
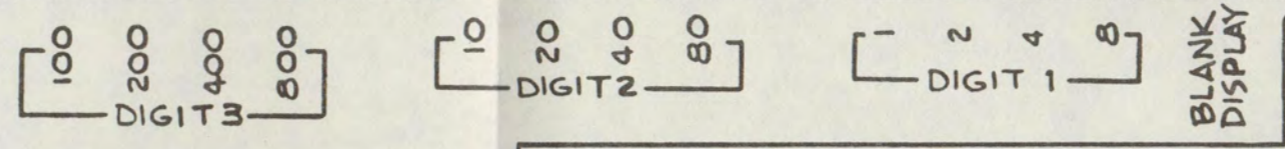
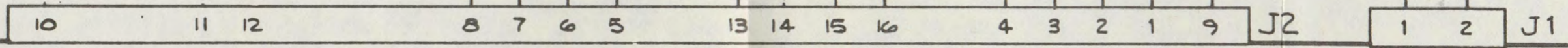
5

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NEXT ASSY		USED ON		REVISIONS			
SYM	DESCRIPTION	DR	CHK	AUTH	DATE		
5004-7601	7601R	A	REL FOR PRODUCTION	TD	JT	388	11/30/77



NOTE: R11-R31 ARE 180Ω



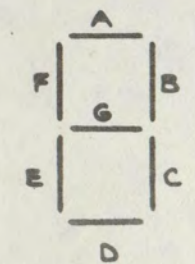
TO J5 OF 7601-R MOTHER BD.

- 3. U1 THRU U4; PIN 16 IS +5V  
PIN 8 IS GROUND.
- 2. CAPACITORS ARE MICROFARADS
- 1. RESISTORS ARE 1/4W, 5%, COMP.

NOTES, UNLESS OTHERWISE SPECIFIED

PC BOARD ASSEMBLY: 6608-1591

SEGMENTS  
DL704



ITEM NO.	EN NO.	PART NO.	DESCRIPTION	REF. DES.
REMOVE ALL BURRS AND SHARP EDGES				
TOLERANCES UNLESS OTHERWISE SPECIFIED				
.XX ±		ANGULAR ±		
.XXX ±		±		
DO NOT SCALE THIS PRINT				
LIST OF MATERIALS			DRAWN BY <i>Jim Song</i> DATE 11/30/77	
			CHK. BY <i>Stan</i> DATE 11/30/77	
			PROJ. ENG. <i>CWE</i>	
			MFG. ENG.	
			APPD. <i>CWE</i>	
			APPD.	
			ECO NO.	
			TITLE FIG 6.2.4 SCHEMATIC: 7601R DISPLAY BD.	
			SIZE B DRAWING NO. 6601-2460 REV. A	
			SCALE ~ SHT. 1 OF 1	

**TET** TIME & FREQUENCY TECHNOLOGY INC.  
3000 Olcott St., Santa Clara, California 95060  
(408) 246-8385

1

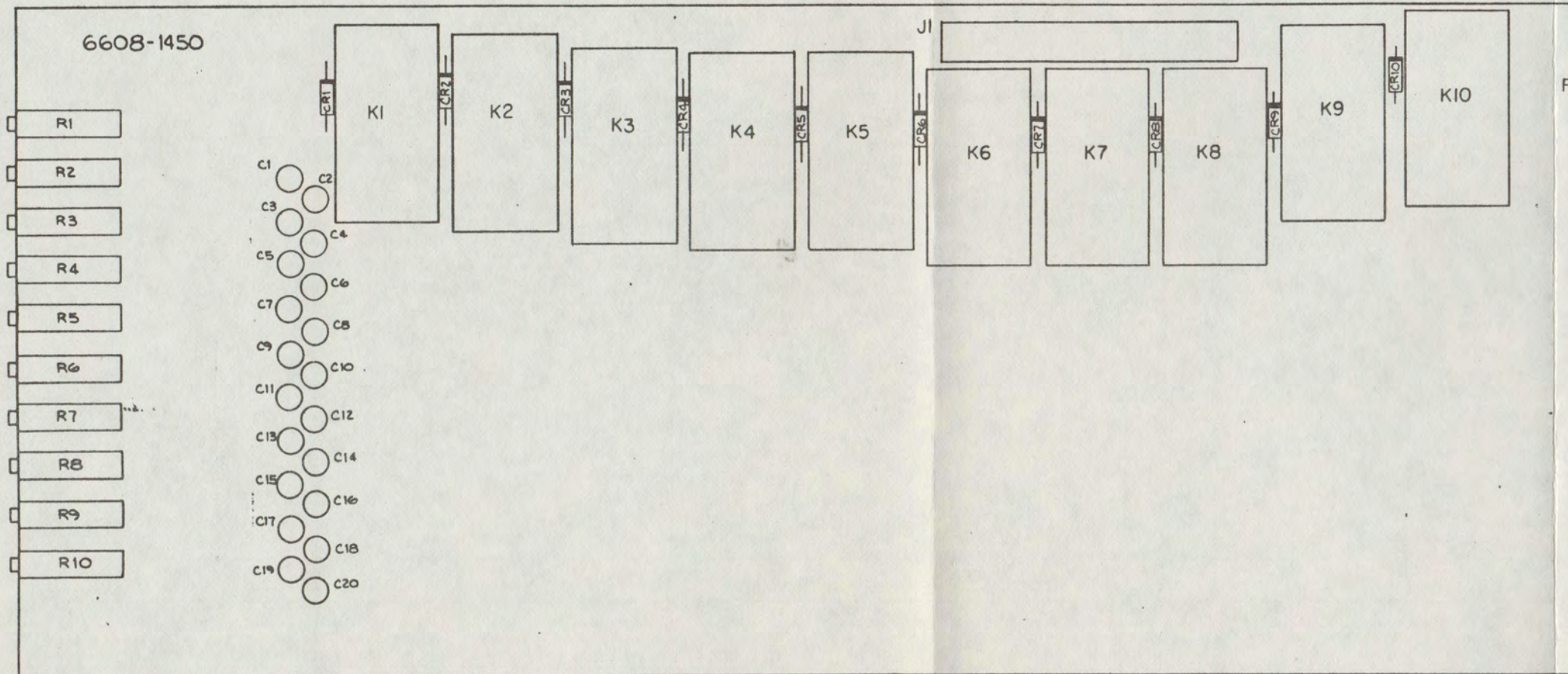
2

3

4

5

NEXT ASSY		USED ON		REVISIONS			
ITEM NO.	EN NO.	SYM	DESCRIPTION	DR	CHK	AUTH	DATE
		A					10/16/72
		B	REVISED PER ECO 1375				6/20/71



6608-1450  
7601-R/7610-R/7630 RELAY BOARD  
SCHEMATIC 6601-1880

NOTE: 1. APPLY HUMISEAL COATING 1A27 TO CIRCUIT SIDE OF BOARD EXCEPT AT FINGER CONTACT AREA.

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ITEM NO.	EN NO.	PART NO.	DESCRIPTION	QTY PER ASSY	REP DES.
REMOVE ALL BURRS AND SHARP EDGES					
TOLERANCES UNLESS OTHERWISE SPECIFIED					
.XX ± ANGULAR ±					
DO NOT SCALE THIS PRINT					

LIST OF MATERIALS	DATE	SCALE	SHT. OF
DRAWN BY: L. REYES PROJ. ENG. APPD. ECO NO.	10/16/72	D	1 OF 1

<b>TET</b> TIME & FREQUENCY TECHNOLOGY INC. 2000 Olcott St., Santa Clara, California 95050 (408) 240-0200	
<b>RELAY BOARD</b> 7601-R/7610-R/7630 SIZE: 6608-1450 SCALE:	

DWG. NO. 6608-1450

Relay BD 7601-R

Assembly # 6608-1450  
Rev B

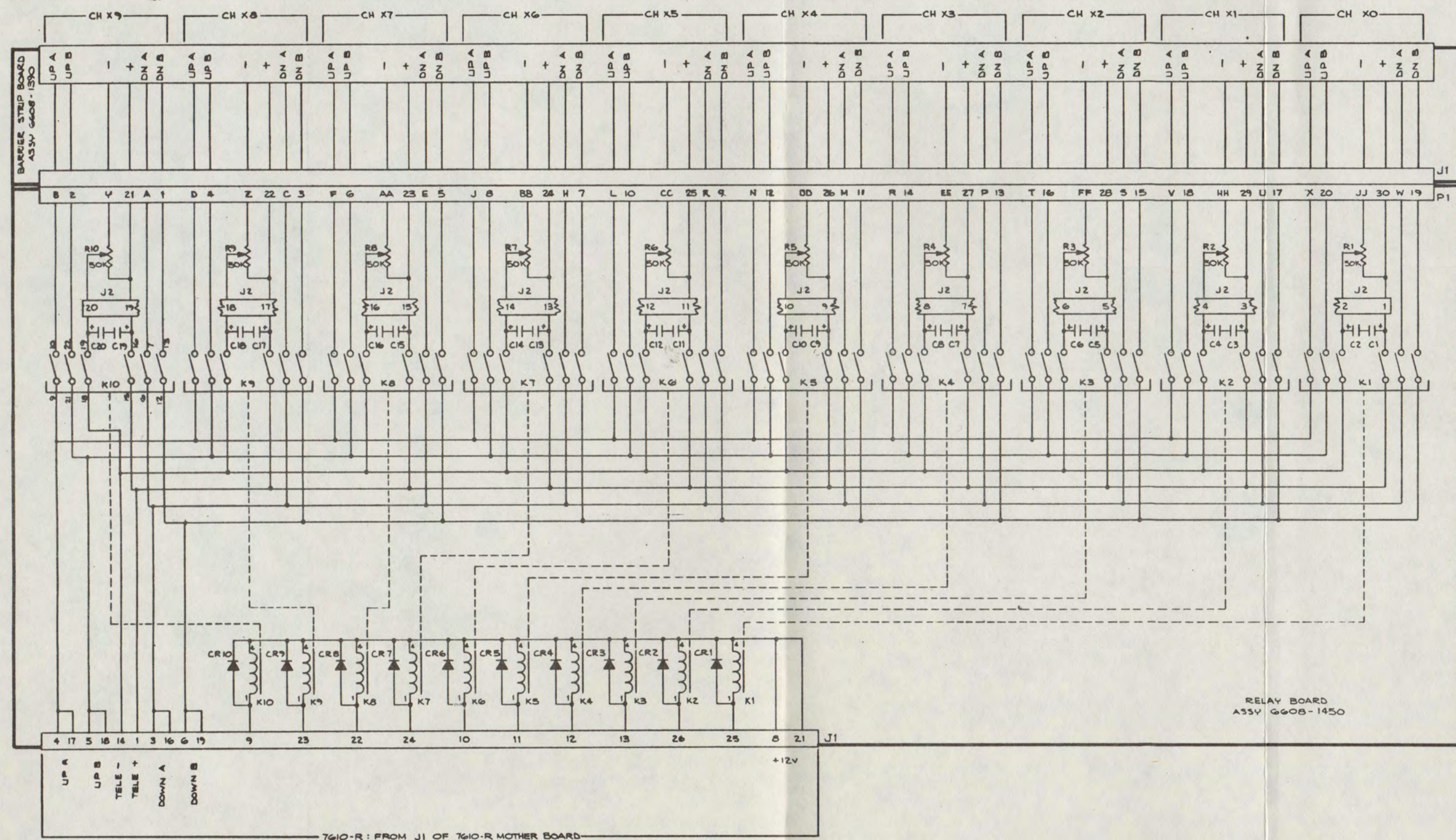
Ckt. Ref.	Description	TFT Stock No.
C1	Cap Tant 100MFD 4VDC	1008-0112
C2	Cap Tant 100MFD 4VDC	1008-0112
C3	Cap Tant 100MFD 4VDC	1008-0112
C4	Cap Tant 100MFD 4VDC	1008-0112
C5	Cap Tant 100MFD 4VDC	1008-0112
C6	Cap Tant 100MFD 4VDC	1008-0112
C7	Cap Tant 100MFD 4VDC	1008-0112
C8	Cap Tant 100MFD 4VDC	1008-0112
C9	Cap Tant 100MFD 4VDC	1008-0112
C10	Cap Tant 100MFD 4VDC	1008-0112
C11	Cap Tant 100MFD 4VDC	1008-0112
C12	Cap Tant 100MFD 4VDC	1008-0112
C13	Cap Tant 100MFD 4VDC	1008-0112
C14	Cap Tant 100MFD 4VDC	1008-0112
C15	Cap Tant 100MFD 4VDC	1008-0112
C16	Cap Tant 100MFD 4VDC	1008-0112
C17	Cap Tant 100MFD 4VDC	1008-0112
C18	Cap Tant 100MFD 4VDC	1008-0112
C19	Cap Tant 100MFD 4VDC	1008-0112
C20	Cap Tant 100MFD 4VDC	1008-0112
CR1	Dio Rect 1N4002	1284-4002
CR2	Dio Rect 1N4002	1284-4002
CR3	Dio Rect 1N4002	1284-4002
CR4	Dio Rect 1N4002	1284-4002
CR5	Dio Rect 1N4002	1284-4002
CR6	Dio Rect 1N4002	1284-4002
CR7	Dio Rect 1N4002	1284-4002
CR8	Dio Rect 1N4002	1284-4002
CR9	Dio Rect 1N4002	1284-4002
CR10	Dio Rect 1N4002	1284-4002
J1	Conn 26 Pin M Header	2250-6512
K1	Relay 12V 6 Pole	1880-0005
K2	Relay 12V 6 Pole	1880-0005
K3	Relay 12V 6 Pole	1880-0005
K4	Relay 12V 6 Pole	1880-0005
K5	Relay 12V 6 Pole	1880-0005
K6	Relay 12V 6 Pole	1880-0005
K7	Relay 12V 6 Pole	1880-0005
K8	Relay 12V 6 Pole	1880-0005
K9	Relay 12V 6 Pole	1880-0005
K10	Relay 12V 6 Pole	1880-0005

Relay BD 7601-R

Assembly # 6608-1450  
Rev B

Ckt. Ref.	Description	TFT Stock No.
R1	Res Var PC MT 50K 10T	1069-5002
R2	Res Var PC MT 50K 10T	1069-5002
R3	Res Var PC MT 50K 10T	1069-5002
R4	Res Var PC MT 50K 10T	1069-5002
R5	Res Var PC MT 50K 10T	1069-5002
R6	Res Var PC MT 50K 10T	1069-5002
R7	Res Var PC MT 50K 10T	1069-5002
R8	Res Var PC MT 50K 10T	1069-5002
R9	Res Var PC MT 50K 10T	1069-5002
R10	Res Var PC MT 50K 10T	1069-5002
	PC BD 7601-R Relay	1600-1450
	Retainer Relay	2140-0025
	Socket Relay	2250-0003

NEXT ASSY		USED ON		REVISIONS			
7610R, 7630		7601R		REL TO PRODUCTION			
DR	CHK	AUTH	DATE				
			388	1977			



RELAY BOARD  
ASSY 6608-1450

7610-R : FROM J1 OF 7610-R MOTHER BOARD  
7630 : FROM J1 OR J2 OF 7630 RELAY SELECT BOARD  
7601-R : FROM J1 OF 7601R MOTHER BOARD

- 5 FOR 7630 BARRIER STRIPS CHX0 THRU CHX9 MAY BE PROGRAMMED FOR ANY CHANNEL SERIES DESIRED, e.g., CH20 THRU CH29 OR CH50 THRU CH59, UP TO CH70 THRU CH79.
  - 4. RELAY CONTACTS SHOWN ARE NORMALLY OPEN.
  - 3. DIODES ARE 1N4002
  - 2. RESISTORS ARE MULT-TURN CERMET
  - 1. CAPACITORS ARE 100MPD, 4VDC, TANT.
- NOTES, UNLESS OTHERWISE SPECIFIED;

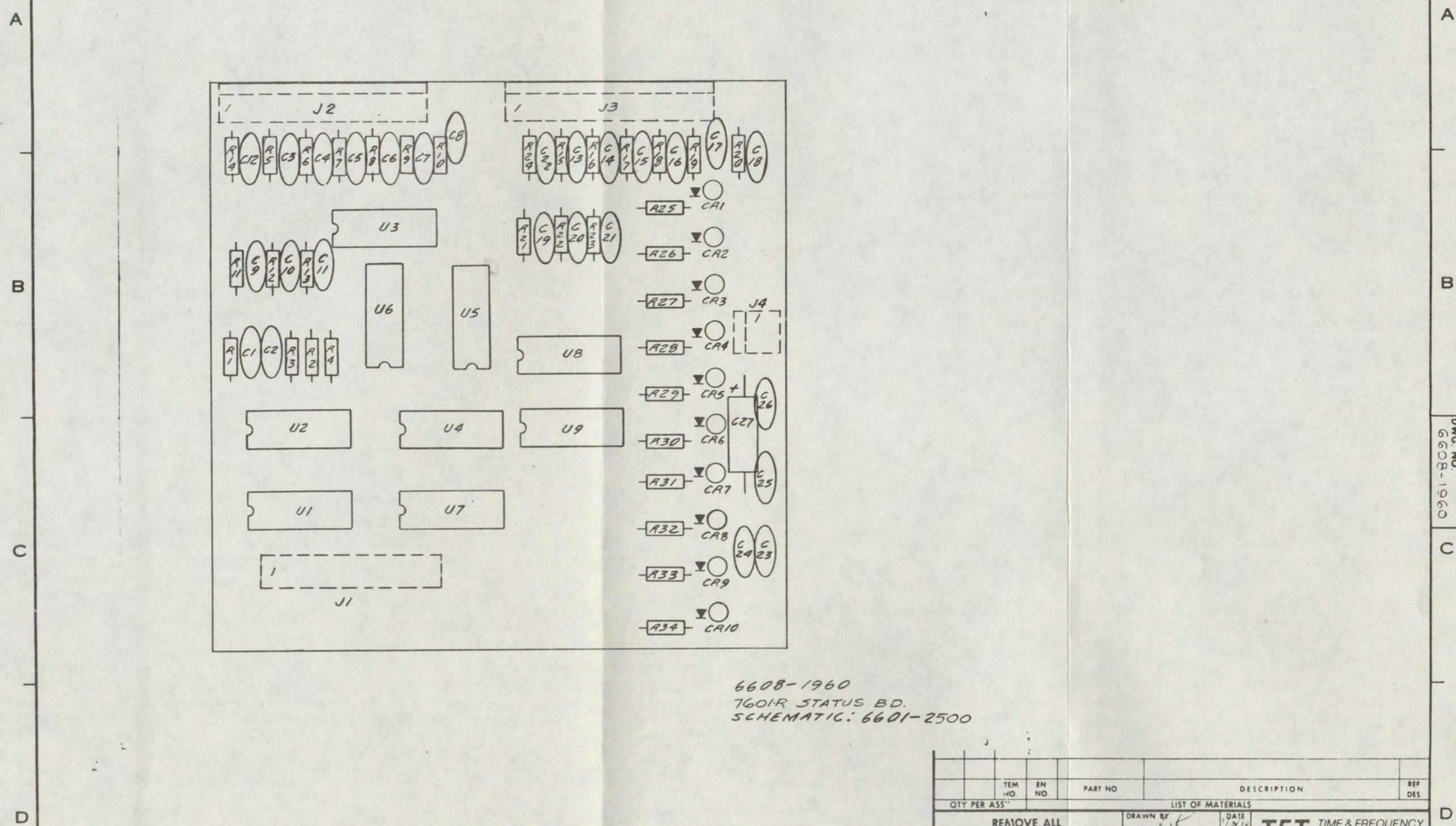
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FIG 6-2-5

ITEM NO.	QTY PER ASSY	EN NO.	PART NO.	DESCRIPTION	REF DES.
LIST OF MATERIALS					
<b>REMOVE ALL BURRS AND SHARP EDGES</b>					
DRAWN BY		DATE		TET TIME & FREQUENCY TECHNOLOGY INC	
CHK BY		4/4/77		3000 Olcott St. Santa Clara, California 95050	
PROJ. ENG.		4/1/77		(408) 248-0300	
MFG. ENG.		4/1/77		TITLE SCHEMATIC	
APPD.		4/1/77		RELAY & BARRIER STRIP BD.	
APPD.		4/1/77		SIZE DRAWING NO	
ECO NO.		D 6601-1080		REV. A	
SCALE		~		SHEET 1 OF 1	

1 2 3 4 5

NEXT ASSY		USED ON		REVISIONS			
SYM	DESCRIPTION	DR	CHK	AUTH	DATE		
D	REV PER ECO 1300	AC	KK		1/3/79		



6608-1960  
760IR STATUS BD.  
SCHEMATIC: 6601-2500

DWG. NO. 6608-1960

www.SteamPoweredRadio.Com

QTY PER ASSY	ITEM NO.	EN NO.	PART NO.	DESCRIPTION	REF DES
LIST OF MATERIALS					
REMOVE ALL BURRS AND SHARP EDGES				DRAWN BY L.K.	DATE 1/3/79
TOLERANCES UNLESS OTHERWISE SPECIFIED				CHK BY	
XX ±				PROJ ENG	
XXX ±				MFG ENG	
DO NOT SCALE THIS PRINT				APPD	
				APPD	
				ECO NO	
				SCALE	SMT OF

**TFT** TIME & FREQUENCY TECHNOLOGY INC  
3000 Olcott St. Santa Clara, California 95051  
(408) 246-6365

TITLE PCB ASSY  
760IR STATUS BD

SIZE C DRAWING NO. 6608-1960 REV D

Model 7601-R

10 Channel Status Board

Assembly # 6608-1960

Rev D

Ckt. Ref.	Description	TFT Stock No.
C1	Cap Mica 120 pf, 500V	1001-0121
C2	Cap Mica 120 pf, 500V	1001-0121
C3	Cap Cer Disc .01 MFD 25V	1005-1039
C4	Cap Cer Disc .01 MFD 25V	1005-1039
C5	Cap Cer Disc .01 MFD 25V	1005-1039
C6	Cap Cer Disc .01 MFD 25V	1005-1039
C7	Cap Cer Disc .01 MFD 25V	1005-1039
C8	Cap Cer Disc .01 MFD 25V	1005-1039
C9	Cap Cer Disc .01 MFD 25V	1005-1039
C10	Cap Cer Disc .01 MFD 25V	1005-1039
C11	Cap Cer Disc .01 MFD 25V	1005-1039
C12	Cap Cer Disc .01 MFD 25V	1005-1039
C13	Cap Cer Disc .01 MFD 25V	1005-1039
C14	Cap Cer Disc .01 MFD 25V	1005-1039
C15	Cap Cer Disc .01 MFD 25V	1005-1039
C16	Cap Cer Disc .01 MFD 25V	1005-1039
C17	Cap Cer Disc .01 MFD 25V	1005-1039
C18	Cap Cer Disc .01 MFD 25V	1005-1039
C19	Cap Cer Disc .01 MFD 25V	1005-1039
C20	Cap Cer Disc .01 MFD 25V	1005-1039
C21	Cap Cer Disc .01 MFD 25V	1005-1039
C22	Cap Cer Disc .01 MFD 25V	1005-1039
C23	Cap Cer Disc .01 MFD 25V	1005-1039
C24	Cap Cer Disc .01 MFD 25V	1005-1039
C25	Cap Cer Disc .01 MFD 25V	1005-1039
C26	Cap Cer Disc .01 MFD 25V	1005-1039
C27	Cap Tant 10 MFD, 20V	1008-0101
CR1	Diode LED HP 5082-4487	1285-4487
CR2	Diode LED HP 5082-4487	1285-4487
CR3	Diode LED HP 5082-4487	1285-4487
CR4	Diode LED HP 5082-4487	1285-4487
CR5	Diode LED HP 5082-4487	1285-4487
CR6	Diode LED HP 5082-4487	1285-4487
CR7	Diode LED HP 5082-4487	1285-4487
CR8	Diode LED HP 5082-4487	1285-4487
CR9	Diode LED HP 5082-4487	1285-4487
CR10	Diode LED HP 5082-4487	1285-4487
J1	Conn Socket 26 Pos	2250-6511
J2	Conn 10 Pin Polarized	2250-6010
J3	Conn 10 Pin Polarized	2250-6010
J4	Plug, 2 Pin	2250-6002
R1	Resistor Car Comp 1/4W <u>+5%</u> 2.2K	1065-2201



Model 7601-R

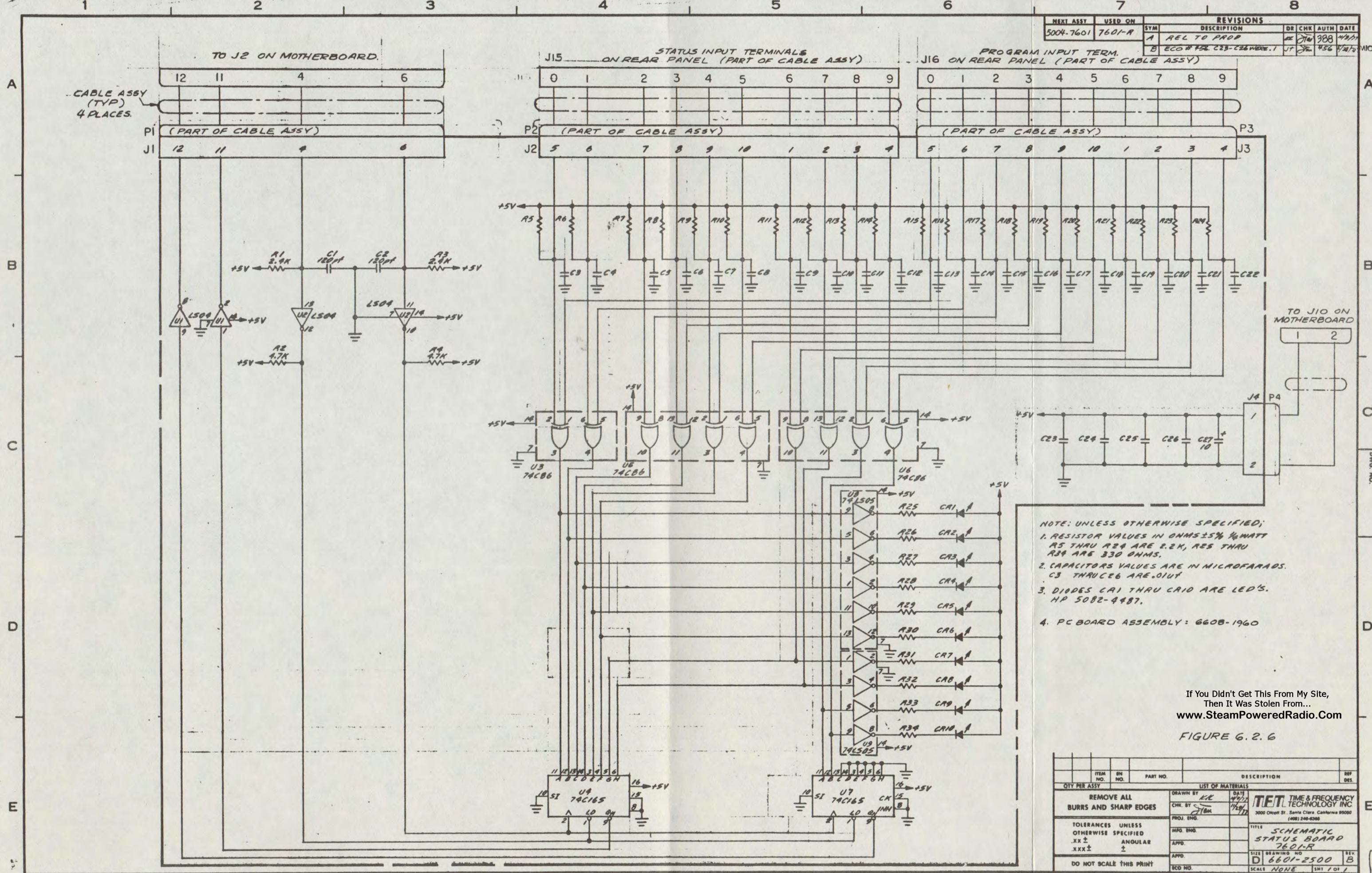
10 Channel Status Board

Assembly # 6608-1960

Rev D

Ckt. Ref.	Description	TFT Stock No.
R2	Resistor Car Comp 1/4W +5% 4.7K	1065-4701
R3	Resistor Car Comp 1/4W +5% 2.4K	1065-2401
R4	Resistor Car Comp 1/4W +5% 4.7K	1065-4701
R5	Resistor Car Comp 1/4W +5% 2.2K	1065-2201
R6	Resistor Car Comp 1/4W +5% 2.2K	1065-2201
R7	Resistor Car Comp 1/4W +5% 2.2K	1065-2201
R8	Resistor Car Comp 1/4W +5% 2.2K	1065-2201
R9	Resistor Car Comp 1/4W +5% 2.2K	1065-2201
R10	Resistor Car Comp 1/4W +5% 2.2K	1065-2201
R11	Resistor Car Comp 1/4W +5% 2.2K	1065-2201
R12	Resistor Car Comp 1/4W +5% 2.2K	1065-2201
R13	Resistor Car Comp 1/4W +5% 2.2K	1065-2201
R14	Resistor Car Comp 1/4W +5% 2.2K	1065-2201
R15	Resistor Car Comp 1/4W +5% 2.2K	1065-2201
R16	Resistor Car Comp 1/4W +5% 2.2K	1065-2201
R17	Resistor Car Comp 1/4W +5% 2.2K	1065-2201
R18	Resistor Car Comp 1/4W +5% 2.2K	1065-2201
R19	Resistor Car Comp 1/4W +5% 2.2K	1065-2201
R20	Resistor Car Comp 1/4W +5% 2.2K	1065-2201
R21	Resistor Car Comp 1/4W +5% 2.2K	1065-2201
R22	Resistor Car Comp 1/4W +5% 2.2K	1065-2201
R23	Resistor Car Comp 1/4W +5% 2.2K	1065-2201
R24	Resistor Car Comp 1/4W +5% 2.2K	1065-2201
R25	Resistor Car Comp 1/4W +5% 330	1065-0330
R26	Resistor Car Comp 1/4W +5% 330	1065-0330
R27	Resistor Car Comp 1/4W +5% 330	1065-0330
R28	Resistor Car Comp 1/4W +5% 330	1065-0330
R29	Resistor Car Comp 1/4W +5% 330	1065-0330
R30	Resistor Car Comp 1/4W +5% 300	1065-0300
R31	Resistor Car Comp 1/4W +5% 330	1065-0330
R32	Resistor Car Comp 1/4W +5% 330	1065-0330
R33	Resistor Car Comp 1/4W +5% 330	1065-0330
R34	Resistor Car Comp 1/4W +5% 330	1065-0330
U1	IC SN7404N	1100-7404
U2	IC SN7404N	1100-7404
U3	IC 74C86	1102-7487
U4	IC 74C165	1102-0165
U5	IC 74C86	1102-7487
U6	IC 74C86	1102-7487
U7	IC 74C165	1102-0165
U8	IC SN74L505	1101-7405
U9	IC SN74L505	1101-7405
	IC Socket Dip 14 Pin	2250-1014
	IC Socket 16 Pin	2250-1016
	P.C. Board	1600-1960

REV	DESCRIPTION	DR	CHK	AUTH	DATE
A	REL TO PRDP	JK		988	4/21/77
B	ECO # PSL C23-C26 WERE 1	JT		456	4/21/77



NOTE: UNLESS OTHERWISE SPECIFIED;  
 1. RESISTOR VALUES IN OHMS ±5%, 1/4 WATT  
 R5 THRU R24 ARE 2.2K, R25 THRU R29 ARE 330 OHMS.  
 2. CAPACITORS VALUES ARE IN MICROFARADS.  
 C3 THRU C26 ARE .01UF  
 3. DIODES CA1 THRU CA10 ARE LED'S.  
 HP 5082-4487.  
 4. PC BOARD ASSEMBLY: 660B-1960

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FIGURE 6.2.6

ITEM NO.	QTY PER ASSY	SN NO.	PART NO.	DESCRIPTION	REF DES.
REMOVE ALL BURRS AND SHARP EDGES					
TOLERANCES UNLESS OTHERWISE SPECIFIED .XX ± ANOULAR .XXX ±					
DO NOT SCALE THIS PRINT					

LIST OF MATERIALS	DATE
DRAWN BY: KLR	4/21/77
CHK. BY: JTB	4/21/77
PROJ. ENG.	
MFG. ENG.	
APPD.	
APD.	
ECO NO.	

TET TIME & FREQUENCY TECHNOLOGY INC	
3000 Olcott St. Santa Clara, California 95050	
(408) 249-8388	
TITLE	SCHEMATIC STATUS BOARD 7601-R
SIZE	D 6601-2500
SCALE	NONE
SHEET	1 OF 1

4

3

2

1

REVISIONS					
ZONE	REV	DESCRIPTION	DR	DATE	APPROVED
	A	RELEASED FOR PRODTN	M.Y	5-14-79	<i>G. J. Tan</i>
	B	REVISED PER ECO	E.F.	7/20/79	<i>G.F.</i>
	C	REVISED PER ECO	A.C	8-8-79	<i>G.F.</i>
	D	REVISED PER ECO	E.F.	—	<i>G.F.</i>
	E	REV. PER ECO 882	M.Y	10/2/79	<i>G.F.</i>
	F	REV PER ECO 1044	KK	1/14/80	<i>G.F.</i>
	G	REV PER ECO 1401	KK	7/27/81	
	H	REV PER ECO 1491	KK	4/5/82	

D

D

C

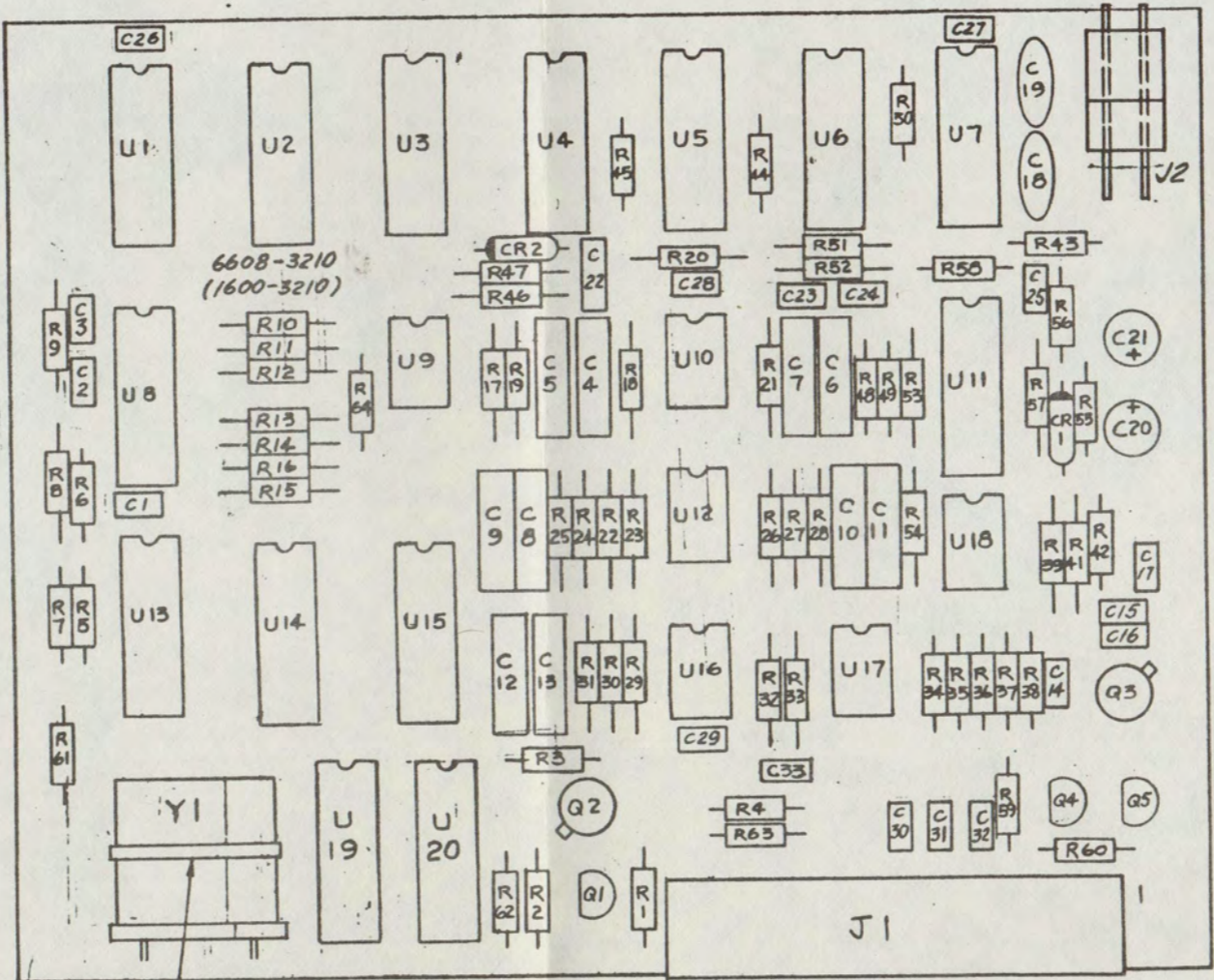
C

B

C

A

A



DWG. NO. 6608-3210  
 H/1/1  
 H/1/1

FIG 6-2-7

NOTE:  
 I. REF SCHEMATIC 6601-3210

5102-2091	7601R
5102-2090	7610R
5102-3240	7815R
NEXT ASSY	USED ON

APPROVALS		DATE	MET TIME & FREQUENCY TECHNOLOGY INC.			
DRAWN	<i>John Lee</i>	5/14/79	FSK R MODEM BD ASSY			
CHECKED	<i>Charles Fong</i>	5/14/79				
ISSUED	<i>John Lee</i>	5/14/79	SIZE	FSCM NO.	DWG. NO.	REV
PROJ ENGR	<i>John Lee</i>	5/14/79	C		6608-3210	H
SCALE	2:1	SHEET	1 OF 1			

4

3

2

1

Model 7610R  
7815R  
7601R

FSK "R" Modem Bd.

Assembly #6608-3210  
Rev H

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
C1	Cap Cer CK05 .022MF	1	1015-0005
C2	Cap Cer CK05 .01MF	1	1015-0002
C3	Cap Cer CK05 .047MF	1	1015-0006
C4	Cap Poly 2.5% .01MF	1	1006-0002
C5	Cap Poly 2.5% .01MF	1	1006-0002
C6	Cap Poly 2.5% .01MF	1	1006-0002
C7	Cap Poly 2.5% .01MF	1	1006-0002
C8	Cap Poly 2.5% .01MF	1	1006-0002
C9	Cap Poly 2.5% .01MF	1	1006-0002
C10	Cap Poly 2.5% .01MF	1	1006-0002
C11	Cap Poly 2.5% .01MF	1	1006-0002
C12	Cap Poly 2.5% .01MF	1	1006-0002
C13	Cap Poly 2.5% .01MF	1	1006-0002
C14	Cap Cer CK05 .1MF	1	1015-0001
C15	Cap Cer CK05 .01MF	1	1015-0002
C16	Cap Cer CK05 .01MF	1	1015-0002
C17	Cap Cer CK05 .01MF	1	1015-0002
C18	Cap Mica 100PF	1	1001-0101
C19	Cap Mica 100PF	1	1001-0101
C20	Cap Tant 10MFD 20V	1	1008-0100
C21	Cap Tant 10MFD 20V	1	1008-0100
C22	Cap Cer CK06 .22MF	1	1015-0003
C23	Cap Cer CK05 .027MF	1	1015-0007
C24	Cap Cer CK05 .0027MF	1	1015-0008
C25	Cap Cer CK05 .068MF	1	1015-0013
C26	Cap Cer 1MF	1	1005-0001
C27	Cap Cer 1MF	1	1005-0001
C28	Cap Cer 1 MF	1	1005-0001
C29	Cap Cer 1MF	1	1005-0001
C30	Cap Cer CK05 .1MF	1	1015-0001
C31	Cap Cer CK05 .1MF	1	1015-0001
C32	Cap Cer CK05 .1MF	1	1015-0001
C33	Cap Cer CK06 .22MF	1	1015-0003
CR1	Diode IN281	1	1280-0281
CR2	Diode IN3064	1	1281-3064
J1	Socket Lock 12 Pin Molex	1	2250-5212
J2	Conn 2 Pin RT Angle FRCN	1	2250-6702
Q1	Transistor 2N4275	1	1271-4275
Q2	Transistor 2N2222	1	1271-2222
Q3	Transistor 2N2222	1	1271-2222
Q4	Transistor 2N4275	1	1271-4275
Q5	Transistor 2N4275	1	1271-4275

Model 7610R  
7815R  
7601R

FSK "R" Modem Bd

Assembly #6608-3210  
Rev H

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
R1	Res Car Comp 1/4W 5% 10K	1	1065-1002
R2	Res Car Comp 1/4W 5% 47K	1	1065-4702
R3	Res Car Comp 1/4W 5% 10K	1	1065-1002
R4	Res Car Comp 1/4W 5% 4.7K	1	1065-4701
R5	Res Car Comp 1/4W 5% 1K	1	1065-1001
R6	Res MT FLM 1/8W 1% 10.7K	1	1061-1072
R7	Res Car Comp 1/4W 5% 1K	1	1065-1001
R8	Res MT FLM 1/8W 1% 5.76K	1	1061-5761
R9	Res MT FLM 1/8W 1% 54.9K	1	1061-5492
R10	Res MT FLM 1/8W 1% 23.7K	1	1061-2372
R11	Res MT FLM 1/8W 1% 10K	1	1061-1002
R12	Res MT FLM 1/8W 1% 10K	1	1061-1002
R13	Res MT FLM 1/8W 1% 10K	1	1061-1002
R14	Res MT FLM 1/8W 1% 10K	1	1061-1002
R15	Res MT FLM 1/8W 1% 10K	1	1061-1002
R16	Res MT FLM 1/8W 1% 10K	1	1061-1002
R17	Res MT FLM 1/8W 1% 24.9K	1	1061-2492
R18	Res MT FLM 1/8W 1% 100K	1	1061-1003
R19	Res MT FLM 1/8W 1% 1.05K	1	1061-1051
R20	Res MT FLM 1/8W 1% 10.5K	1	1061-1052
R21	Res MT FLM 1/8W 1% 21K	1	1061-2102
R22	Res MT FLM 1/8W 1% 10.7K	1	1061-1072
R23	Res MT FLM 1/8W 1% 10.7K	1	1061-1072
R24	Res MT FLM 1/8W 1% 4.32K	1	1061-4321
R25	Res MT FLM 1/8W 1% 21.5K	1	1061-2152
R26	Res MT FLM 1/8W 1% 8.45K	1	1061-8451
R27	Res MT FLM 1/8W 1% 2.80K	1	1061-2801
R28	Res MT FLM 1/8W 1% 34.0K	1	1061-3402
R29	Res MT FLM 1/8W 1% 12.7K	1	1061-1272
R30	Res MT FLM 1/8W 1% 845	1	1061-0845
R31	Res MT FLM 1/8W 1% 51.1K	1	1061-5112
R32	Res Car Comp 1/4W 5% 10K	1	1065-1002
R33	Res Car Comp 1/4W 5% 390K	1	1065-3903
R34	Res Car Comp 1/4W 5% 100K	1	1065-1003
R35	Res Car Comp 1/4W 5% 22K	1	1065-2202
R36	Res Car Comp 1/4W 5% 330K	1	1065-3303
R37	Res Car Comp 1/4W 5% 22K	1	1065-2202
R38	Res Car Comp 1/4W 5% 47K	1	1065-4702
R39	Res MT FLM 1/8W 1% 665K	1	1061-6653
R40	Not Used		
R41	Res MT FLM 1/8W 1% 665K	1	1061-6653
R42	Res Car Comp 1/4W 5% 330K	1	1065-3303
R43	Res Car Comp 1/4W 5% 330K	1	1065-3303

Model 7610R  
7815R  
7601 R

FSK "R" Modem BD

Assembly #6608-3210  
Rev H

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
R44	Res Car Comp 1/4W 5% 22K	1	1065-2202
R45	Res Car Comp 1/4W 5% 22K	1	1065-2202
R46	Res MT FLM 1/8W 1% 113K	1	1061-1133
R47	Res MT FLM 1/8W 1% 200K	1	1061-2003
R48	Res Car Comp 1/4W 5% 120K	1	1065-1203
R49	Res Car Comp 1/4W 5% 160K	1	1065-1603
R50	Res Car Comp 1/4W 5% 56K	1	1065-5602
R51	Res MT FLM 1/8W 1% 8.25K	1	1061-8251
R52	Res MT FLM 1/8W 1% 174K	1	1061-1743
R53	Res MT FLM 1/8W 1% 20.5K	1	1061-2052
R54	Res MT FLM 1/8W 1% 113K	1	1061-1133
R55	Res Car Comp 1/4W 5% 10K	1	1065-1002
R56	Res Car Comp 1/4W 5% 100K	1	1065-1003
R57	Res Car Comp 1/4W 5% 8.2K	1	1065-8201
R58	Res Car Comp 1/4W 5% 56K	1	1065-5602
R59	Res Car Comp 1/4W 5% 10K	1	1065-1002
R60	Res Car Comp 1/4W 5% 10K	1	1065-1002
R61	Res Car Comp 1/4W 5% 4.7K	1	1065-4701
R62	Res Car Comp 1/4W 5% 10	1	1065-0010
R63	Res Car Comp 1/4W 5% 10	1	1065-0010
R64	Res Mt Film 1/8W 1% 10K	1	1061-1002
U1	IC CD4520BCN	1	1102-4520
U2	IC CD4520BCN	1	1002-4520
U3	IC CD4081BE	1	1102-4081
U4	IC CD4001AE	1	1102-4001
U5	IC CD4013BE	1	1102-4013
U6	IC CD4081BE	1	1102-4081
U7	IC CD4069	1	1102-4069
U8	IC LM324N	1	1100-0324
U9	IC LM1458N	1	1101-1458
U10	IC LM1458N	1	1101-1458
U11	IC LM324N	1	1102-0324
U12	IC LM1458N	1	1101-1458
U13	IC CD4520BCN	1	1102-4520
U14	IC CD4001AE	1	1102-4001
U15	IC CD4081BE	1	1108-4081
U16	IC LM1458N	1	1101-1458
U17	IC LM1458N	1	1101-1458
U18	IC LM748CN	1	1100-0748
U19	IC CD4001AE	1	1102-4001
U20	IC CD4520BCN	1	1102-4520
Y1	Crystal 1.00MHz	1	2400-1001

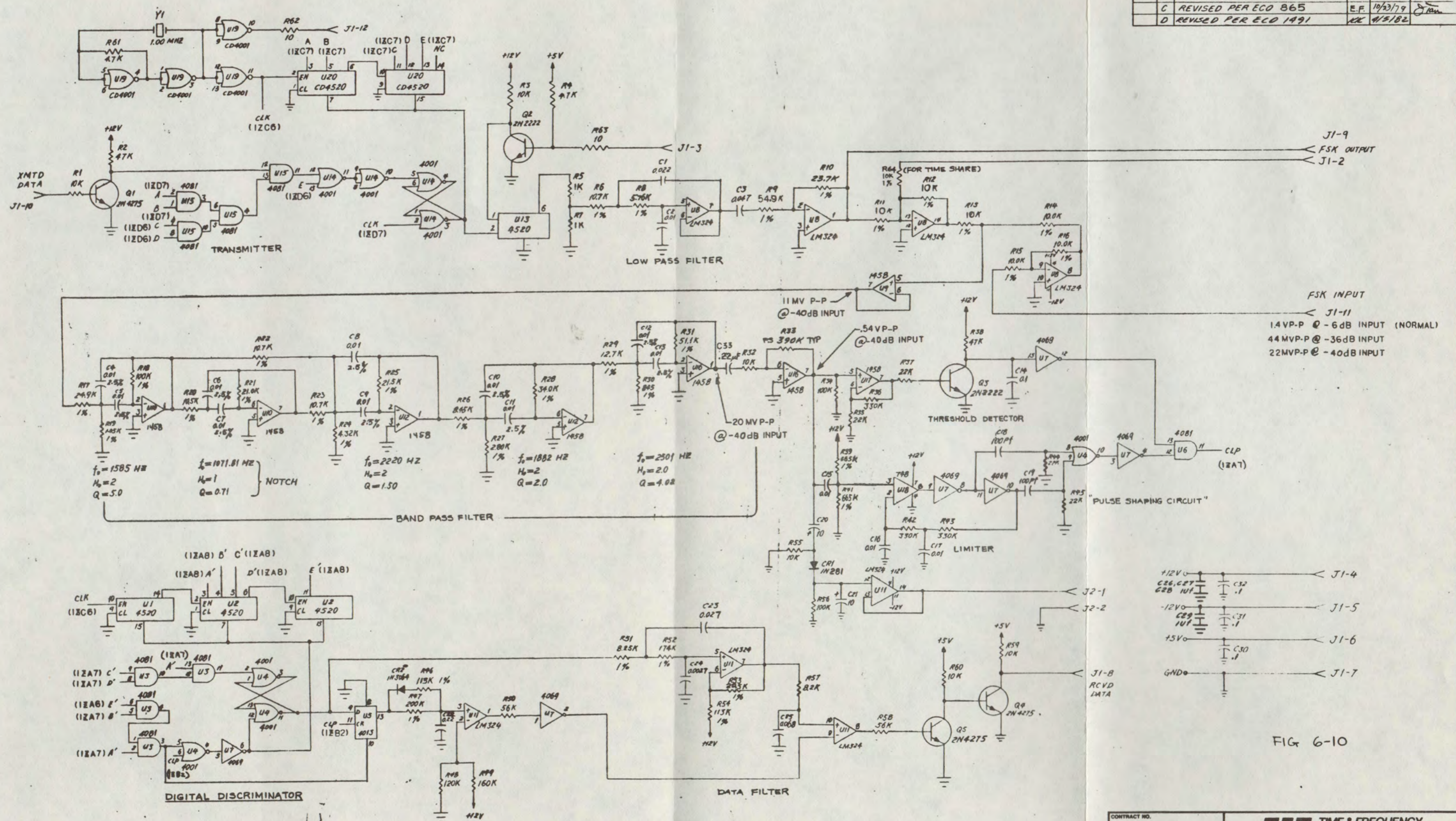
Model 7610R  
7815R  
7601R

FSK "R" Modem BD

Assembly #6608-3210  
Rev H

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
	IC Socket 8 Pin IC Socket 14 Pin IC Socket 16 Pin	6 10 4	2250-1008 2250-1014 2250-1016
	Tie Wrap	1	2140-0005
	P.C. Board, FSK "R" Modem	1	1600-3210

DWG. NO. 6601-3210		REV. 1-1	REV. D
REVISIONS			
ZONE	REV.	DESCRIPTION	DR DATE APPROVED
A		RELEASED FOR PRODUCTION	M.Y. 5/4/79 J.S.M.
B		REVISED PER ECO 819	E.C. 7/20/79
C		REVISED PER ECO 865	E.F. 10/23/79 J.S.M.
D		REVISED PER ECO 1491	K.K. 4/5/82



FSK INPUT  
 J1-11  
 1.4VP-P @ -6dB INPUT (NORMAL)  
 44 MVP-P @ -36dB INPUT  
 22 MVP-P @ -40dB INPUT

J1-4  
 +12V  
 C26, C27  
 100F  
 100F  
 J1-5  
 -12V  
 C29  
 100F  
 100F  
 J1-6  
 +5V  
 C30  
 100F  
 J1-7  
 GND

FIG 6-10

4. PC. BD. ASSY. 6608-3210

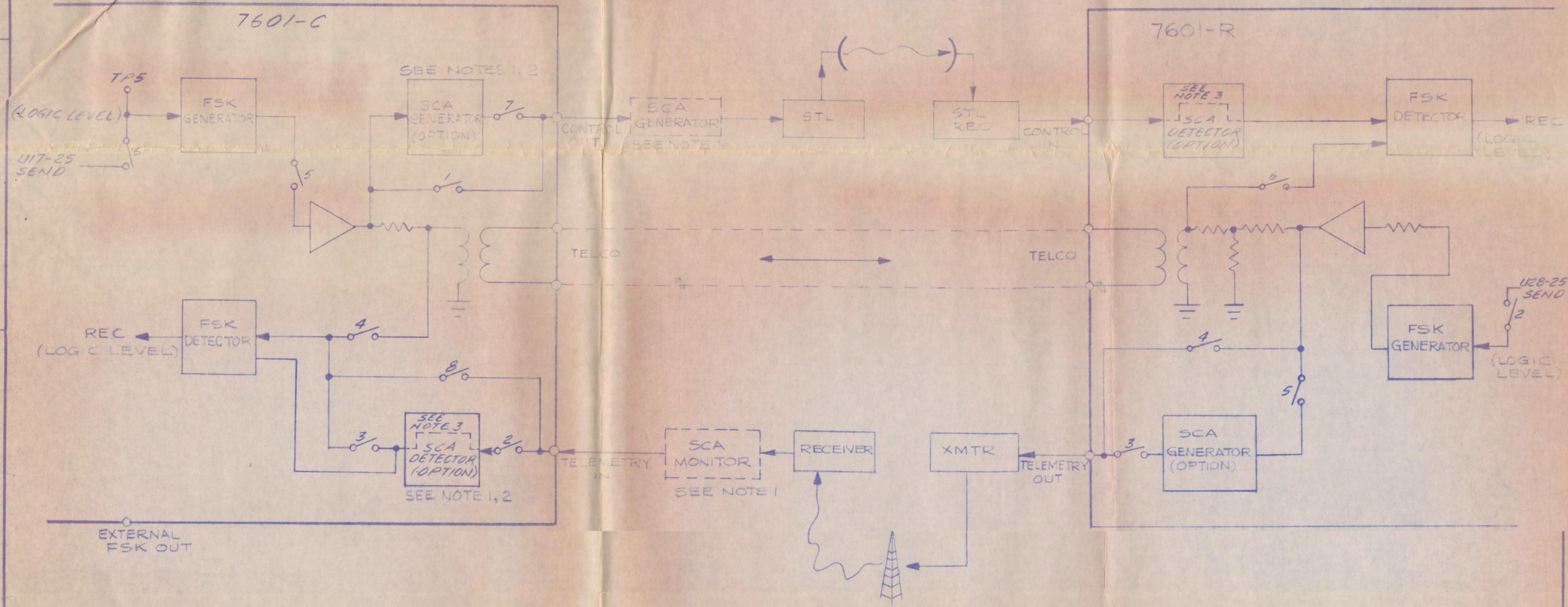
3. ALL 1% RESISTORS ARE 1/8 W, EXCEPT R39, R41  
 2. RESISTOR VALUES ARE IN OHMS, 1/4 W, 5%  
 1. CAPACITOR VALUES ARE IN MICROFARADS, 10%  
 NOTES: UNLESS OTHERWISE SPECIFIED;

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CONTRACT NO.		MEM TIME & FREQUENCY TECHNOLOGY INC.	
APPROVALS		DATE	
DRAWN	Anna Chou	3-12-79	
CHECKED	John J. Jones	5/4/79	
ISSUED	ROY DICK	4/25	
	MIC. DATE	6-10-79	
	QA XR		
5102-2091	7601R		
5102-2090	7610R		
5102-3240	7815R		
NEXT ASSY	USED ON		
SCALE NONE		SHEET 1 OF 1	



NEXT ASSY	USED ON	REVISIONS					
5004-7601	7601	SYM	DESCRIPTION	DR	CHK	AUTH	DATE
		A	REL. TO PRODUCTION	JT	JT	388	7/6/77
		B	REVISED PER ECO 1439	KL			11/2/77



R FSK OUTPUT  $\frac{2315\text{ Hz} = 0}{1736\text{ Hz} = 1}$  → 600 BAUD DATA RATE  
 FSK FREQ FOR TELCO  
 OR SCA  
 C FSK OUTPUT ←  $\frac{1180\text{ Hz} = 0}{980\text{ Hz} = 1}$  300 BAUD DATA RATE

FIGURE G.3

- 3. JUMPER BETWEEN PINS 11 AND 12 REQUIRED WHEN PCB IS WITHOUT GENERATOR
- 2. SCA GENERATOR AND DETECTOR ARE ON ONE CARD.
- 1. IF THE STUDIO HAS AN SCA GENERATOR OR SCA MONITOR, THE 7601 GENERATOR AND/OR SCA DETECTOR MAY BE ELIMINATED. THE RESPECTIVE JUMPER WOULD THEN BE INSTALLED.

NOTES:

QTY PER ASSY	ITEM NO	EN NO	PART NO	DESCRIPTION	REF DES
LIST OF MATERIALS					
REMOVE ALL BURRS AND SHARP EDGES			DRAWN BY	JTAU	DATE
TOLERANCES UNLESS OTHERWISE SPECIFIED			CHK. BY	JTAU	12-5-77
xx ±			PROJ. ENG		
xxx ±			MFG. ENG		
DO NOT SCALE THIS PRINT			APPD.		
			APPD.		
			ECO NO		
				TITLE	7601 BLOCK DIAGRAM COMMUNICATION OPTIONS
				SIZE	DRAWING NO
				C	6600-1490
				SCALE	1/2" = 1"
				SHT	1 OF 1

**TFT** TIME & FREQUENCY TECHNOLOGY INC  
 3000 Olcott St., Santa Clara, California 95051  
 (408) 246-6365

Table 2-1 Model 7601 Communication Interface Selections

DIP Switch S1 position on 7601-C Mother Board

	TELCO (NO SCA)	SCA GEN & DET	SCA GEN (NO DET)	SCA DET (NO GEN)
1	OFF	OFF	OFF	ON
2	OFF	ON	ON	ON
3	OFF	OFF	OFF	OFF
4	ON	ON	ON	ON
5	ON	ON	ON	ON
6	ON	ON	ON	ON
7	OFF	ON	ON	ON
8	OFF	OFF	OFF	OFF

FOR OTHER COMBINATIONS CONSULT FACTORY

DIP Switch S1 position on 7601-R Mother Board

	TELCO (NO SCA)	SCA GEN & DET	SCA DET (NO GEN)
1	OFF	OFF	OFF
2	ON	ON	ON
3	OFF	ON	OFF
4	OFF	OFF	ON
5	OFF	ON	OFF
6	ON	ON	ON
7	OFF	OFF	OFF

FOR OTHER COMBINATIONS CONSULT FACTORY

NOTE: All of the above configurations require a complete FSK Modem board to the 7601-C and 7601-R

TFT OPERATION MANUAL ADDENDUM

S/N \_\_\_\_\_

MODEL 7601,      MANUAL REVISION LEVEL D EFFECTIVITY 7601 RUN 1

IMPORTANT MANUAL CHANGES

- 1.0 ATTACHED ARE TABLE 2-1 AND BLOCK DIAGRAM FIGURE 6.3 DRAWING 6600-1490 WHICH HAVE BEEN REVISED AND UPDATED

Table 2-1 Model 7601 Communication Interface Selections

DIP Switch S1 position on 7601-C Mother Board

	TELCO (NO SCA)	SCA GEN & DET	SCA GEN (NO DET)	SCA DET (NO GEN)
1	OFF	OFF	OFF	ON
2	OFF	ON	ON	ON
3	OFF	OFF	OFF	OFF
4	ON	ON	ON	ON
5	ON	ON	ON	ON
6	ON	ON	ON	ON
7	OFF	ON	ON	ON
8	OFF	OFF	OFF	OFF

FOR OTHER COMBINATIONS CONSULT FACTORY

DIP Switch S1 position on 7601-R Mother Board

	TELCO (NO SCA)	SCA GEN & DET	SCA DET (NO GEN)
1	OFF	OFF	OFF
2	ON	ON	ON
3	OFF	ON	OFF
4	OFF	OFF	ON
5	OFF	ON	OFF
6	ON	ON	ON
7	OFF	OFF	OFF

FOR OTHER COMBINATIONS CONSULT FACTORY

NOTE: All of the above configurations require a complete FSK Modem board to the 7601-C and 7601-R