

ADVANCED DATA ACQUISITION,
LOGGING AND ALARM SYSTEM
MODEL 7640C/7840/7841

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SECTION 1

GENERAL INFORMATION

1.1 General Description.

1.1.1 7640 and 7840 Systems.

The 7640 and 7840 Advanced Data Acquisition, Logging and Alarm Systems are similar, the principal difference being that the 7640 System provides a CRT data readout as well as a TTY printer readout.

The 7640 System is a computer assisted option for the Model 7610 Remote Control System. It can also be used to assist the operation of any remote control equipment or used as an independent system in data acquisition, status monitoring, and logging. Both telemetry and status functions for up to 100 channels can be displayed on the 15-inch CRT. Up to 30 telemetry channels may be called up simultaneously via the keyboard on the CRT unit.

In addition to the passive display, the 7640 System has a built-in processor and special software package to enable the user to pre-program two sets of upper and lower limits to the parameter being monitored, so that central control can be instantly alerted when these parameters are exceeded. The additional feature of automatic or call-up logging provides a permanent record.

The 7840 System is a microcomputer based data acquisition limit alarm and logging system. It can be used to assist the 7610 Remote Control System or any other remote control equipment or act as an independent system for data acquisition, status monitoring, logging and alarm. Both telemetry and status functions for up to 60 channels

can be selected for monitoring and logging on a Model 43 Printer. A built-in microprocessor and special software package enable the programming of up to two levels of upper and lower limits (one set may be used for control) for each parameter being monitored, so that the operator can be instantly alerted when these parameters are exceeded. The additional feature of automatic or call-up logging provides a permanent record.

The major components of the two systems are as follows:

<u>7640 System</u>	<u>7840 System</u>
Model 7640C CPU	Model 7840 CPU
Model 7841 Remote Scanner	Model 7841 Remote Scanner
Model 43 Printer	Model 43 Printer
Model 400E CRT Data Terminal	

These units are described in the following paragraphs.

1.1.2 Model 7640C Central Processing Unit.

A microprocessor-based CPU provides direct interaction with the computer programs and tolerance limits stored in the nonvolatile memories. It processes the telemetry data consisting of site number, channel identification, and meter reading via the FSK modem. A built-in alerting feature provides an aural alarm and also causes the appropriate CRT display to flash when any pre-programmed limits are exceeded.

In addition to the information storage and processing capabilities, the CPU also provides a clock, consisting of calendar and time information, for display and logging purposes. Two parallel BCD inputs and 30 status inputs are provided on the rear panel.

1.1.3 Model 7840 Central Processing Unit.

A microprocessor-based CPU provides direct interaction with the computer programs and tolerance limits stored in the nonvolatile memories. It processes the telemetry data consisting of site number, channel identification, and meter reading via the FSK modem. A built-in alerting feature provides an aural alarm and also causes the appropriate data to be logged when any preprogrammed limits have been exceeded. In addition to its information storage and processing capabilities, the CPU also provides a clock, which consists of a calendar and time information for logging purposes. Two parallel BCD inputs and 30 status inputs are provided on the rear panel.

1.1.4 Model 7841 Remote Scanner.

The Model 7841 is a self-contained scanner equipped with all the necessary scanner boards, 10-turn calibration potentiometers, and DVM for independent system operation as well as Channel Select and Calibration switches on the front panel. The 7841 is capable of scanning up to 60 telemetry inputs from various sensors, such as temperature, power, voltages, currents, contact closures, and intrusion. It converts these inputs to digital data and transmits them to the UART in the CPU via its own UART.

1.1.5 Model 43 Printer.

A Model 43 Printer is a standard part of both systems. This terminal provides automatic print-outs of selected telemetry information on a prescheduled basis, or gives instant print-out on manual command. Up to 60 columns of data can be printed on the character

printer. A typewriter keyboard also comes as standard equipment for annotation and programming the CPU. The printer logging format provides sign-on and sign-off time, as well as three rows of 5-character headings for each data column. In addition, the printer will print an "out-of-tolerance" parameter for telemetry data and an "alarm condition" for status data.

1.1.6 Model 400E CRT Data Terminal.

The Model 400E CRT Data Terminal provides the interface between the operator and the 7640 System. This modular (detached keyboard) terminal can be located in any 19-inch rack or on a desk top. All system inputs and instructions to the computer are handled through the CRT keyboard. This same keyboard may also be used for inputting headings to the logging system, calling up data from remote terminals, and selecting pages.

A 15-inch black and white CRT display is standard, with a 19-inch rack mounting kit optionally available. The CRT terminal displays 100 channels of data in groups of 30 per page. The operator specifies, through the keyboard, a site and channel number for each of the 100 display channels. Once a channel assignment has been made, the operator may program information for that display number. Status or telemetry functions may be assigned to and displayed on any one of the 100 channels interchangeably.

1.2 Specifications.

1.2.1 7640 System.

Number of Telemetry and Status Channels	Up to 100 channels displayed as title, sign, decimal position, 4-digit numbers and on/off status.
Telemetry Channels	Remote site: 60 channels per site including one BCD input. Control site: two BCD inputs.
Status Channels	Any telemetry channel from the remote site may be programmed to be displayed as telemetry data or on/off status. Up to 30 status inputs are available at the control site.
Number of Remote Sites Monitored	Up to 4.
Number of Channels Logged	Up to 60. logged periodically on command and upon wide alarm condition.
Data Input Status and BCD Telemetry	TTL compatible levels Full Scale: ± 4.096 VDC differential reads ± 4096 . ± 300 VDC common mode
Data Accuracy	0.1% of reading
Data Scan Rate	4 channels per second and 10 status inputs per second.
Data Link	350-600 Hz FSK. Can share Model 7610 data link.
CRT Composite Video Output	Enables one auxiliary CRT display to be driven from the main display at remote locations up to 50 feet.
CPU Memory Operating Program	Stored in nonvolatile EPROM (up to 16K bytes).

1.2.1 7640 System. (Continued).

Operator Entered Parameters	Stored in RAM with 8-hour battery back-up (up to 7K bytes).
Operating Temperature	Model 7841: 0° to +50° C Model 7640C: 10° to 40° C
Dimensions	
Model 7841	H: 7" (17.8 cm) W: 19" (48 cm) D: 13" (33 cm)
Model 7640C	H: 5.25" (13.3 cm) W: 19" (48 cm) D: 15.5" (39.4 cm)
CRT Data Terminal	H: 14" (35.5 cm) W: 15" (38.1 cm) D: 13.6" (34.6 cm)
CRT Detached Keyboard	H: 2.7" (6.8 cm) W: 17" (43.2 cm) D: 7.4" (18.7 cm)
Printer with Keyboard	H: 5.5" (14 cm) W: 18" (45.7 cm) D: 21.5" (54.6 cm)

1.2.2 7840 System.

Number of Telemetry Channels	20 channels, expandable to 60 by adding scanner boards to Model 7841.
Number of Status Channels	30 inputs are provided on the Model 7840 CPU rear panel.
Number of Channels Logged	Up to 60.
Number of Remote Sites	Up to 4 sites.
Data Inputs	
Telemetry	Full scale: ± 4.096 VDC differential reads ± 4096 ± 300 VDC command mode $\pm 0.1\%$ of reading accuracy
Status	TTL compatible levels or relay contact closure.
BCD	Two channels of TTL BCD inputs available on the rear panel of Model 7840.

1.2.2 7840 System (Continued).

Data Link Between Model 7841 and Model 7840 UART to UART differential output and input or 350-600 Hz FSK

Data Scan Rate 4 channels per second

Operating Temperature 0° C to +50° C

Power 115/230 VAC 50-60 Hz
45 watts for Model 7840
30 watts for Model 7841
60 watts for Model 43

Dimensions

Model 7840 H: 5.25" (13.3 cm); W: 19" (48 cm);
D: 15.5" (39.4 cm)

Model 7841 H: 7" (17.8 cm); W: 19" (48 cm);
D: 13" (33 cm)

Model 43: H: 5.5" (14 cm); W: 18" (45.7 cm);
D: 21.5" (54.6 cm)

1.3

Warranty

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

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

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

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

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

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

1.4

Claim for Damage in Shipment.

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

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

PLEASE ADVISE US IF WE CAN ASSIST YOU IN ANY MANNER

Time & Frequency Technology, Inc.
3090 Oakmead Village Drive
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SECTION 2

INSTALLATION

2.1 General.

This section gives instructions for installing the equipment at the control site (Subsection 2.4) and at the remote site (Subsection 2.5). The Models 7640C, 7840 and 7841 are to be mounted in standard 19-inch relay racks. The CRT Display unit of the Model 400E (7640 System only) can be placed on a desk top; or, with the optional rack-mount kit, it can also be mounted in a 19-inch rack.

As part of the installation procedure at the remote site, the Model 7841 must be programmed for the number of Relay Scanner Boards used and for the site at which the 7841 is located. These procedures are covered in Subsections 2.5.3 and 2.5.4.

The analog-to-digital conversion must be calibrated during installation. This is covered in Subsection 2.5.8.

2.2 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 procedures 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.

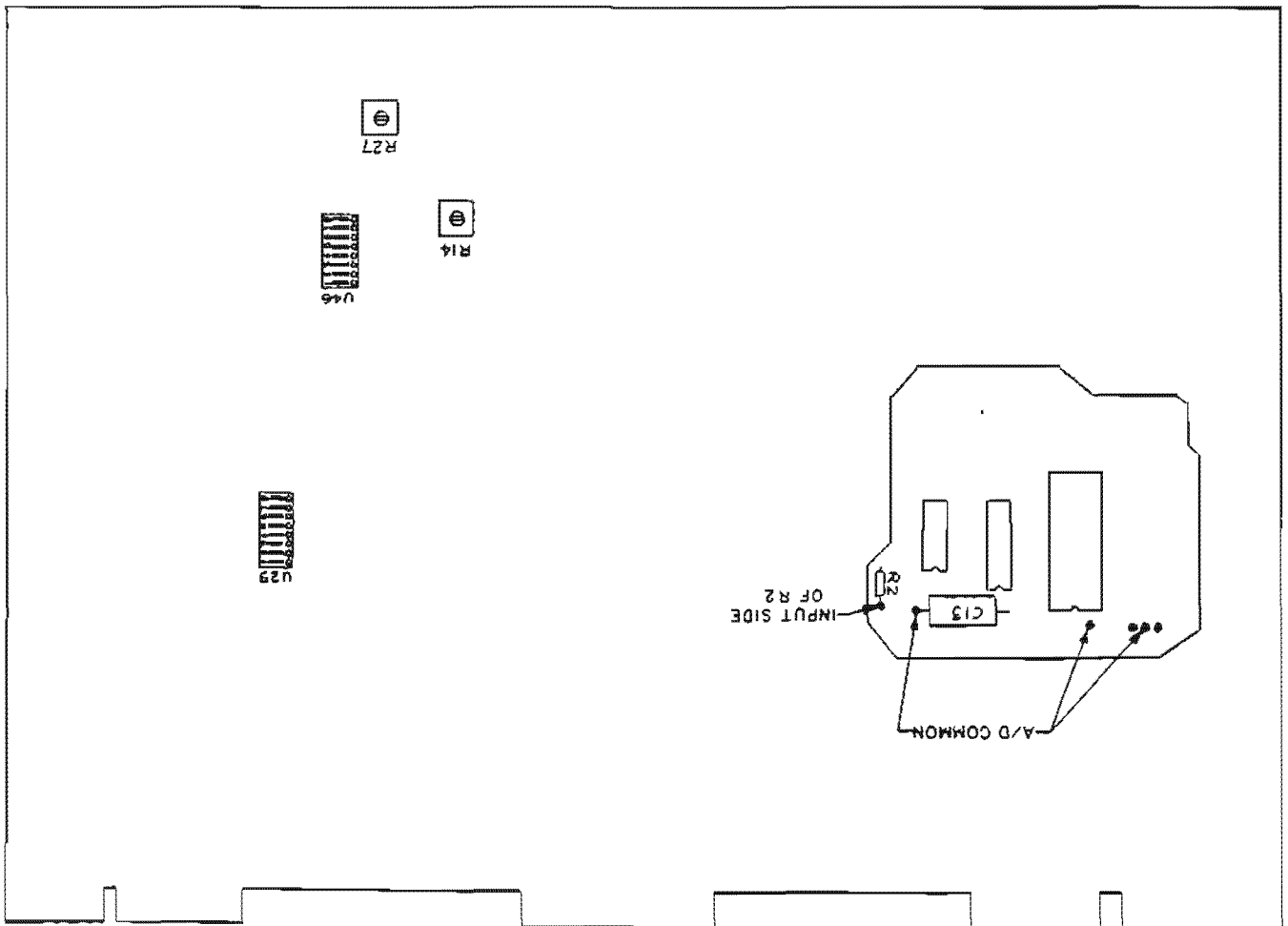
2.3 Preinstallation Checkout Procedures.

2.3.1 7640 System.

To ensure that the 7640 System is functional when received and to familiarize personnel with the system, a preinstallation checkout and precalibration should be performed as follows:

- a. Connect the CRT Data Terminal to the 7640C (see Subsection 2.4.1.4).
- b. Connect the TELE IN port of the 7640C to the TELE OUT port on the 7841, using one of the 4-foot coax cables provided.
- c. Remove the top cover from the 7841. Place all switches on DIP switches U29 into the ON position and U46 into the OFF position (see Figure 2-1).
- d. Connect a 2 VDC source to the Channel 0 input on the rear panel of the 7841.
- e. Apply power to the 7640C, 7841 and the CRT if it has not already been done.
- f. The CRT should display Page 0 and Channels 00 through 29. Set up the Data Terminal to display Site 0 Channel 2 at display number 8 (see Section 3).
- g. Select Channel 0 to be displayed on the front panel of the 7841. Adjust the Channel 0 calibration potentiometer on the 7841 so that the CRT display

Figure 2-1. Scan Control Board, Model 7841



2.3.1 7640 System (Continued)

shows the same DC level as displayed on the front panel of the 7841.

This completes the 7640 System preinstallation procedure.

2.3.2 7840 System.

To ensure that the 7840 System is functional when received and to familiarize personnel with the system, a preinstallation checkout and precalibration should be performed as follows:

- a. Connect the Model 43 Printer to the 7840 (see Subsection 2.4.2.3).
- b. Connect the TELE IN port of the 7840 to the TELE OUT port on the 7841.
- c. Remove the top cover from the 7841. Place all switches on DIP switches U29 into the ON position and U46 into the OFF position (see Figure 2-1).
- d. Connect a 2 VDC source to the Channel 0 input on the rear panel of the 7841.
- e. Apply power to the 7840, 7841 and the Model 43 Printer if it has not already been done.
- f. Set up the Model 43 Printer to log Site 0, Channel 0 in column 1 (see Section 3).
- g. Select Channel 0 to be displayed on the front panel of the 7841. Adjust the Channel 0 calibration potentiometer on the 7841 so that the telemetry reading for Channel 0 is 2000 ± 0003 . Manually log column 1 (see Section 3). The

2.3.2 7840 System (Continued).

telemetry data logged in column 1 should be the same as that displayed on the front panel of the 7841.

This completes the 7840 System preinstallation procedure.

2.4 Control Site Installation.

2.4.1 7640 System.

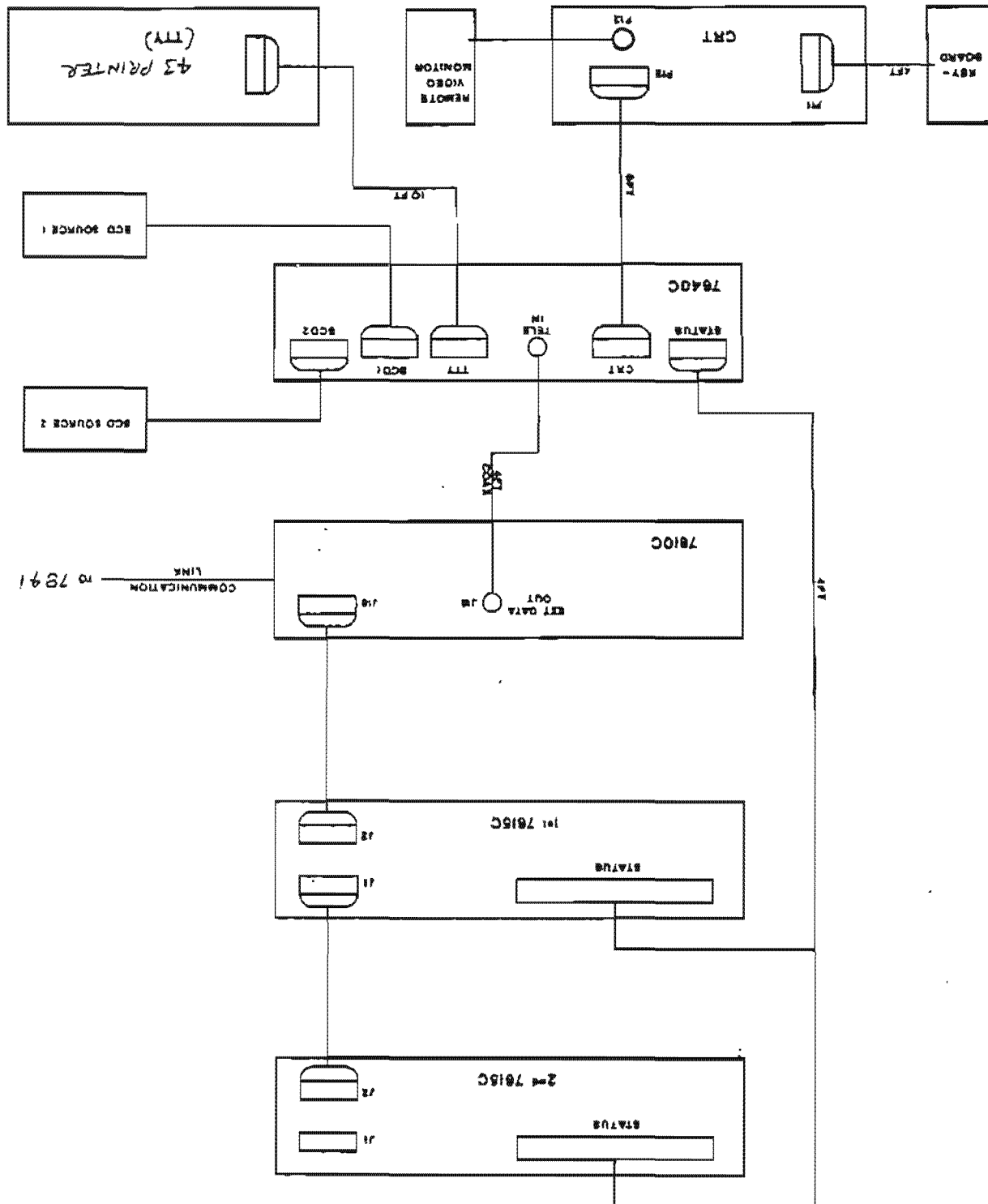
2.4.1.1 Equipment List.

The 7640 System control site equipment consists of a Model 7640C Central Processing Unit, a Model 400E CRT Data Terminal (CRT Display with separate Keyboard), a Model 43 Printer, and the following interface cabling (see Figure 2-2):

- a. One 4-foot coax for connecting the 7640C to the 7610C.
- b. One 4-foot, 31-conductor cable with a D-type female connector on one end and spade lugs on the other, for interfacing to an external status source.
- c. One 10-foot, 25-conductor ribbon cable with D connectors for the Printer interface.
- d. The CRT Data Terminal is supplied with a 4-foot ribbon cable for connecting the Keyboard to the CRT Display Unit, and a 6-foot cable for connecting the CRT Data Terminal to the 7640C. A 6-foot cable is also supplied for extending the connection between the CRT Data Terminal and the 7640C.

Other hardware supplied includes 2 crimp type "D" connectors for external BCD interface. A BNC connector for the 7610C/7640C interface is also supplied where needed.

Figure 2-2. 7640C System Interconnection



2.4.1.2 Model 7640C Rack Mounting and Cabling.

To mount the 7640C, proceed as follows:

- a. Remove the 7640C top cover.
- b. Connect the backup battery to the power supply by connecting the floating blue wire to the positive (red) terminal of the battery.
- c. Replace the top cover.
- d. Using the hardware supplied, rack-mount the 7640C within 3.5 feet of the 7610C.
- e. Connect the 4-foot coax cable from the EXT DATA OUT connector on the 7610C rear panel to the TELE IN connector on the 7640C rear panel.

2.4.1.3 Model 7610C Preparation.

If the 7610C has a BNC connector at J15, the EXT DATA OUT port, proceed with Subsection 2.4.1.4. If not, refer to the 7610 Manual and install the connector provided as follows:

- a. Remove power from the 7610C.
- b. Remove the top cover.
- c. Remove the rear panel blank over J15, the EXT DATA OUT port. See Figure 3.2 in the 7610 Manual.
- d. Mount the BNC connector at J15.
- e. Solder the wire from J5 pin 5 to the BNC connector. See Figure 6.1.3 in the 7610 Manual.

The 7610C may now be placed back in service.

2.4.1.4 Model 400E CRT Data Terminal Installation.

Refer to Figures 2-3, 2-2, and 3-2 for the following installation instructions.

- a. If the optional rack-mount kit is used, rack-mount the CRT within 4.5 feet (10 feet if the extension cable is used) of the 7640C, and in such a way that the Keyboard may be conveniently used within 3 feet of the CRT.
- b. If the rack-mount kit is not used, place the CRT in a convenient location within 4.5 feet (10 feet with extension cable) of the 7640C, and so that the Keyboard may be used within 3 feet of the CRT.
- c. Remove the access door at the rear of the CRT case.
- d. Uncoil the ac power cord from inside the case and move it aside.
- e. Connect the 6-foot cable from P12 of the CRT Display to the 7640C CRT I/O port, or to the extension cable if used. Plug the other end of the extension cable (if used) into the 7640C CRT I/O port.
- f. Connect the 4-foot ribbon cable from the Keyboard to P11 of the CRT Data Terminal.
- g. A remote video monitor may be used in conjunction with the CRT Data Terminal by connecting a 75-ohm coax cable from BNC connector P13 of the Terminal to the VIDEO IN of the remote monitor. Any excess power, coax, or ribbon cabling may be stored inside the CRT case.
- h. Replace the access door to provide strain relief.

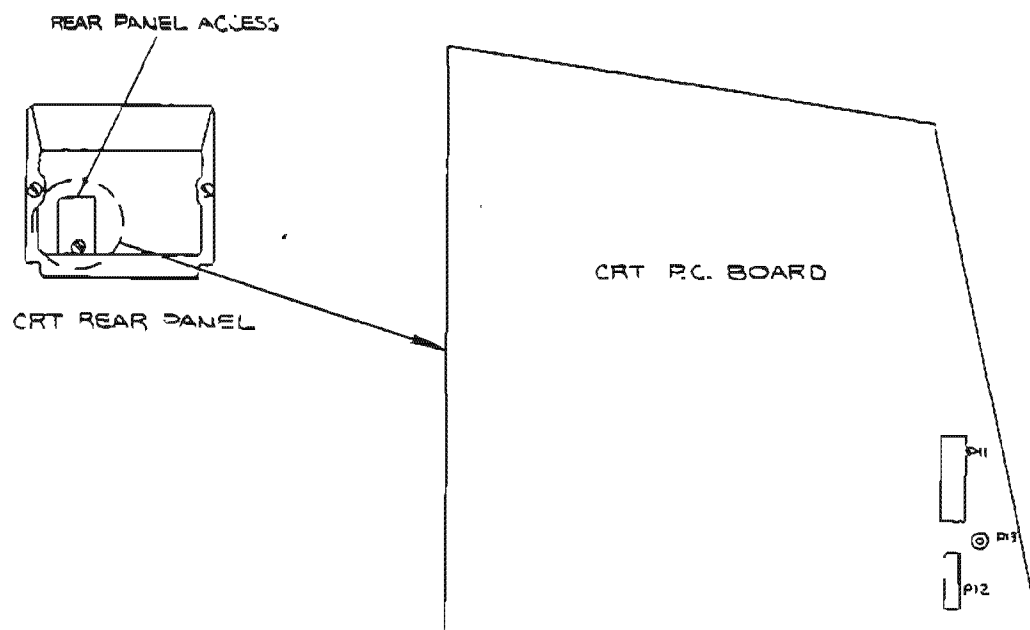


Figure 2-3. CRT Display Access Door and Connectors

2.4.1.5 Model 43 Printer Installation (Figures 2-2 and 3-2).

- a. Place the Printer in a convenient location within 8 feet of the 7640C.
- b. Connect the 10-foot, 25-conductor ribbon cable from the Printer's rear panel to the TTY I/O port on the 7640C.

2.4.1.6 Connecting External BCD Inputs (Figures 2-2, 2-4, and 3-2).

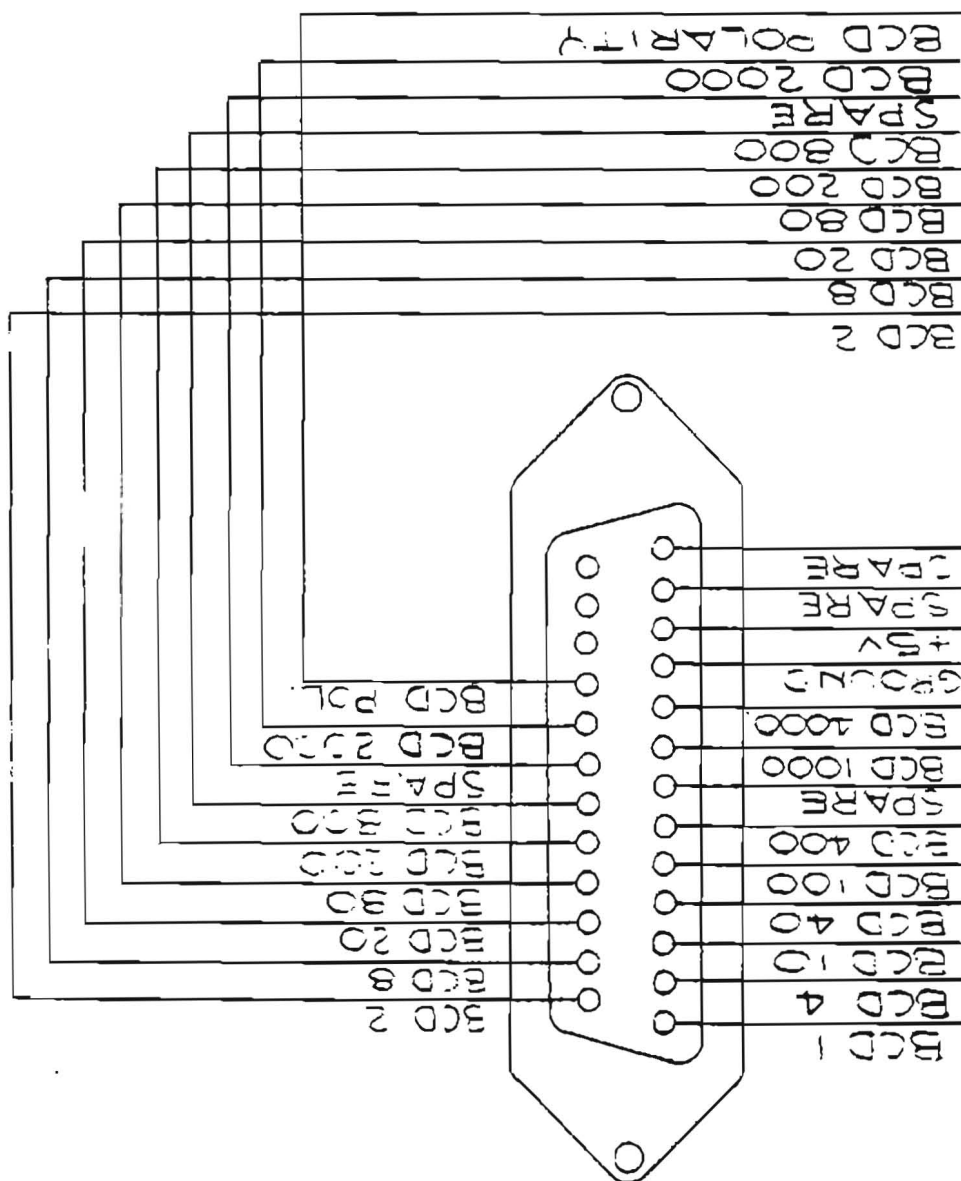
Two rear-panel connectors for parallel, TTL-level BCD inputs are provided on the 7640C. Figure 2-4 shows the pin assignments.

- a. Connect the BCD output from the instrument to be monitored to one of the crimp type "D" connectors provided. If not all of the 16 data lines are required, unused lines may be tied to a convenient state. For example, if the instrument to be monitored does not have a polarity indication line, the BCD P pin may be tied high to show a plus or tied low to show a minus.
- b. Connect the ground pin of the 7640C connector to ground of the instrument to be monitored. This is the ground reference.
- c. Plug the connector into either the BCD 1 IN or BCD 2 IN port on the 7640C rear panel.

2.4.1.7 Connecting External Status Inputs (Figures 2-2, 2-5, and 3-2).

A rear-panel connector (STATUS IN) is provided for accepting 15 TTL-level status inputs from each of two Model 7615 Status Monitoring/Direct Control Systems or other status sources. Figure 2-5 shows the pin assignments.

Figure 2-4. Pin Assignments for BCD Input Connectors



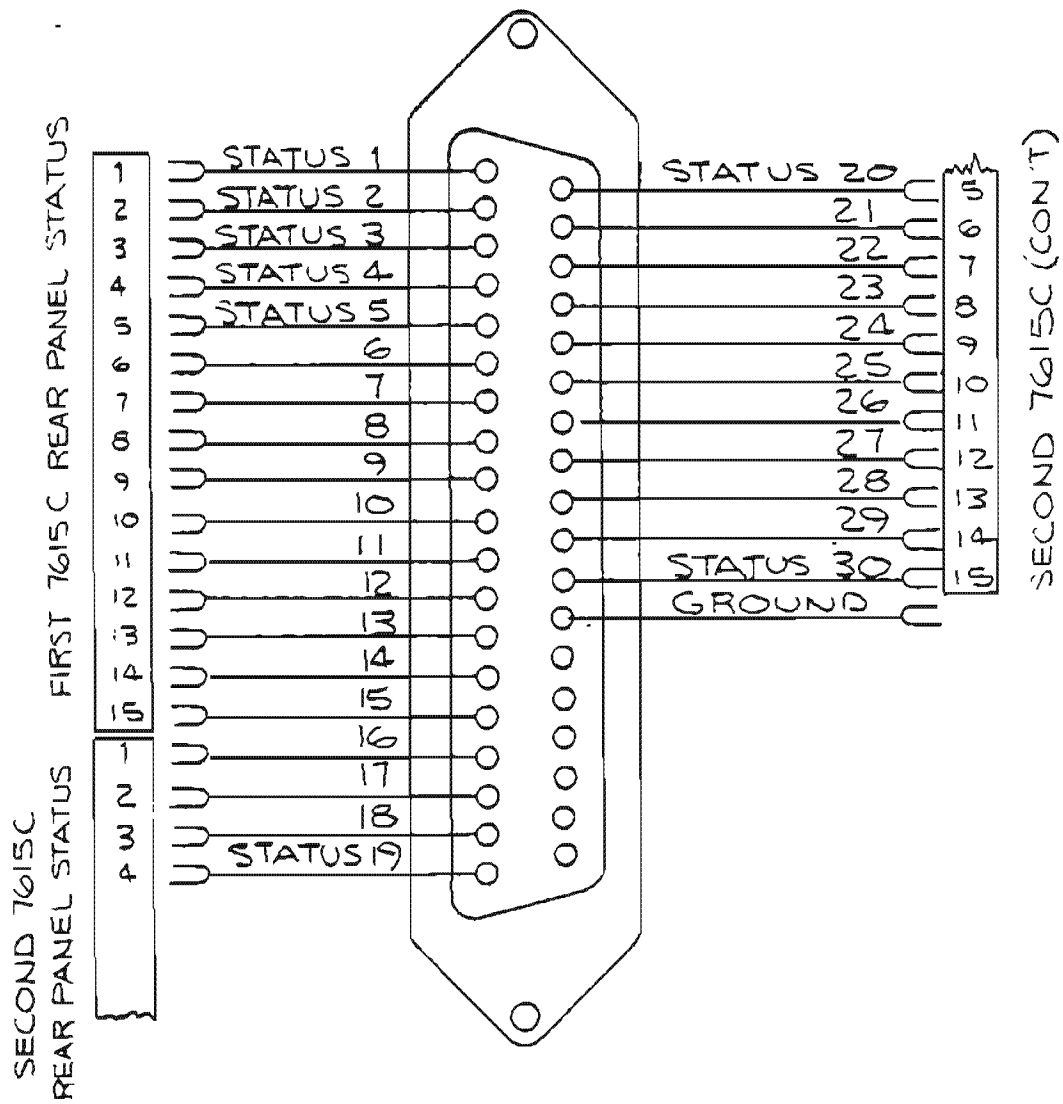


Figure 2-5. Pin Assignments for Status Input Connectors

2.4.1.7 Connecting External Status Inputs (Continued).

- a. Connect the spade terminals of the 30 status lines of the 4-foot, 31-conductor cable to the STATUS barrier strip terminals on the rear panels of two Model 7615s, or to terminals on other TTL-level status sources. A low on a Model 7615 terminal corresponds to a lighted status indicator on the Model 7615 front panel, and ON for the 7640C.
- b. A ground line is supplied for reference where needed.
- c. Plug the cable into the STATUS IN connector on the 7640C rear panel.

2.4.2 7840 System.

2.4.2.1 Equipment List.

The 7840 System control site equipment consists of a Model 7840 Central Processing Unit, a Model 43 Printer, and the following interface cabling (see Figure 2-6):

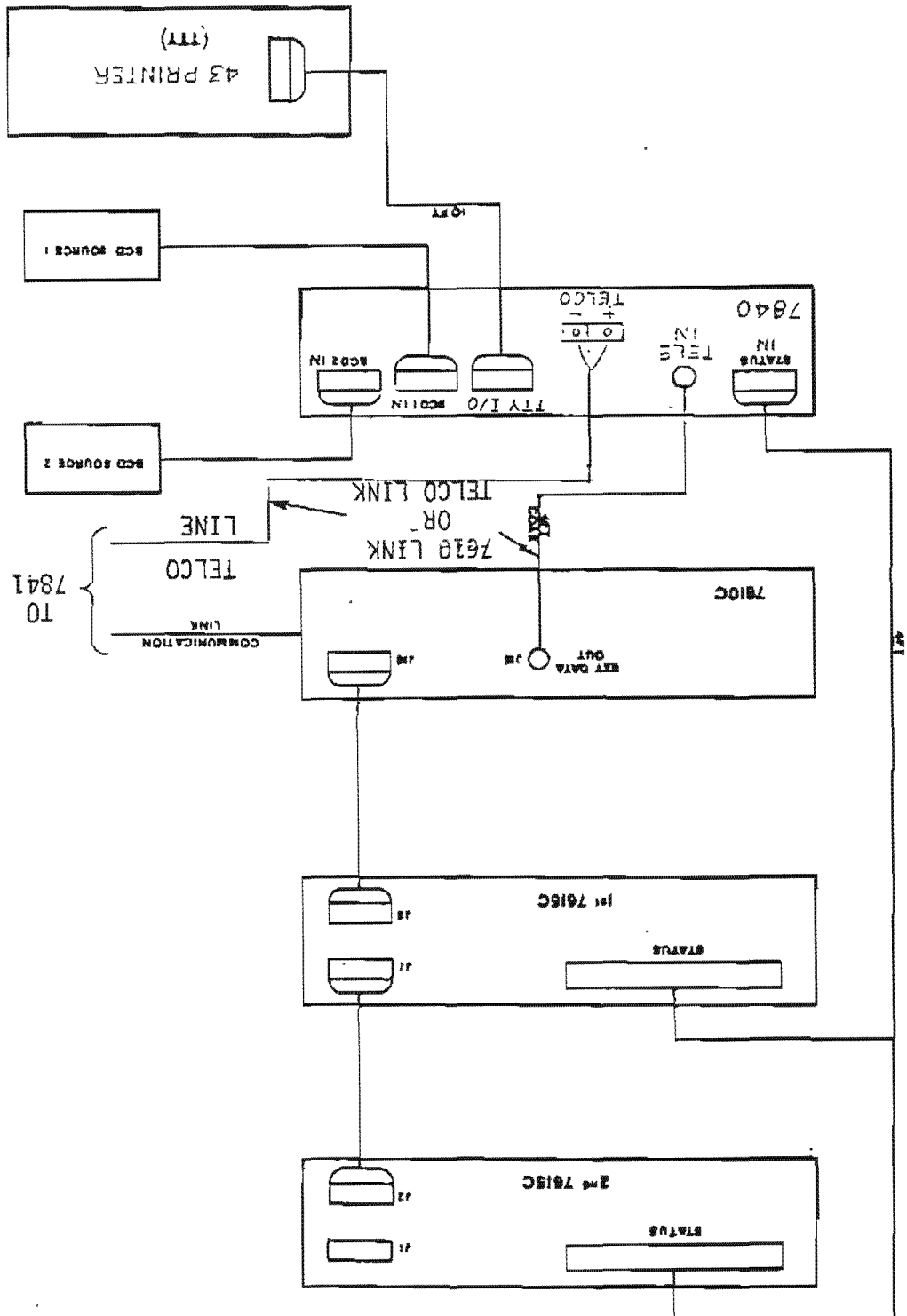
- a. One 4-foot, 31-conductor cable with a D-type female connector on one end and spade lugs on the other, for interfacing to an external status source.
- b. One 10-foot, 25-conductor ribbon cable with D connectors for the Printer interface.

Other hardware supplied includes two crimp type D connectors for external BCD interface.

2.4.2.2 Model 7840 Rack Mounting and Cabling.

To mount the 7840, proceed as follows:

Figure 2-6. 7840 System Interconnection



2.4.2.2 Model 7840 Rack Mounting and Cabling (Continued).

- a. Remove the 7840 top cover.
- b. Connect the backup battery to the power supply by connecting the floating blue wire to the positive (red) terminal of the battery.
- c. Replace the top cover.
- d. Using the hardware supplied, rack-mount the 7840.
- e. Connect a 4-foot coax cable from the EXT DATA OUT terminal on the 7610C rear panel to the TELEIN connector on the 7840 rear panel if the 7610 data link is shared. If the 7840 is used independently, connect the TELCO + and - inputs on the rear panel of the 7840 to the TELCO lines.

2.4.2.3 Model 43 Printer Installation (Figures 2-6 and 3-4).

- a. Place the Printer in a convenient location within 8 feet of the 7840.
- b. Connect the 10-foot, 25-conductor ribbon cable from the Printer's rear panel to the CRT I/O port on the 7840.

2.4.2.4 Connecting External BCD Inputs (Figures 2-6, 2-4, and 3-4).

Two rear-panel connectors for parallel, TTL-level BCD inputs are provided on the 7840. Figure 2-4 shows the pin assignments.

2.4.2.4 Connecting External BCD Inputs (Continued).

- a. Connect the BCD output from the instrument to be monitored to one of the crimp type D connectors provided. If not all of the 16 data lines are required, unused lines may be tied to a convenient state. For example, if the instrument to be monitored does not have a polarity indication line, the BCD P pin may be tied high to show a plus or tied low to show a minus.
- b. Connect the ground pin of the 7840 connector to ground of the instrument to be monitored. This is the ground reference.
- c. Plug the connector into either the BCD 1 IN or BCD 2 IN port on the 7840 rear panel.

2.4.2.5 Connecting External Status Inputs. (Figures 2-6, 2-5, and 3-4).

A rear-panel connector (STATUS IN) is provided for accepting 15 TTL-level status inputs from each of two Model 7615 Status Monitoring/ Direct Control Systems or other status sources. Figure 2-5 shows the pin assignments.

- a. Connect the spade terminals of the 30 status lines of the 4-foot, 31-conductor cable to the STATUS barrier strip terminals on the rear panels of two Model 7615s, or to terminals on other TTL-level status sources. A low on a Model 7615 terminal corresponds to a lighted status indicator on the Model 7615 front panel, and ON for the 7840.
- b. A ground line is supplied for reference where needed.
- c. Plug the cable into the STATUS IN connector on the 7840 rear panel.

2.5 Remote Site Installation (Model 7841).

2.5.1 Equipment List.

The remote site equipment for both the 7640 and 7840 Systems consists of a Model 7841 Remote Scanner with up to six Relay Scanner Boards, and a 4-foot coax cable for connecting to the 7610R in data-link-sharing installations.

2.5.2 Relay Scanner Board Installation.

Up to six Relay Scanner Boards, 0 through 5, may be installed in a single 7841. Each Relay Scanner Board contains 10 channels, numbered 0 to 9. The channel assigned to each relay is determined by the board it is on and its position on that board. For example, relay 4 (K5) on board 0 is channel 04, and relay 0 (K1) on board 5 is channel 50.

The channel group, or decade, that these boards are assigned to is determined by the decade select jumper, as shown in Figure 2-7. The boards are normally installed in the order of their jumper position numbers, and no two boards jumpered for the same decade may be used with a single 7841.

CAUTION

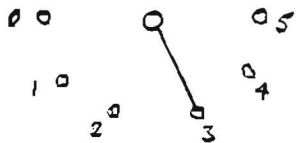
Using two boards jumpered for the same decade will damage the Remote Scanner Boards, the intercabling, and the instrument being monitored.

2.5.3 Relay Scanner Board Select Programming.

The 7841 must be programmed for the number of Relay Scanner Boards used, as follows:

RELAY SCANNER BOARD

DECADE SELECT



(SHOWN JUMPERED FOR CHANNELS 30 TO 39)

DECADE SELECT JUMPER POSITION	CHANNEL SELECTED
0	0 - 9
1	10 - 19
2	20 - 29
3	30 - 39
4	40 - 49
5	50 - 59

CAUTION: NO TWO RELAY SCANNER BOARDS JUMPERED FOR THE SAME DECADE MAY BE USED WITH THE SAME 7841.

Figure 2-7. Decade Selection

2.5.3 Relay Scanner Board Select Programming (Continued).

- a. Remove the top cover from the 7841.
- b. Program internal microswitches U46 by referring to Figure 2-8.

2.5.4 Site Identification Programming.

Up to 16 7841s may be used in a single 7640 or 7840 System. The site number(s) assigned to the 7841(s) is programmed in by means of internal microswitches.

The site number used must be from 00 to 15, but does not have to correspond to the number of 7841s used or the order in which they are used. The same site number may not be assigned to more than one 7841 in the same 7640 or 7840 System.

Program the 7841's site identification by referring to Figure 2-9 and setting the internal U29 microswitch to meet system requirements. Then replace the top cover of the 7841.

2.5.5 Connecting External BCD Inputs.

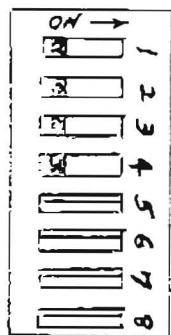
A rear-panel BCD IN port with a crimp type D-connector has been provided to interface a user-supplied BCD source with the 7640 or 7840 System. This port requires TTL-compatible positive logic. Pull-ups are provided. If an external BCD source is not used, set position 6 of microswitch U29 to ON (Figure 2-9) and proceed to Section 2.5.6. If an external BCD source is used, set position 6 of microswitch U29 to OFF and proceed with this section.

U46 Switch Position	Number of Relay Scanner Boards Used					
	1	2	3	4	5	6
1	0	0	0	0	0	0
2	0	0	0	0	●	●
3	0	0	●	●	0	0
4	0	●	0	●	0	●

0 = OFF

● = ON

Note: Switch positions 5 through 8 are not used.



Example: U46 Programmed
for One Relay Scanner Board

Example: U46 Programmed
for Five Relay Scanner Boards

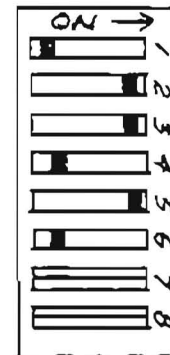
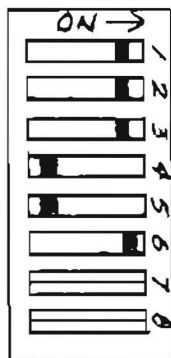
Figure 2-8. Relay Scanner Board Programming

U29 Switch Position	Site Number															
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	●	●	●	●	●	●	●	●	●	●	○	○	○	○	○	○
2	●	●	●	●	●	●	●	○	○	○	●	●	●	●	●	●
3	●	●	●	●	○	○	○	○	●	●	●	●	●	●	○	○
4	●	●	○	○	●	●	○	○	●	●	●	●	○	○	●	●
5	●	○	●	○	●	○	●	●	●	○	●	○	●	○	●	○

○ = OFF

● = ON

Note: Switch position 6, when off, enables the external BCD port. Switch positions 7 and 8 are not used.



Example: U29 Programmed for
Site 3 and No External BCD
Source

Example: U29 Programmed for
Site 12 and an External BCD
Source

Figure 2-9. Site Identification Programming

2.5.5 Connecting External BCD Inputs. (Continued).

Twenty-four BCD input lines are provided at this port. The lower eight lines, BCDC0 to BCDC7, are used for channel programming and the upper sixteen lines, BCDO to BCDP, are used for data with polarity indication. The upper and lower data limits are from -7999 to +7999.

The external BCD data will be substituted for one channel on a Relay Scanner Board when that channel's number has been programmed into the BCD in port. For example, programming the BCD In port for channel 05 will cause the external BCD data to be transmitted in place of the data on Relay Scanner Board 0, relay 5 (K6). If fewer than six Relay Scanner Boards are being used, the external BCD data may be assigned one of the channels on the next unused board in sequence. As an example, if three Relay Scanner Boards are being used (channels 00 through 29), the BCD In port may be assigned to any channel on the fourth board (channels 30 through 39).

To program the port's channel number and to input data, proceed as follows:

- a. Determine the channel number for the BCD IN port.
- b. Using Figure 2-10 and the examples provided, tie the lines to the proper state. If fewer than six Relay Scanner Boards are used and the BCD IN port has been assigned a channel number on the next sequential unused Relay Scanner Board, the BCD IN port counts as one Relay Scanner Board and must be programmed into the 7841. (See Section 2.5.3 and Figure 2-8.) For example, if Relay Scanner Boards 0 through 4 are used (channels 00 through 49), the BCD IN port may be assigned to any channel from 50 to 59 and U46 will be programmed for six boards.
- c. Connect the BCD output from the instrument to be monitored to the 7841 BCD IN port, pins 9 through

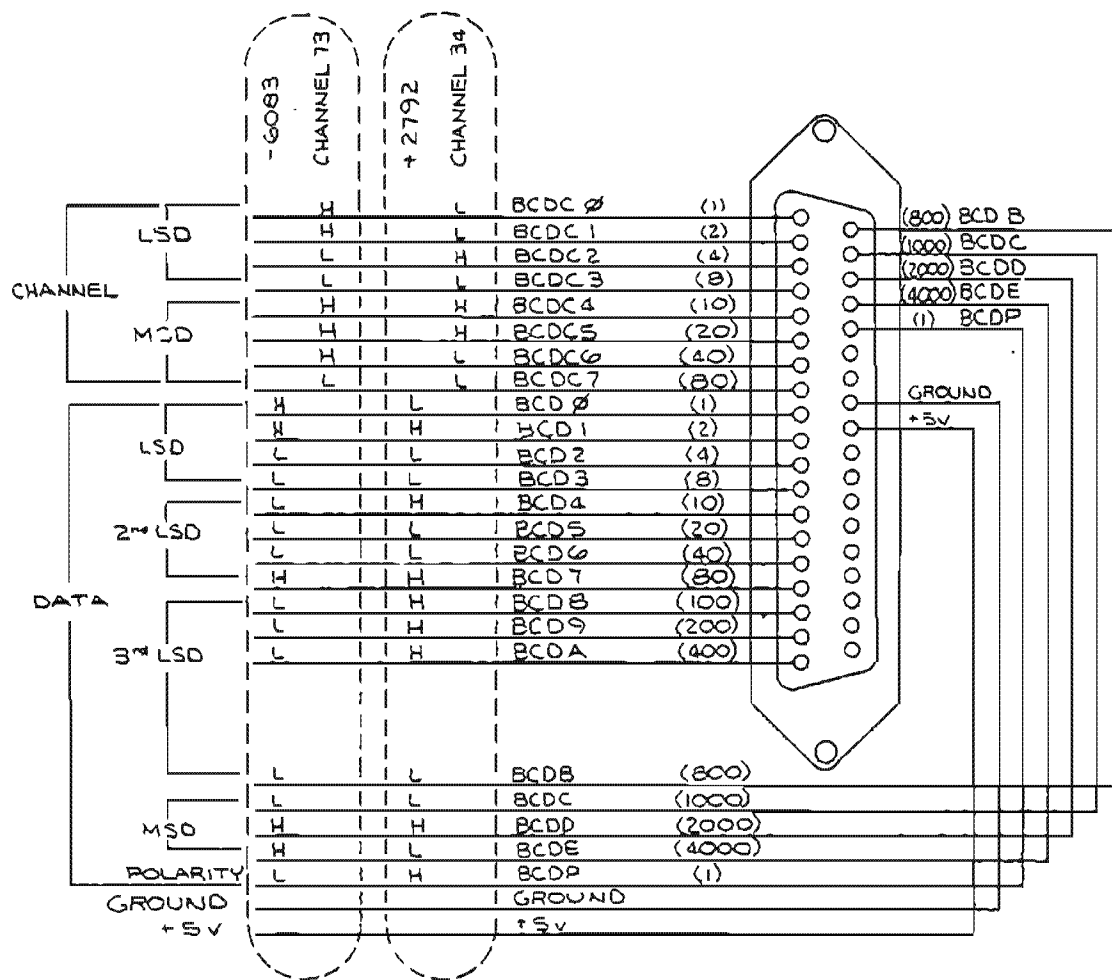


Figure 2-10. External BCD Connector

2.5.5 Connecting External BCD Inputs (Continued).

24. If all 16 pin lines are not required, unused lines may be tied to a convenient state along with the channel select lines. For example, if the instrument to be monitored does not have a polarity indication line, pin 24 may be tied high to show a plus or tied low to show a minus.

- d. Connect pin 27 of the BCD IN port to ground of the instrument to be monitored. This is the ground reference.
- e. Plug the interconnect cable into the 7841 BCD IN port (Figure 2-12).

The BCD IN port is now ready to input data.

2.5.6 Relay Scanner Board Switching Check.

This check involves hearing low-noise relay clicks, so it requires careful listening.

- a. Connect the 7841's power cord to the proper power source, 110 Vac or 220 Vac, as indicated on the rear panel. Wait 30 seconds.
- b. Listen for rapid relay clicks (4 per second) on each board in turn as the 7841 cycles through the boards. This indicates that the Relay Scanner Boards are receiving power and switching signals.

2.5.7 Rack Mounting and Cabling.

2.5.7.1 7610 Shared-Link Operation.

- a. Rack-mount the 7841 within 3.5 feet of the 7610R, using the hardware provided.
- b. Connect the 4-foot coax cable from the EXT DATA IN connector on the 7610R rear panel to the FSK OUT connector on the 7841 rear panel (see Figure 2-12) .
- c. The 7841 is now operating and ready to be calibrated.

2.5.7.2 Independent Operation.

- a. Rack-mount the 7841.
- b. Connect the TELCO lines to the TELCO + and - connectors on the 7841 rear panel (see Figure 2-12) .
- c. The 7841 is now operating and ready to be calibrated.

2.5.8 Calibration.

To calibrate the Model 7841, proceed as follows:

- a. Apply power to the 7841.
- b. Place the 7841 CALIBRATE switch in the calibrate position (illuminated). This will stop the scan at the channel to be calibrated (see Figure 2-11) .
- c. With the CHANNEL SELECT switches, select the data channel to be calibrated.

- d. Adjust the calibration potentiometer for the selected channel to display the value of the parameter being sampled on the TELEMETRY DATA display.
For example, if channel 3 is monitoring the final amplifier plate voltage for which the transmitter's analog meter indicates 2650 volts, the channel 3 potentiometer should be adjusted for a digital display of 2650.
- e. After all channels have been calibrated, place the 7841 CALIBRATE switch in the noncalibrate position (nonilluminated).

REVISED		REVISED		REVISED		REVISED	
DATE	BY	DATE	BY	DATE	BY	DATE	BY
7841							
DESCRIPTION		DESCRIPTION		DESCRIPTION		DESCRIPTION	
A		RELEASED FOR PRODUCTION		AC		6267	

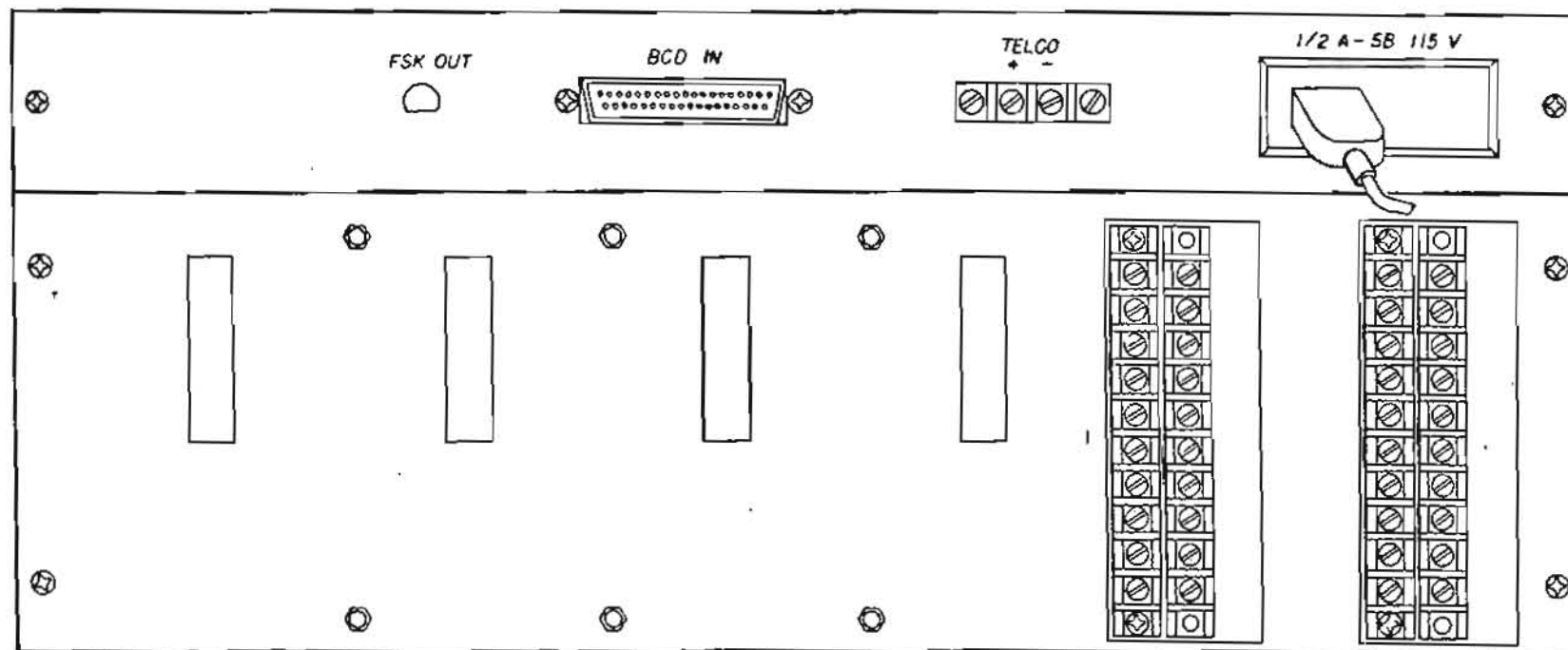


FIGURE 2.12

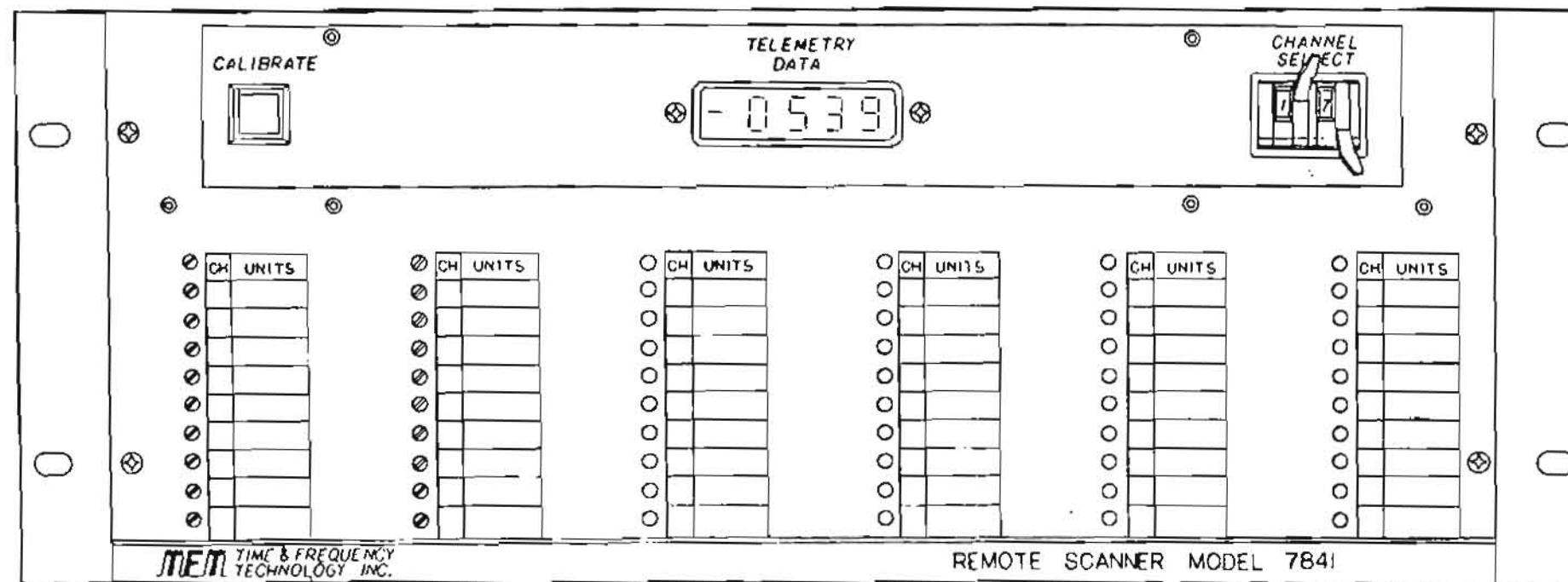


FIGURE 2.11

ITEM NO.		REV. NO.	PART NO.	DESCRIPTION	DATE
7841					
DRAWN BY		DATE	TET TIME & FREQUENCY TECHNOLOGY, INC.		
CIR. BY		DATE	8000 Ocean Bl. Suite 200, Long Beach, CA 90801		
PROD. ENG.		DATE	1000 1-800-838-8388		
TOLERANCES UNLESS OTHERWISE SPECIFIED		DATE	FRONT & REAR PANEL		
FRA 2 ANGULAR 2		DATE	MODEL 7841		
DO NOT SCALE THIS PRINT		DATE	D 6600-2111		
REV. NO.		DATE	A		

SECTION 3

OPERATION

3.1 7640 System Operation.

3.1.1 General.

The 7640 System is a computer-assisted option for the 7610 Remote Control System. It can also be used to assist the operation of any remote-control equipment or used as an independent system in data acquisition, status monitoring and logging. Both telemetry and status functions for up to 120 channels can be displayed on the 15-inch CRT. Up to 30 telemetry channels may be called up simultaneously via the keyboard on the CRT unit.

Two sets of upper and lower limits for the parameter being monitored can be preprogrammed by means of a built-in microprocessor and a special software package, so that central control can be alerted when these parameter limits are exceeded. A permanent record is provided by automatic or call-up logging.

The 7640 System consists of a Model 7640C CPU, an Ann Arbor Model 400E CRT Data Terminal, and a Teletype Model 43 Printer (TTY) at the control site; and a Model 7841 Remote Scanner at the remote site. This subsection describes the 7640 control site operation only. Operation of the 7841 Remote Scanner is for calibration purposes only, and is covered in Subsection 2.5.8.

3.1.2 Controls, Connectors, and Indicators.

3.1.2.1 Model 7640C Front Panel.

Fig. 3-1
Ref. No.

Name

Function

1	ALARM RESET switch with integral light	When the switch button is depressed, it resets the audible alarm and the alarm light.
---	--	---

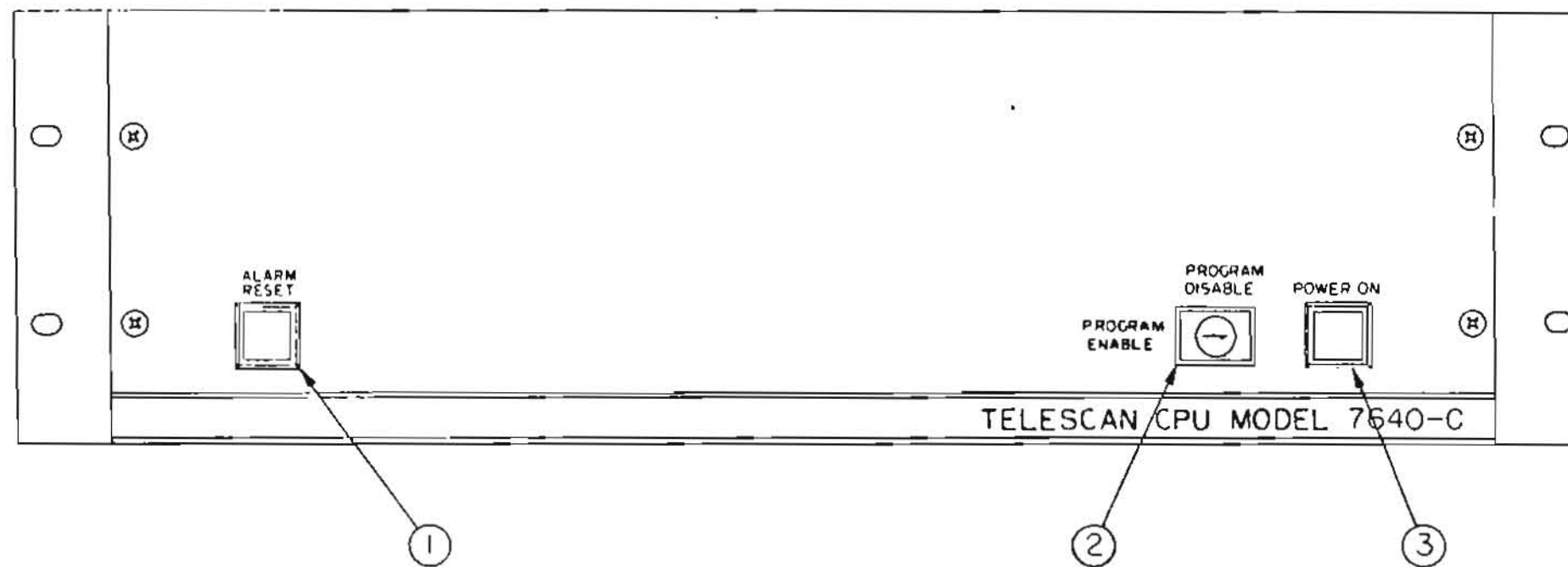


FIG 3-1

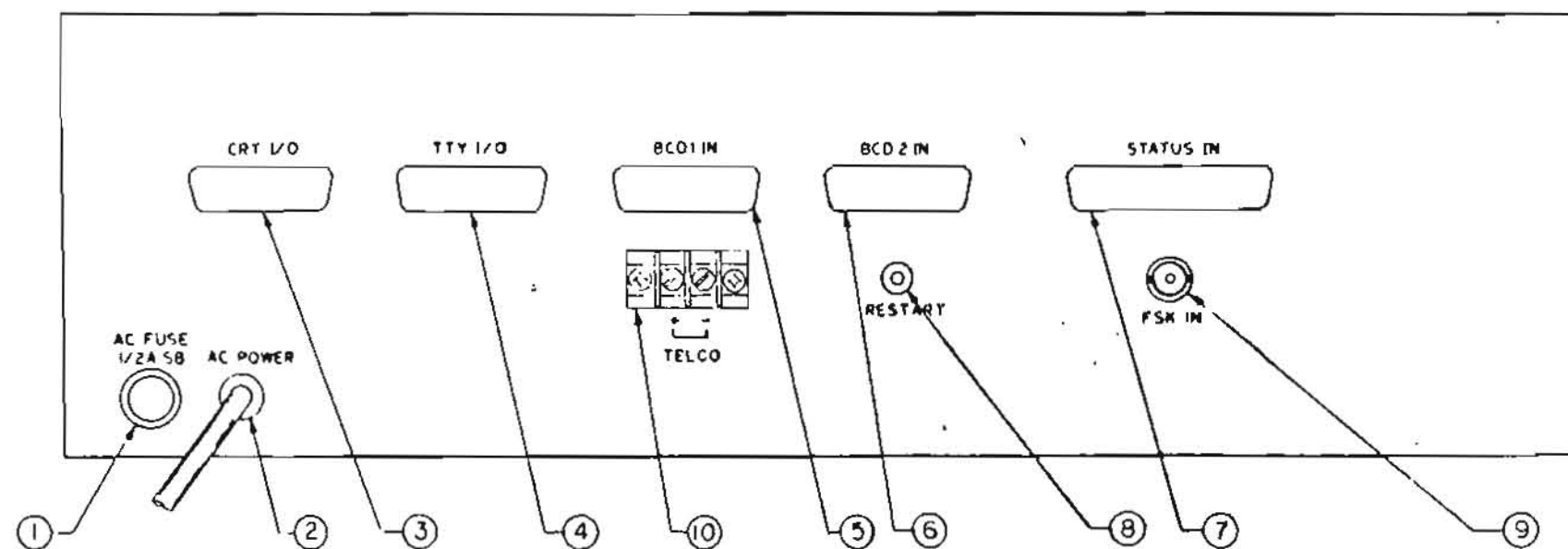


FIG 3-2

ITEM NO	QTY	IN	PART NO	DESCRIPTION	REV
REMOVE ALL BURS AND SHARP EDGES					
TOLERANCES UNLESS OTHERWISE SPECIFIED					
FRACTIONAL ANGULAR					
DO NOT SCALE THIS PRINT					

DATE: 10/1/79
 DRAWN BY: J. J. J.
 CHECKED BY: J. J. J.
 APPROVED BY: J. J. J.
 TIT TIME & FREQUENCY TECHNOLOGY INC.
 1000 Old St. Louis, Mo. 63101
 (314) 425-1100

3.1.2.1 Model 7640C Front Panel (Continued).

Fig. 3-1

<u>Ref. No.</u>	<u>Name</u>	<u>Function</u>
2	PROGRAM ENABLE/PROGRAM DISABLE switch	This is a locking switch and key. In the ENABLE position, it allows the operator to write data into the 7640C's memory. In the DISABLE position, it tells the microprocessor to disregard any memory write signals from the operator. This prevents accidental program changes and unauthorized entry. It may be locked in either position and affects no other operations.
3	POWER ON switch with integral light	When depressed, it turns on the power supply that operates the 7640C. The integral POWER ON light is lit when the power supply produces rated output voltage.

3.1.2.2 Model 7640C Rear Panel.

Fig. 3-2

<u>Ref. No.</u>	<u>Name</u>	<u>Function</u>
1	AC Fuse 1/2 A SB	Provides short-circuit protection to the 7640C from the primary power source.
2	AC POWER	Connects the 7640C to the primary power source (115V AC unless otherwise specified).
3	CRT I/O	This input/output port connects with a 25- conductor cable to the CRT Data Terminal.

3.1.2.2 Model 7640C Rear Panel (Continued)

Fig. 3-2
Ref. No.

	<u>Name</u>	<u>Function</u>
4	TTY I/O	This input/output port connects with a 25-conductor cable to the Printer.
5	BCD 1 IN	This input port accepts 16 lines of external BCD data for display.
6	BCD 2 IN	This input port also accepts 16 lines of external BCD data for display.
7	STATUS IN	This input port provides a means of monitoring up to 30 lines of on/off status.
8	RESTART switch	Enables the operator to restart the microprocessor when interference with the system occurs immediately after power up. Interference will show up as meaningless data or no data being displayed.
9	TELE IN	This input port accepts FSK data, normally through the 7610 system, from the 7841.

3.1.2.3 Ann Arbor Model 400 E CRT Data Terminal Keyboard.

All system inputs and instructions to the computer are handled through this keyboard. It can also be used for inputting headings to the logging system, calling up data from remote terminals, and selecting pages.

The following special keys are used in programming the Model 7640C:

(CTRL) This Control key is used for setting up the program functions. It must be depressed simultaneously with the key identifying the function; for example, (CTRL) P.

3.1.2.3 Model 400E CRT Data Terminal Keyboard (Continued).

- (CR) This Carriage Return key is used to respond to a displayed statement or question. It may be used alone, or after a typed message. When used, it causes the computer to proceed to the next operation.
- (DEL) This Delete key is used to correct a typing error. When depressed before (CR) is depressed, it deletes whatever has been typed since the last (CR) so that the operator can then type a corrected statement. Note that the Delete key is upper case.

The other keys on the keyboard that are used with the 7640C are conventional typewriter keys.

If at power on, or at any time, data on the CRT Display is not being updated, initialize the system by briefly turning the power to the CRT off, turning it back on, then pushing the restart switch on the rear panel of the 7640C. Page 0 will appear on the CRT Display after 4 seconds.

3.1.2.4 TELETYPE MODEL 43 PRINTER.

The Model 43 Printer will function as a standard typewriter when placed in the local mode of operation. The local mode, indicated by the LOCAL light being lit, may be entered by depressing the LOCAL switch or the PRINTER TEST switch. No logging will take place as long as the Printer remains in the local mode. For normal 7640 system operation the Printer should be placed into logging mode, as indicated by the DATA light being lit, by depressing the TERM READY switch.

3.1.3 Turn-On.

After installation is completed (Section 2.4.1), the 7640C is turned on by depressing the front-panel POWER ON switch. The light in the switch should come on, indicating normal power supply operation. If no data or meaningless data is displayed immediately after turn-on, press the rear-panel RESTART switch.

3.1.4 Operating Procedures.

3.1.4.1 General.

The following operating procedures assume that the 7640 System has been installed at both the control site (Section 2.4.1) and the remote site (Section 2.5).

Operating procedures for the 7640 System consist of programming the display numbers, date and time, and alarm lock; specifying the page to be displayed; and setting up the logging operation. These are covered in the subsections that follow.

In the operations that are described, typed programming commands are not entered until the (CR) key is pressed. This allows the operator to correct a typing error by pressing the delete (DEL) key, and typing in the correct command, before pressing (CR).

In the following discussion, only when specified are two keys to be pressed simultaneously.

3.1.4.2 Specifying Page To Be Displayed.

The CRT displays the 120 (maximum) data inputs on four pages, as follows:

<u>Page No.</u>	<u>Data Display Numbers</u>
0	00 through 29
1	30 through 59
2	60 through 89
3	90 through 119

When power is applied to the 7640 System for the first time, page 0 will be displayed. If a different page is to be displayed, either initially or at any later time, simultaneously press the (CTRL) and P keys on the 400E keyboard. This will cause the following statement

3.1.4.2 Specifying Page To Be Displayed (Continued).

to be displayed:

ENTER PAGE # (0-3):

Respond to this by typing the desired page number, followed by CR.

The new page will then be displayed.

In the display number programming of Subsection 3.1.4.3, it is not necessary to display the page containing the display number being set up.

3.1.4.3 Programming a Display Number.

When power is turned on for the first time, page 0 will be displayed on the CRT with display numbers 00 through 29. There will be no data entered for any of these display numbers (or for any of the 90 other display numbers on the other pages); so the operator will have to set up these display numbers to record desired parameters.

A data source may be assigned to a maximum of six display numbers. If the data is assigned to more than six display numbers, only the highest six assigned will be active. Subsections 3.1.4.3.1 through 3.1.4.3.4 give the procedures to be followed for initial assignment and subsequent reassignment. The discussion in Subsections 3.1.4.3.1 through 3.1.4.3.4 is based on the Display Number Programming Flowchart, Figure 3-3.

3.1.4.3.1 Initial Steps.

The first step is to ensure that the key switch on the 7640C CPU front panel is in the PROGRAM ENABLE position. Then simultaneously press the CTRL and C keys on the keyboard. The CRT will display

ENTER DISPLAY # (0-119):

(CTRL) C

ENTER DISPLAY # (0-119): 002 (CTRL)

DISPLAY # = 002
(Questions as follow)

DATA SOURCE REMOTE (R) STATUS (S) BCD (B)=?

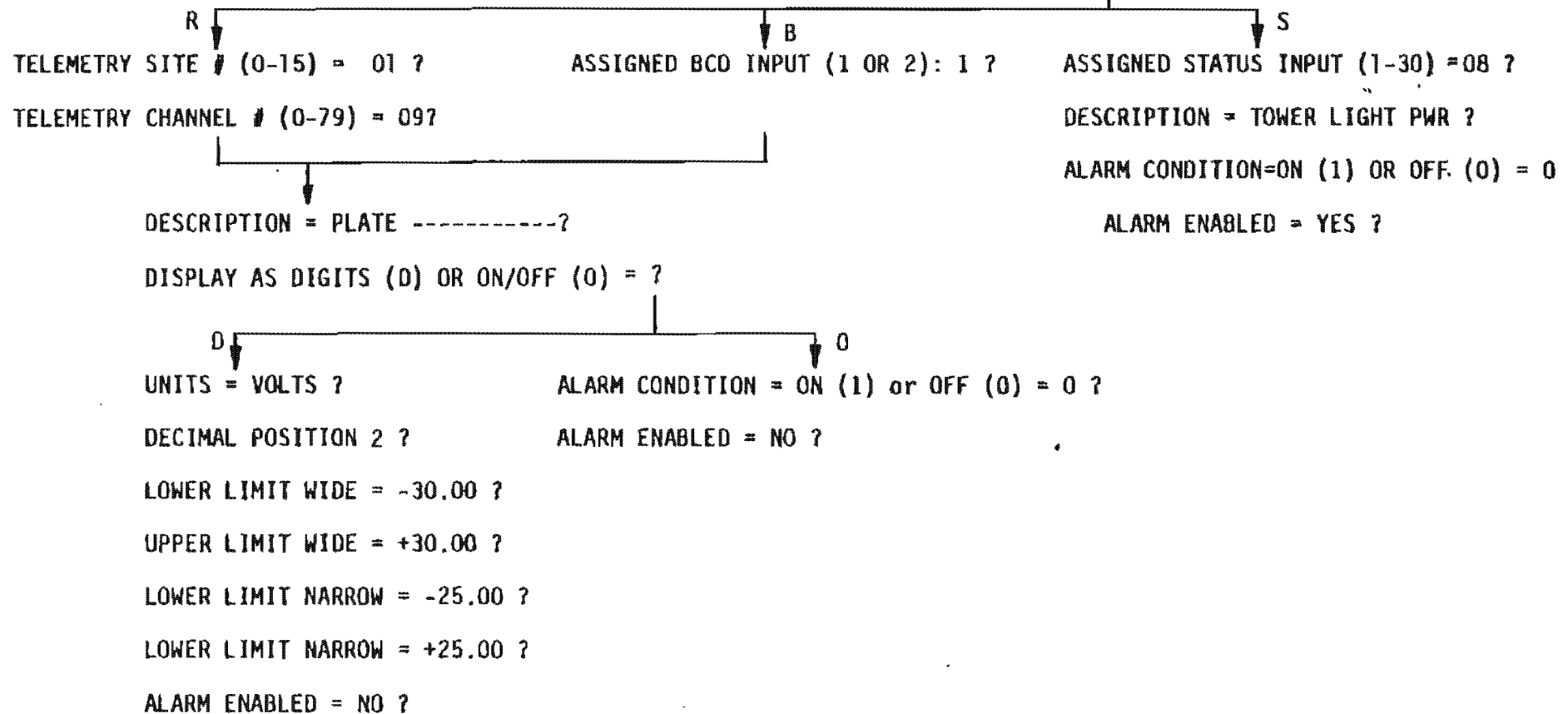


Figure 3-3. 7640 Display Number Programming Flowchart

3.1.4.3.1 Initial Steps (Continued).

Assume that display number 002 is to be set up. Type

2 (CR)

(002, 02, or 2 would be accepted). The computer now begins the questioning for display number, 002 by displaying

DISPLAY # = 002

This line remains at the top of the display until the setup of display number 002 is completed. Immediately following the display number, the CRT displays

DATA SOURCE REMOTE (R) STATUS (S) BCD (B) = ____?

The blank following the colon would actually be R, S, or B to indicate the current data source. At initial turn-on it is R.

3.1.4.3.2 Remote Data Source.

Assume that the current data source is R; that is, one of up to 16 remote sites, each of which can furnish 80 telemetry channels. Assume also in this example that the assignment of display number 002 to a remote site is not to be changed. For this situation, simply press the (CR) key. If S or B follows the colon, and the display number data source is to be changed to a remote site, type

R (CR)

as a response.

Since R has been designated the data source in this example, the next question will be

TELEMETRY SITE # (0-15) = ____?

At initial power turn-on, or before any site has been assigned to display number 002, the blank would actually read NONE. Thereafter it will be the number that has been assigned (00 to 15). Assume the desired site number is 01. Enter

01 (CR) or 1 (CR)

If the current telemetry site number is correct, simply press the (CR) KEY.

3.1.4.3.2 Remote Data Source (Continued).

After (CR) is pressed, the TELEMETRY SITE # question will disappear, and

TELEMETRY CHANNEL # (0-79) = ____?

will appear. Initially the blank will read NONE. Subsequently it will be the telemetry channel number assigned to display number 002. The telemetry channel number can be any from 00 to 79. Assume the desired telemetry channel number is 09. Enter

09 (CR) or 9 (CR)

If the current telemetry channel number is correct, simply press the (CR) key.

The next question will be

DESCRIPTION = _____?

Initially, only blanks will appear following the =. Subsequently, it will be a description of the parameter currently assigned to display number 002. The description can be up to 15 characters in length. To enter an initial description or change an existing one, enter, for example,

XMTR PLATE CUR (CR)

Note that each space counts as one character. If the current description is correct, simply press the (CR) key.

The next question will be

DISPLAY AS DIGITS (D) OR ON/OFF (O) = ____?

Initially the blank will be D, indicating that the parameter value is to be displayed as four digits plus a sign and decimal point. Subsequently it will be either D or O, depending on the latest entry for display number 002. If a digital display is desired initially, simply type (CR).

Assume in this example that the DIGITS display is selected. The computer will then follow with

UNITS = ____?

Initially blanks will follow the =. Subsequently, the blanks will be replaced with the current word, abbreviation, or symbol for the units in which the parameter is displayed. To enter a new unit initially or change an existing one, type up to five characters to describe the desired unit; for example

MA (CR)

3.1.4.3.2 Remote Data Source (Continued).

The next question is

DECIMAL POSITION = ____?

Initially blanks will follow the *. The decimal position is defined as follows:

<u>Decimal Position</u>	<u>Example</u>
0	+.3432
1	+3.432
2	+34.32
3	+343.2
4	+3432.
5 or greater	+3432

Enter the desired decimal position; for example

3 (CR)

After programming is completed for display number 002, and data is received from the remote site, the 002 line might typically read

02 XMTR PLATE CUR +232.5 MA

After the response to the DECIMAL POSITION question has been made, the computer will ask about alarm limits. Limits are set up for each display number which, if exceeded, will cause the display for that display number to start flashing. The values for the limits are entered in the same way as other parameters. The computer enters the decimal position automatically.

If the narrow limits are exceeded, the audible alarm will sound and the data for that display number will start flashing. This is true only if the alarm is enabled. If not, only the digital data will be displayed.

If the wide limits are exceeded, the audible alarm will sound and the display line will flash. To update alarm limits, a four-digit number must be entered. In addition, if the display number is one that is designated for logging, it will be logged by itself along with the time it went out of limits. After that channel is logged by itself, all other channels will be logged.

While a display number is being set up, that display number is automatically disabled to prevent false alarms. After the last interrogation and response are completed, the display number is automatically enabled.

3.1.4.3.2 Remote Data Source (Continued).

After all the wide and narrow limits have been set, the next question appearing on the CRT is

ALARM ENABLED = ____?

Initially the blank will read NO. If this is correct, press the (CR) key. If the alarm is to be enabled, enter

Y (CR)

The response can also be

N (CR)

to disable the alarm when that is appropriate. Since ALARM ENABLED is the last question in the series, the display number being set up will return to active status as soon as (CR) is pressed.

If, as a response to the computers question of

DISPLAY AS DIGITS (D) OR ON/OFF (O) = ____?

a 0 had been selected instead of the D, the computer will then display ON for display number 002 if the analog voltage received from the remote site is greater than 1.5 volts, and OFF if it is less than 1.5 volts.

The next question will be

ALARM CONDITION = ON (1) or OFF (0) = ____?

Initially the blank will be 0, indicating that a voltage less than 1.5 volts constitutes an alarm. If this is correct, press the (CR) key. If a voltage greater than 1.5 volts constitutes an alarm, enter

1 (CR)

Assume in this example that only (CR) is entered, so that an off condition constitutes an alarm.

The next question is

ALARM ENABLED = ____?

Initially the blank will read NO. If this is correct, press the (CR) key. If the alarm is to be enabled, enter

Y (CR)

Assume in this example that Y (CR) was entered. The CRT would display YES in the blank space, and an alarm would be set off whenever (in this example) the transmitter plate current went off.

3.1.4.3.2 Remote Data Source (Continued).

After Y (CR) is entered, both of the lines at the top of the CRT go blank since the interrogation is finished. These two lines are always blank except in the interrogation or programming mode. At this point, programming the display numbers can be continued, if desired, by pressing (CTRL) and C simultaneously, thus initiating another sequence of questions.

3.1.4.3.3 Status Data Source.

If the data source for the display number being set up is one of the 30 status inputs coming into the 7640C through the rear-panel connector, the response to the

DATA SOURCE REMOTE (R) STATUS (S) BCD (B) = ____?

question of Subsection 3.1.4.3.1 would be

S (CR)

(or would be simply (CR) if S was indicated as the current data source in the question). The computer would then ask

ASSIGNED STATUS INPUT (1-30) = ____?

Initially the blank would read NONE. Thereafter it will be the number of the status input to be monitored (1 to 30).

Assume the desired status input is number 8. If the current number is 08, simply press the (CR) key. Otherwise, enter

08 (CR) or 8 (CR)

The next question is

DESCRIPTION = _____?

Initially the space after the = will be blank. Type in any description of up to 15 characters (including spaces) followed by (CR) such as

TOWER LIGHT PWR (CR)

If an existing description is correct, simply press the (CR) key.

The next question is

ALARM CONDITION = ON (1) OR OFF (0) = ____?

Initially the blank will be 0, indicating that a TTL High (off) constitutes an alarm. If this is correct, press the (CR) key. If a voltage greater than 1.5 volts constitutes an alarm, enter

1 (CR)

3.1.4.3.3 Status Data Source (Continued).

Assume in this example that only is entered, so that an off condition constitutes an alarm.

The next question is

ALARM ENABLED = ____?

Initially the blank will read NO. If this is correct, press the key. If the alarm is to be enabled, enter

Y

Assume in this example that Y was entered. The CRT would display YES in the blank space, and an alarm would be set off whenever (in this example) the tower light power is off.

Since this is the end of the interrogation sequence, the top of the CRT will go blank and display number 002 will become active.

3.1.4.3.4 BCD Data Source.

If the data source for the display number being set up is one of the two BCD inputs, the response to the

DATA SOURCE REMOTE (R) STATUS (S) BCD (B) = ____?

question of Subsection 3.1.4.3.1 would be

B

(or would be simply if B was indicated as the current data source in the question). The computer would then ask

ASSIGNED BCD INPUT (1 OR 2) = ____?

Initially the blank would read NONE. Thereafter it will be the number of the BCD input to be monitored (1 or 2).

Assume the desired BCD input for display number 002 is 1. If the current number is 1, simply press the key. Otherwise enter

1

The computer now follows the same loop that is used for a remote data source (see Figure 3-3), because the data input is the same kind as that from a remote site. After the ALARM ENABLED question is answered, the top of the CRT screen will go blank and display number 002 will become active.

3.1.4.4 Programming Date and Time.

Date and time are displayed continuously at the bottom of the CRT screen. Normally the date and time need be set only when the 7640 System is first put into service, and at 0000 on 29 February of each leap year. Even if power fails, a battery keeps an internal clock running for at least 8 hours.

To set the date and time, first make sure that the key switch on the 7640C CPU front panel is in the PROGRAM ENABLE position. Then simultaneously press

(CTRL) T

The CRT will display

DATE = ____?

The space following the = will contain what should be the current month (two digits) and day (two digits), separated by a slash. If the date is correct, press the (CR) key. If the time is to be changed, enter the correct current time followed by (CR); exactly 1 minute later the CRT will display, after the =, a time that is 1 minute later than the time that was entered. Assume, for example, that the following entry was typed:

0915 (CR)

One minute later the CRT would display 09:16 as the time. The computer inserts the colon automatically.

If an invalid date or time is typed in, the computer will not accept it, and the DATE and/or TIME question will remain on the CRT screen.

3.1.4.5 Logging (Figure 3-4).

To set up a log, first make sure that the key switch on the 7640C CPU front panel is in the PROGRAM ENABLE position. Then simultaneously press

(CTRL) L

The CRT will display

OF CHANNELS TO BE LOGGED = ____?

FUNCTION: SET UP LOG ASSIGNMENTS, FORMAT, HEADINGS, AND TIMING

(CTRL) L

OF CHANNELS TO BE LOGGED = 20 ?

The following Log Column # is output at line zero of the CRT and questioning begins on line one of the CRT.

LOG COLUMN = 20

ENTER DISPLAY # (000-119): _____?

LOG COLUMN = 20

COLUMN HEADING = _____?

LOG COLUMN = 19

ENTER DISPLAY # (000-119): _____?

LOG COLUMN = 19

COLUMN HEADING = _____?

LOG COLUMN = 01

ENTER DISPLAY # (000-119): _____?

LOG COLUMN = 01

COLUMN HEADING = _____?

Above questioning repeats until display # and column heading have been specified for column 01.

LOG START TIME = 07:00 ?

LOG STOP TIME = 19:35 ?

LOG INTERVAL = 00:30?

Figure 3-4. 7640 Log Programming Flowchart

3.1.4.5 Logging (Continued).

Initially, the blank will read 00. To reply, enter the number of channels to be logged within the limits of 01 through 20. For example, enter

20 (CR)

The CRT will then display

LOG COLUMN = 20

The computer would then start asking questions about log column 20, which is the farthest column to the right. The first question would be

ENTER DISPLAY # (0-119): ____?

This is the display number from which the data is to be logged in (for this example) column 20. Initially, the blank will read NONE. Subsequently, it will be the latest display number entered for column 20. If the displayed display number is correct, simply press (CR). If a new display number, e.g., number 105, is to be entered, press

105 (CR)

The next question will be

COLUMN HEADING = ____?

Initially, blanks will follow the =. Subsequently, it will be the column heading that has been entered for column 20. If an existing heading is displayed, it will be a maximum of 15 characters, with each 5 characters separated by a slash to indicate the characters that go into each of the three rows. If the displayed heading is correct, enter (CR). If a new heading is to be entered, type the new heading, and follow it with (CR). For example

/FIL./VOLTS/ (CR)

Next, the computer will ask the same set of questions for column 19, then for column 18, and so through column 1. As each column is being set up, the CRT will display, at the top of the screen, the number of the column being set up. For example

LOG COLUMN = 19

After column 1 is set up, the computer will ask

LOG START TIME = ____?

Initially, the blank will read 0000. Subsequently, it will be the latest start time entered. Type a new start time, if desired. For example

0700 (CR)

3.1.4.5 Logging (Continued).

The computer will enter a colon between 07 and 00. The next question will be

LOG STOP TIME = ____?

It is handled in the same way as LOG START TIME. The next question is

LOG INTERVAL = ____?

This refers to the number of hours and minutes between rows on the log. If it is to be 30 minutes, for example, type

0030 (CR)

Logging will begin at the log start time and continue at the log interval until the log stop time. However, if the log interval is set after the log start time, logging will restart immediately and continue at the new log interval until the log stop time.

Entering a log start time of 0000 and a log stop time of 2400 will provide continuous 24 hour logging at the log interval.

If 15 or fewer columns (not including the time column) are to be logged, the + and - signs preceding the numerical values will be included (see Figure 3-5). For more than 15 columns, the signs are omitted (Figure 3-6).

To cause the headings to be printed on the log, press (CTRL) and H simultaneously. This is the only way in which headings can be printed except at the log start time. At the log start time, the log sign on/off message, date, and headings will automatically be printed as shown in Figure 3-5.

To cause a line of the log to be printed, regardless of the automatically timed interval, press (CTRL) and O simultaneously. This will not affect the automatic interval. If the incoming data for a display number parameter designated for logging exceeds the wide limits which have been set up for that parameter, that parameter's value will be printed out on a line by itself with the time at which it exceeded the limits. Just below that line, an entire line will be logged.

DATE = 06/20
 LOG SIGN ON
 LOG SIGN OFF

TIME	AUR. PLATE KV	AUR. PLATE AMPS	CANEN A B I	AURAL POWER I	VIS. PLATE V	VIS. PLATE AMPS	VIS. POWER X	STBY. INIT.	VSQR- STAT.	LINE PHASE	LINE PHASE	AUX. GEN.	AUX. GEN.	BREAK ER 1	BREAK ER 2
06:13	+06.03	+0.532	OFF	+096.4	+06.34	+02.94	+104.0	OFF	+01.12	+228.4	+231.0	ON	OFF	OFF	OFF
06:14	+06.03	+0.532	OFF	+096.4	+06.34	+03.99	+104.0	OFF	+01.12	+228.4	+231.0	ON	OFF	OFF	OFF
06:17	+06.03	+0.532	OFF	+096.4	+06.34	+03.93	+104.0	OFF	+01.12	+228.4	+231.0	ON	OFF	OFF	OFF
06:17						+00.97									
06:17	+06.03	+0.532	OFF	+096.4	+06.34	+03.88	+104.0	OFF	+01.12	+228.4	+231.0	ON	OFF	OFF	OFF
06:18	+06.03	+0.532	OFF	+096.4	+06.34	+03.83	+104.0	OFF	+01.12	+228.4	+231.0	ON	OFF	OFF	OFF
06:19	+06.03	+0.532	OFF	+096.4	+06.34	+03.90	+104.0	OFF	+01.12	+228.4	+231.0	ON	OFF	OFF	OFF

Figure 3-5. Typical 7640 Log With Signs

DATE = 06/20
 LOG SIGN ON
 LOG SIGN OFF

TIME	AUR. PLATE KV	AUR. PLATE AMPS	CANEN A B I	AURAL POWER I	VIS. PLATE V	VIS. PLATE AMPS	VIS. POWER X	STBY. INIT.	VSQR- STAT.	LINE PHASE	LINE PHASE	AUX. GEN.	AUX. GEN.	BREAK ER 1	BREAK ER 2	INTRA SIDM	AIR TEMP.	AIR TEMP.	POWER AMP.	FIL. VOLTS
07:10	06.02	0.532	OFF	096.4	06.34	03.85	104.0	OFF	01.12	228.4	231.0	ON	OFF	OFF	OFF	OFF	18.00	03.00	01.06	100.0
07:22	06.02	0.532	OFF	096.4	06.34	03.89	104.0	OFF	01.12	228.4	231.0	ON	OFF	OFF	OFF	OFF	18.00	03.00	01.06	100.0
07:30	06.02	0.532	OFF	096.4	06.34	03.89	104.0	OFF	01.12	228.4	231.0	ON	OFF	OFF	OFF	OFF	18.00	03.00	01.06	100.0
07:33						00.93														
07:35	06.02	0.532	OFF	096.4	06.34	00.83	104.0	OFF	01.12	228.4	231.0	ON	OFF	OFF	OFF	OFF	18.00	03.00	01.06	100.0
07:36	06.02	0.532	OFF	096.4	06.34	00.83	104.0	OFF	01.12	228.4	231.0	ON	OFF	OFF	OFF	OFF	18.00	03.00	01.06	100.0

Figure 3-6. Typical 7640 Log Without Signs

3.1.4.5 Logging (Continued).

All parameters in an alarm state will be underlined in the log.

3.1.4.6 Programming an Alarm Lock (Figure 3-7).

Normally, a display number that is flashing in an alarmed state will stop flashing when the data for that display number goes to a non-alarm value. It may be desirable to have the display continue to flash after the data for that display number has gone to a non-alarm value. For example, if a locked door is forced open, causing an intrusion alarm to be set off on a status display, the alarm would normally turn off after the door is closed, and the operator may not be aware that there was an intrusion alarm. To make sure such alarms are noted, the alarm can be locked by pressing

CTRL) R

simultaneously. The computer will then ask

LOCK ALARM = ____?

If the blank reads NO and the operator presses CR), all display numbers will be taken out of the alarm lock status, and those having values within limits will cease flashing. If the blank reads YES and the operator presses CR), or if the blank reads NO and the operator types YES, all display numbers will be in an alarm lock status. The CRT will then display

RESET DISPLAY # (0-119): ____

If the statement is ignored, all display numbers will remain in an alarm lock status. If the operator types in a display number followed by CR), that display number will be unlocked from the alarm status, and will stop flashing when its value is within limits.

3.1.4.7 Display of Instructions (Figure 3-8).

If the operator wishes to see the complete set of instructions for setting up the various programs, he can press CTRL) and I simultaneously, and the instruction set will be displayed on the CRT.

FUNCTION: Lock Alarm Condition on CRT. If locked, the data for a display # will continue to flash even after data has gone from an alarm to non-alarm value. The alarm state is reset by specifying the display #. If not locked, flashing for a display # will stop whenever data for that display # goes to a non-alarm value

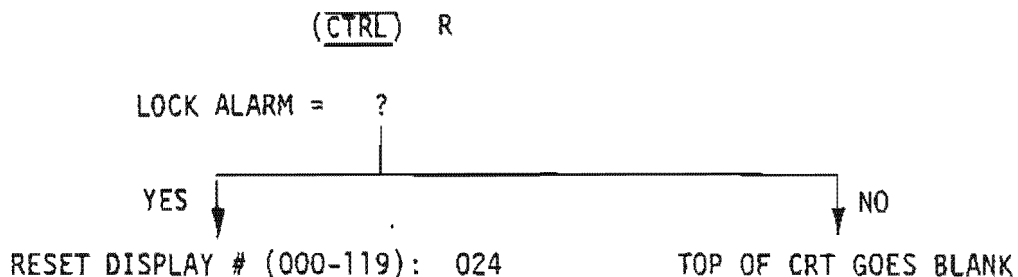


Figure 3-7. 7640 Alarm Lock Programming Flowchart

FUNCTION: DISPLAY INSTRUCTION SET

(CTRL) I

The CTRL I function causes the instruction set of the 7640 to be displayed on the CRT as follows:

CTRL & P:	TO SPECIFY ONE OF FOUR PAGES FOR DISPLAY (0-3)
CTRL & C:	TO PROGRAM A DISPLAY NUMBERS PARAMETERS
CTRL & T:	TO PROGRAM DATE AND TIME
CTRL & R:	TO LOCK OR UNLOCK ALARM STATE
CTRL & L:	TO PROGRAM LOG PARAMETERS
CTRL & O:	TO MANUALLY LOG ALL LOG COLUMNS
CTRL & H:	TO MANUALLY LOG ALL COLUMN HEADINGS

Figure 3-8. 7640 Display of Instructions

3.1.4.8 Use of the Program Enable Key Switch.

All of the displayed program notes and interrogations described in Subsections 3.1.4.3 through 3.1.4.6 take place only if the key switch on the Model 7640C CPU front panel is in the PROGRAM ENABLE position. In the PROGRAM DISABLE position of the key switch, it is possible to use the (CTRL) and P keys to change a page, or the (CTRL) and I to call up the instructions; but no changes in the programs can be made.

If the (CTRL) and C keys are pressed while the key switch is in PROGRAM DISABLE, it will be impossible to change parameters; but if (CR) is pressed, the CRT will display

ENTER DISPLAY # (0-119) =

If a display number followed by a (CR) is entered, the computer will display the selected display number at the top of the CRT screen, and then will step through the normal set of questions, as described in Subsection 3.1.4.3. However, the questions will not be followed by a ?; instead, each will be followed by the value or response that was entered earlier.

In the PROGRAM DISABLE mode, (CTRL) 0 can be used to print out a line of log, and (CTRL) H can be used to print out the log headings, and (CTRL) T will have no effect; but if (CTRL) L is used, no changes can be made in the logging parameters. The computer will step through the questions, without the ?, showing the responses previously entered. However, if the number of columns to be logged was specified as 0, (CTRL) L, (CTRL) 0, (CTRL) H will have no effect.

3.1.4.9 Response to Alarms.

In programming each parameter for display, as described in Subsection 3.1.4.3, the operator can specify whether an alarm is to be

3.1.4.9 Response to Alarms (Continued).

turned on when that particular parameter exceeds preset limits. Whenever an alarm-enabled parameter exceeds its limits, the following alarms will be set off:

- a. The ALARM light on the 7640C front panel will light.
- b. An audible alarm will sound.
- c. The number of any page with an alarm condition will be flashed in the lower left hand corner of the CRT.
- d. The CRT display for the alarmed parameter will flash.
- e. If the parameter has been designated for logging (Subsection 3.1.4.5), it will be immediately printed out by itself on the log, together with the time at which it went out of limits. Immediately below it, an entire line of the log will be printed out so that the operator will know what the other parameter values were at the time the one parameter went out of limits. All alarmed parameters on the log will be underlined.

When an alarm is set off, the operator can turn off the ALARM light and the audible alarm by depressing the front-panel ALARM RESET switch. He can then determine which parameter is responsible by examining the pages of the display to see which display number is flashing.

Normally, all alarm flashing will turn off automatically when the out-of-limits parameter goes back within the preset limits. However, it is possible to lock the alarm in the on condition as

described in Subsection 3.1.4.6. The audible alarm must always be reset from the front-panel ALARM RESET switch.

3.1.4.10 Battery Alarm.

The 7640C battery will automatically be tested once every hour. If the battery is low the following alarms will be set off:

3.1.4.10 Battery Alarm (Continued).

- a. The ALARM light on the 7640C front panel will light.
- b. An audible alarm will sound.
- c. BATTERY LOW will be displayed in the lower right-hand corner of the CRT.

When an alarm is set off, the operator can turn off the ALARM light and the audible alarm by depressing the front-panel ALARM RESET switch.

The BATTERY LOW message will remain in the lower right-hand corner of the CRT until the next battery check. The message will remain until the battery test passes.

3.2 7840 System Operation.

3.2.1 General.

The 7840 System is a microcomputer-based data acquisition, limit alarm, and logging system. It can be used to assist the 7610 Remote Control System or any other remote-control equipment or act as an independent system for data acquisition, status monitoring, logging, and alarm. Both telemetry and status functions for up to 60 channels can be selected for monitoring and logging on a Model 43 Printer. A built-in microprocessor and special software package enable the programming of up to two levels of upper and lower limits (one set may be used for control) for each parameter being monitored, so that the operator can be instantly alerted when these parameters are exceeded. The additional feature of automatic or call-up logging provides a permanent record.

3.2.1 General (Continued).

The 7840 System consists of a Model 7840 CPU and a Model 43 Printer (TTY) at the control site; and a Model 7841 Remote Scanner at the remote site. This subsection describes the 7840 control site operation only. Operation of the 7841 Remote Scanner is for calibration purposes only, and is covered in Subsection 2.5.8.

3.2.2 Controls, Connectors, and Indicators.

3.2.2.1 Model 7840 Front Panel.

Fig. 3-9
Ref. No.

	<u>Name</u>	<u>Function</u>
1	ALARM RESET switch with integral light	When the switch button is depressed, it resets the audible alarm and the alarm light.
2	PROGRAM ENABLE/PROGRAM DISABLE switch	This is a locking switch and key. In the ENABLE position, it allows the operator to write data into the 7840's memory. In the DISABLE position, it tells the microprocessor to disregard any memory write signals from the operator. This prevents accidental program changes and unauthorized entry. It may be locked in either position and affects no other operations.
3	POWER ON switch with integral light	When depressed, it turns on the power supply that operates the 7840. The integral POWER ON light is lit when the power supply produces rated output voltage.

NEXT ASSY		VISED ON		REVISIONS			
ITEM NO	EN	NO	DATE	DESCRIPTION	BY	CHK	DATE
7840	A			REL FOR PUBLICATION	TO		6/2/77
7840	B				AC		6/2/77

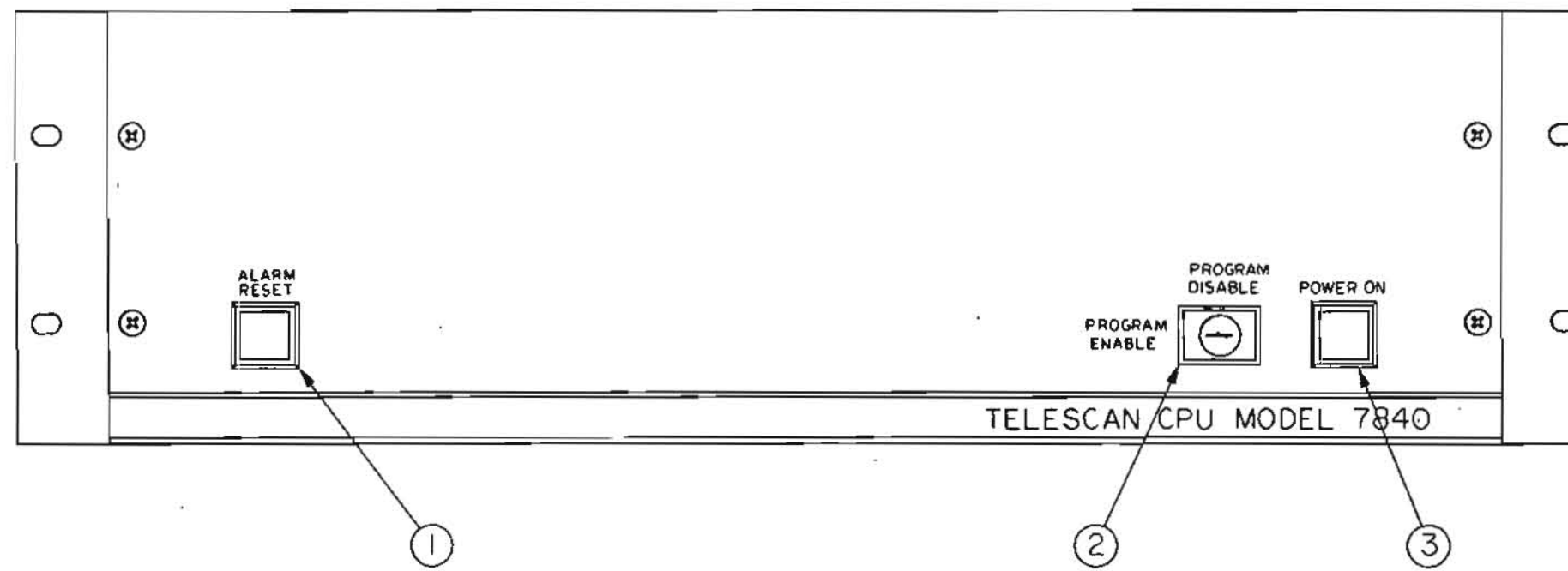


FIG 3-9

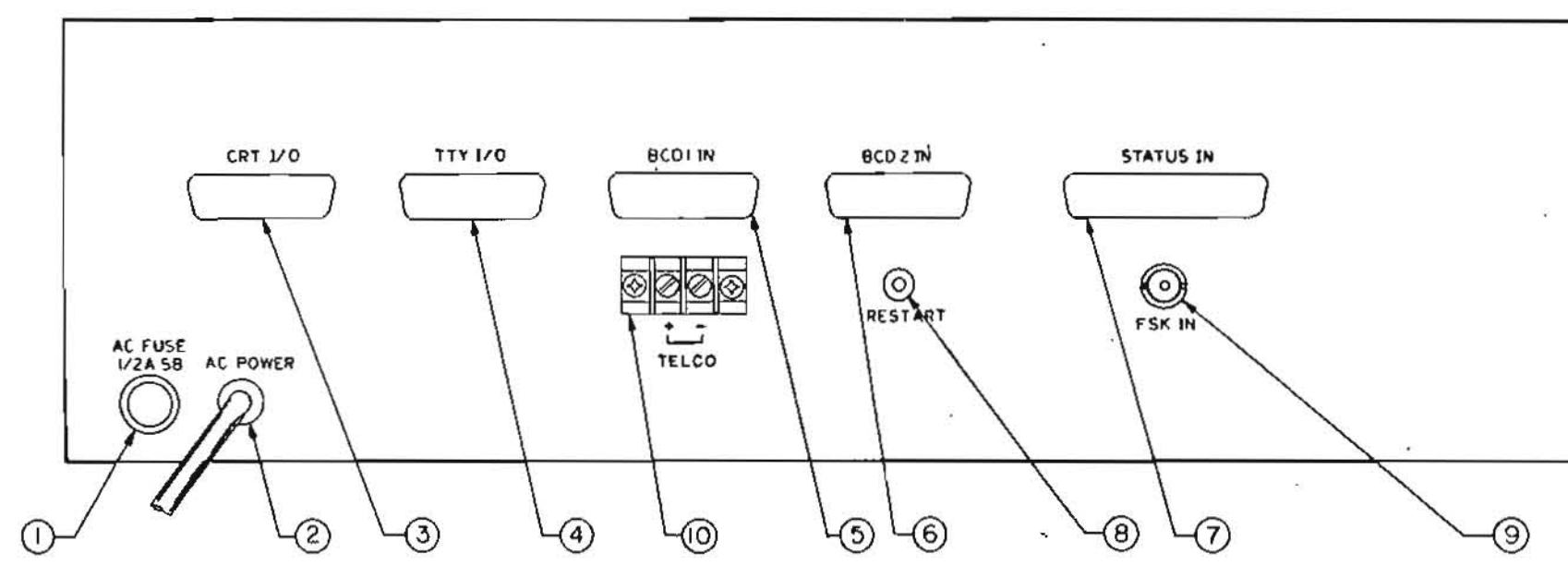


FIG 3-10

ITEM NO	EN	NO	PART NO	DESCRIPTION	REV
7840	A				001
QTY PER ASSY					
LIST OF MATERIALS					
REMOVE ALL BURRS AND SHARP EDGES			DRAWN BY: <i>[Signature]</i> DATE: 6/2/77 CHK BY: <i>[Signature]</i> DATE: 6/2/77 PROJ ENG: <i>[Signature]</i> DATE: 6/2/77 MFG ENG: <i>[Signature]</i> DATE: 6/2/77 APP: <i>[Signature]</i> DATE: 6/2/77 DO NOT SCALE THIS PRINT		
TOLERANCES UNLESS OTHERWISE SPECIFIED			TET TIME & FREQUENCY TECHNOLOGY INC 3000 Ocean St. Santa Clara, California 95050 (408) 298-4298		
FRONT AND REAR PANELS 7840/7840			DRAWING NO: D 6600-1710 SCALE: 1:1		

3.2.2.2 Model 7840 Rear Panel.

Fig. 3-10
Ref. No.

	<u>Name</u>	<u>Function</u>
1	AC FUSE 1/2A SB	Provides short-circuit protection to the 7840 from the primary power source.
2	AC POWER cord	Connects the 7840 to the primary power source (115V AC unless otherwise specified).
3	TTY I/O connector	This input/output port connects with a 25-conductor cable to the Model 43 Printer (TTY).
4	BCD1 IN connector	This input port accepts 16 lines of external BCD data for display.
5	BCD2 IN connector	This input port also accepts 16 lines of external BCD data for display.
6	STATUS IN connector	This input port provides a means of monitoring up to 30 lines of on/off status.
7	RESTART switch	Enables the operator to restart the microprocessor when interference with the system occurs immediately after power up. Interference will show up as meaningless data or no data being displayed.
8	TELE IN connector	This input port accepts FSK data, normally through the 7610 System from the 7841.
9	TELCO connectors	This input port accepts TELCO data from the 7841.

3.2.2.3 Teletype Model 43 Printer

All system inputs and instructions to the computer are handled through the Printer keyboard. It can also be used for inputting headings to the logging system, calling up data from remote terminals, and selecting pages.

3.2.2.3 Model 43 Printer (Continued).

The following special keys are used in programming the Model 7840:

- | | |
|-------------|--|
| <u>CTRL</u> | This Control key is used for setting up the program functions. It must be depressed simultaneously with the key identifying the function; for example, <u>CTRL</u> C. |
| <u>CR</u> | This Carriage Return key is used to respond to a statement or question. It may be used alone, or after a typed message. When used, the <u>CR</u> key causes the computer to proceed to the next operation. |
| <u>DEL</u> | This Delete key is used to correct a typing error. When depressed before <u>CR</u> is depressed, the question is repeated so that the operator can then type a corrected statement. |

The other keys on the keyboard that are used with the 7840 are conventional typewriter keys.

The Model 43 Printer will function as a standard typewriter when placed in the local mode of operation. The local mode, indicated by the LOCAL light being lit, may be entered by depressing the LOCAL switch or the PRINTER TEST switch. No logging will take place as long as the Printer remains in the local mode. For normal system operation the Printer should be placed into the logging mode, as indicated by the DATA light being lit, by depressing the AUTO ANSW switch. The following keys must be set:

1. CAPS LOCK must be in the CAP position.
2. 30 UP CPS 10 DN must be in the 30 UP position.
3. HALF UP DUPLEX FULL DN must be in the FULL DN position.

3.2.3 Turn-On.

After installation is completed (Section 2.4.2), the 7840 CPU is turned on by depressing the front-panel POWER ON switch. The light in the switch should come on, indicating normal power supply operation. If no data or meaningless data is displayed immediately after turn-on, press the rear-panel RESTART switch.

3.2.4 Operating Procedures.

3.2.4.1 General.

Operating procedures for the 7840 System consist of programming the column numbers, date and time, and alarm lock; and setting up the logging operation. These are covered in the subsections that follow.

In the operations that are described, typed programming commands are not entered until the **(CR)** key is pressed. This allows the operator to correct a typing error by pressing the delete **(DEL)** key, and typing in the correct command, before pressing **(CR)**.

In the following discussion, two keys are to be pressed simultaneously only when so specified.

3.2.4.2 Programming a Column Number.

When power is turned on for the first time, there will be no data entered for any of the log columns; so the operator will have to set up these column numbers to record desired parameters. A data source may be assigned to a maximum of six column numbers. If the data is assigned to more than six numbers, only the highest six assigned will be active. Subsections 3.2.4.2.1 through 3.2.4.2.4 give the

3.2.4.2 Programming a Column Number (Continued).

procedures to be followed for initial assignment and subsequent reassignment. The discussion in Subsections 3.2.4.2.1 through 3.2.4.2.4 is based on the Column Number Programming Flowchart, Figure 3-11, and Printout, Figure 3-12.

3.2.4.2.1 Initial Steps.

The first step is to ensure that the key switch on the 7840 CPU front panel is in the PROGRAM ENABLE position. Then simultaneously press the (CTRL) and C keys on the keyboard. The Printer will type

ENTER DISPLAY # (0-60):

Assume that column number 002 is to be set up. Type

2 (CR)

(02 or 2 would also be accepted). The computer now begins the questioning for column number 002 by typing

DISPLAY # = 002

Immediately following the column number, the Printer prints

DATA SOURCE REMOTE (R) STATUS (S) BCD (B) = _____?

The blank following the = would actually be R, S, or B to indicate the current data source. At initial turn-on it is R.

3.2.4.2.2 Remote Data Source.

Assume that the current data source is R; that is, one of up to 16 remote sites, each of which can furnish 80 telemetry channels.

(CTRL) C

ENTER DISPLAY # (0-60): 002 (CTRL)

COLUMN # = 02
(Questions as follow)

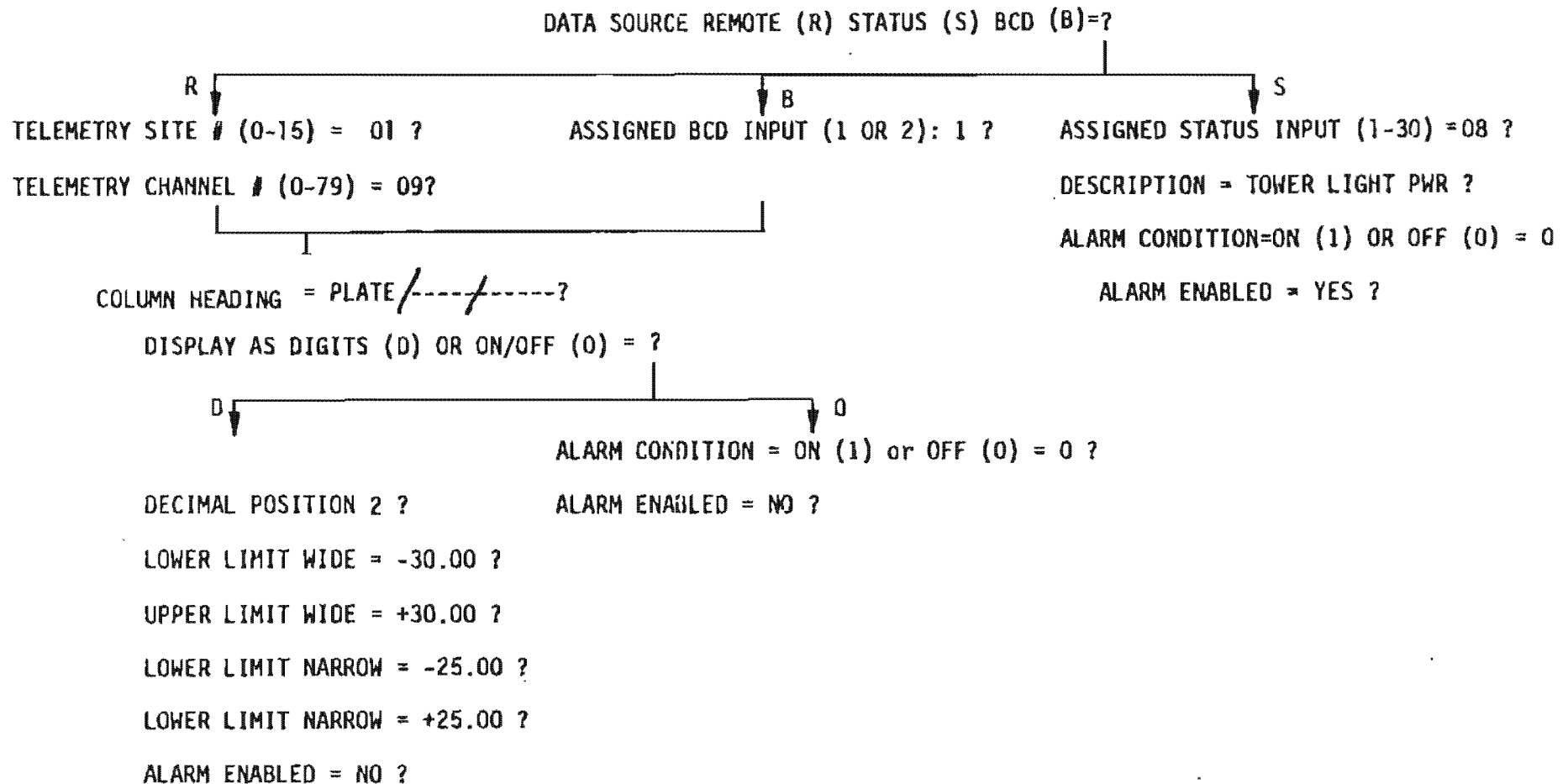


Figure 3-11 7840 Column Number Programming Flowchart

```

*****
CTRL & C: TO PROGRAM A DISPLAY NUMBERS PARAMETERS
CTRL & Y: TO PROGRAM DATE AND TIME
CTRL & R: TO LOCK OR UNLOCK ALARM STATE
CTRL & L: TO PROGRAM LOG PARAMETERS
CTRL & O: TO MANUALLY LOG ALL LOG COLUMNS
CTRL & H: TO MANUALLY LOG ALL COLUMN HEADINGS
CTRL & A: TO SET ALARM LOG FORMAT
CTRL & F: TELEMETRY FAILURE AUDIBLE ALARM DISABLE
CTRL & N: ENABLE OR DISABLE ATS NARROW LIMIT INPUT

```

NOTE: LOG COLUMNS 16 TO 29 ARE PREASSIGNED.

```

*****
DATE = 03/16?
TIME = 16:00?08:05

```

```

*****
ENTER COLUMN # (1-60): 47
COLUMN # = 47
DATA SOURCE REMOTE(R) STATUS(S) BCD(B)= R?
TELEMETRY SITE # (0-15) = NONE ?1
TELEMETRY CHANNEL # (0-79) = NONE ?40
LOG HEADING = / / / ?/PLATE/VOLTS/INPUT
DISPLAY AS DIGITS (D) OR ON/OFF (O) = D?
DECIMAL POSITION = 0?2
LOWER LIMIT WIDE = -40.00 ?+08.00
UPPER LIMIT WIDE = +40.00 ?+09.00
ALARM ENABLED = NO ?YES

```

```

*****
ENTER COLUMN # (1-60): 3
COLUMN # = 03
DATA SOURCE REMOTE(R) STATUS(S) BCD(B)= B?S
ASSIGNED STATUS INPUT (1-30): NONE ?1
LOG HEADING = /CAMER/A # 1/STAT.?/CAMER/A # 2/STAT.
ALARM CONDITION=ON(1) OR OFF(0) = 1?
ALARM ENABLED = YES ?NO

```

Figure 3-12 7840 Column Number Programming Printout

3.2.4.2.2 Remote Data Source (Continued).

Assume also in this example that the assignment of column number 002 to a remote site is not to be changed. For this situation, simply press the key. If S or B follows the colon, and the display number data source is to be changed to a remote site, type

R

as a response.

Since R has been designated the data source in this example, the next question will be

TELEMETRY SITE # (0-15) = ____?

At initial power turn-on, or before any site has been assigned to column number 002, the blank would actually read NONE. Thereafter it will be the number that has been assigned (00 to 15). Assume the desired site number is 01. Enter

01 or .1

If the current telemetry site number is correct, simply press the key.

After is pressed, the TELEMETRY SITE # question will disappear, and

TELEMETRY CHANNEL # (0-79) = ____?

will appear. Initially the blank will read NONE. Subsequently it will be the telemetry channel number assigned to column number 002. The telemetry channel number can be any from 00 to 79. Assume the

3.2.4.2.2 Remote Data Source (Continued).

desired telemetry channel number is 09. Enter

09 or 9

If the current telemetry channel number is correct, simply press the key.

The next question will be

COLUMN HEADING = ____ / ____ / ____ ?

Initially, only blanks will appear following the =. Subsequently, it will be a heading currently assigned to column number 002. The heading can be up to 15 characters in length. To enter an initial heading or change an existing one, enter, for example,

XMTR PLATE CUR

Note that each space counts as one character. If the current heading is correct, simply press the key.

The next question will be

DISPLAY AS DIGITS (D) OR ON/OFF (O) = ____ ?

Initially, the blank will be D, indicating that the parameter value is to be printed as four digits plus a sign and decimal point. Subsequently, it will be either D or O, depending on the latest entry for column number 002. If a digital display is desired initially, simply type .

Assume in this example that the DIGITS display is selected. The computer will then follow with

DECIMAL POSITION = ____ ?

3.2.4.2.2 Remote Data Source (Continued).

Initially blanks will follow the =. The decimal position is defined as follows:

<u>Decimal Position</u>	<u>Example</u>
0	+.3432
1	+3.432
2	+34.32
3	+343.2
4	+3432.
5 or greater	+3432

Enter the desired decimal position; for example

3

After the response to the DECIMAL POSITION question has been made, the computer will ask about alarm limits. The values for the limits are entered in the same way as other parameters. The computer enters the decimal position automatically.

If the wide limits are exceeded, the audible alarm will sound. To update alarm limits, a four-digit number must be entered. In addition, the column will be logged by itself along with the time it went out of limits.

While a column number is being set up, that column number is automatically disabled to prevent false alarms. After the last interrogation and response are completed, the column number is automatically enabled.

After all the limits have been set, the next question will be

ALARM ENABLED = _____?

3.2.4.2.2 Remote Data Source (Continued).

Initially the blank will read NO. If this is correct, press the key. If the alarm is to be enabled, enter

Y

The response can also be

N

to disable the alarm when that is appropriate. Since ALARM ENABLED is the last question in the series, the column number being set up will return to active status as soon as is pressed.

If, as a response to the computer's question of

DISPLAY AS DIGITS (D) OR ON/OFF (O) = _____?

an O had been selected instead of the D, the computer will then log ON for column number 002 if the analog voltage received from the remote site is greater than 1.5 volts, and OFF if it is less than 1.5 volts.

The next question will be

ALARM CONDITION = ON (1) OR OFF (0) = _____?

Initially the blank will be 0 indicating that a voltage less than 1.5 volts constitutes an alarm. If this is correct, press the key. If a voltage greater than 1.5 volts constitutes an alarm, enter

1

Assume in this example that only is entered, so that an off condition constitutes an alarm.

The next question is

ALARM ENABLED = _____?

3.2.4.2.2 Remote Data Source (Continued).

Initially the blank will read NO. If this is correct, press the CR key. If the alarm is to be enabled, enter

Y CR

Assume in this example that Y CR was entered. The Printer would print YES in the blank space, and an alarm would be set off whenever (in this example) the transmitter plate current went off.

After Y CR is entered, the interrogation is finished. At this point, programming the column numbers can be continued, if desired, by pressing CTRL and C simultaneously, thus initiating another sequence of questions.

3.2.4.2.3 Status Data Source.

If the data source for the column number being set up is one of the 30 status inputs coming into the 7840 through the rear-panel connector, the response to the

DATA SOURCE REMOTE (R) STATUS (S) BCD (B) = ____?

question of Subsection 3.2.4.2.1 would be

S CR

(or would be simply CR) if S was indicated as the current data source in the question). The computer would then ask

ASSIGNED STATUS INPUT (1-30) = ____?

Initially the blank would read NONE. Thereafter it will be the number of the status input to be monitored (1 to 30).

Assume the desired status input is number 8. If the current number is 08, simply press the CR key. Otherwise, enter

08 CR or 8 CR

3.2.4.2.3 Status Data Source (Continued).

The next question is

COLUMN HEADING = / / ?

Initially the space after the = will be blank. Type in any heading of up to 15 characters (including spaces) followed by such as

TOWER LIGHT PWR

If an existing heading is correct, simply press the key.

The next question is

ALARM CONDITION = ON (1) OR OFF (0) = ?

Initially the blank will be 0, indicating that a TTL high (off) constitutes an alarm. If this is correct, press the key. If a voltage greater than 1.5 volts constitutes an alarm, enter

1

Assume in this example that only is entered, so that an off condition constitutes an alarm.

The next question is

ALARM ENABLED = ?

Initially the blank will read NO. If this is correct, press the key. If the alarm is to be enabled, enter

Y

Assume in this example that Y was entered. The Printer would print YES in the blank space, and an alarm would be set off whenever (in this example) the tower light power is off.

3.2.4.2.3 Status Data Source (Continued).

This is the end of the interrogation sequence.

3.2.4.2.4 BCD Data Source.

If the data source for the column number being set up is one of the two BCD inputs, the response to the

DATA SOURCE REMOTE (R) STATUS (S) BCD (B) = ____?

question of Subsection 3.2.4.2.1 would be

B

(or would be simply if B was indicated as the current data source in the question). The computer would then ask

ASSIGNED BCD INPUT (1 OR 2) = ____?

Initially the blank would read NONE. Thereafter it will be the number of the BCD input to be monitored (1 or 2).

Assume the desired BCD input for column number 002 is 1. If the current number is 1, simply press the key. Otherwise enter

1

The computer now follows the same loop that is used for a remote data source (see Figure 3-11), because the data input is the same kind as that from a remote site. After the ALARM ENABLED question is answered, display number 002 will become active.

3.2.4.3 Programming Date and Time.

Date and time are continuously updated. Normally

3.2.4.3 Programming Date and Time. (Continued).

the date and time need be set only when the system is first put into service, and at 0000 on 29 February of each leap year. Even if power fails, a battery keeps an internal clock running for at least 8 hours.

To set the date and time, first make sure that the key switch on the 7840 CPU front panel is in the PROGRAM ENABLE position. Then simultaneously press

(CTRL) T

The Printer will ask

DATE = ____?

(see Figure 3-12). The space following the = will contain what should be the current month (two digits) and day (two digits), separated by a slash. If the date is correct, press the **(CR)** key. If the time is to be changed, enter the correct current time followed by **(CR)**; exactly 1 minute later the time printed will be 1 minute later than the time that was entered. Assume, for example, that the following entry was typed:

0915 **(CR)**

One minute later the Printer would print 09:16 as the time. The computer inserts the colon automatically. If an invalid date or time is typed in, the computer will not accept it, and the DATE and/or TIME question will be repeated.

3.2.4.4 Logging (Figure 3-13).

To set up a log, first make sure that the key switch on the 7840 CPU front panel is in the PROGRAM ENABLE position. Then

(CTRL) L

```
*****
# OF CHANNELS TO BE LOGGED (0-60) = 00730
LOG START TIME = 00:00?01:00
LOG STOP TIME = 23:59?22:00
LOG INTERVAL = 01:01?01:00
*****
```

Figure 3-13 7840 Log Programming
Flowchart

3.2.4.4 Logging (Continued).

simultaneously press

(CTRL) L

The Printer will print

OF COLUMNS TO BE LOGGED (0-60) = ____?

Initially, the blank will read 00. To reply, enter the number of columns to be logged within the limits of 01 through 60. For example, enter

20 (CR)

The computer will then ask

LOG START TIME = ____?

Initially, the blank will read 0000. Subsequently, it will be the latest start time entered. Type a new start time, if desired. For example

0700 (CR)

The computer will enter a colon between 07 and 00. The next question will be

LOG STOP TIME = ____?

It is handled in the same way as LOG START TIME. The next question is

LOG INTERVAL = ____?

This refers to the number of hours and minutes between rows on the log. If it is to be 30 minutes, for example, type

0030 (CR)

Logging will begin at the log start time and continue at the log interval until the log stop time. However, if the log interval is set after the log start time, logging will start immediately and continue at the new log interval until the log stop time.

Entering a log start time of 0000 and a log stop time of 2400 will provide continuous 24 hour logging at the log interval.

3.2.4.4 Logging (Continued).

To cause the headings to be printed on the log, press CTRL and H simultaneously. This is the only way in which headings can be printed except at the log start time. At the log start time, the sign on/off message, date, and headings will automatically be printed as shown in Figure 3-14.

To cause a line of the log to be printed, regardless of the automatically timed interval, press CTRL and O simultaneously. This will not affect the automatic interval. If the incoming data for a column number parameter designated for logging exceeds the wide limits which have been set up for that parameter, that parameter's value will be printed out on a line by itself with the time at which it exceeded the limits, or an entire line will be logged. Refer to CTRL A, alarm log format description. All parameters in an alarm state will be underlined in the log.

3.2.4.5 Programming an Alarm Lock (Figure 3-15).

Normally, a column number that is underlined in an alarmed state will stop being underlined when the data for that column number goes to a non-alarm value. It may be desirable to continue to underline after the data for that column number has gone to a non-alarm value. This will prevent alarm toggling for unstable data. The alarm can be locked by pressing

CTRL R

simultaneously. The computer will then ask

LOCK ALARM = _____?

TIME:	AUR.	AUR.	CAMER	AURAL	VIS.	VIS.	VIS.	STBY.	LINE	LINE	AUX.	TEMP.	TEMP.	BREAK	POWER
-----	PLATE	PLATE	A # 1	POWER	PLATE	PLATE	POWER	XMIT.	PHASE	PHASE	GEN.	ROOM1	OUT	ER #	AMP.
-----	KV	AMPS	STAT.	Z	V	AMPS	X	STAT.	ONE	TWO	STAT.	DEG.C	DEG.C	ONE	GRID.
	PLATE	PLATE	FORWA	REVER	A. C.	PROGR	PROGR	POWER	POWER	EFFIC	V.S.W	FORWA	REVER	EFFIC	FIL.
	VOLT	CURR	RD VO	SE VO	CURR	AM R	AM N	(IND	(DIR	IENCY	.R.	RD PO	SE PO	IENCY	VOLTS
	AGE	ENT	LTAGE	LTAGE	ENT			IR.)	ECT)	I		WER	WER	II	XMIT2
15:52	+0.984	+0.2956	OFF	+18.60	+3.676	+37.89	+098.4	OFF	-369.6	+186.0	ON	+29.56	+186.0	ON	+29.56
	+0.984	+0.3790	+29.56	+3.676	+1.860	+2.487	+4.4876	+0.182	+008.6	+023.1	+01.28	+0353.	+005.4	+0933.	+186.0
15:52	+0.984	+0.2956	OFF	+18.60	+3.676	+37.90	+098.4	OFF	-369.6	+186.0	ON	+29.58	+186.0	ON	+29.58
	+0.984	+0.3790	+29.58	+3.676	+1.860	+2.487	+4.4876	+0.182	+008.6	+023.1	+01.28	+0353.	+005.4	+0933.	+186.0
15:52	COLUMN # IN ALARM = 02 /AUR. /PLATE/AMPS +.3010														
15:53	+0.983	+0.3010	OFF	+18.60	+3.676	+37.88	+098.3	OFF	-369.8	+186.0	ON	+30.10	+186.0	ON	+30.10
	+0.983	+0.3788	+30.10	+3.676	+1.860	+2.487	+4.4876	+0.182	+008.6	+023.1	+01.28	+0364.	+005.4	+0962.	+186.0
15:55	+0.983	+0.2985	OFF	+18.61	+3.677	+37.88	+098.3	OFF	-369.8	+186.1	ON	+29.85	+186.1	ON	+29.85
	+0.983	+0.3788	+29.85	+3.677	+1.861	+2.487	+4.4876	+0.182	+008.6	+023.1	+01.28	+0358.	+005.4	+0947.	+186.1
TIME:	AUR.	AUR.	CAMER	AURAL	VIS.	VIS.	VIS.	STBY.	LINE	LINE	AUX.	TEMP.	TEMP.	BREAK	POWER
-----	PLATE	PLATE	A # 1	POWER	PLATE	PLATE	POWER	XMIT.	PHASE	PHASE	GEN.	ROOM1	OUT	ER #	AMP.
-----	KV	AMPS	STAT.	Z	V	AMPS	X	STAT.	ONE	TWO	STAT.	DEG.C	DEG.C	ONE	GRID.
	PLATE	PLATE	FORWA	REVER	A. C.	PROGR	PROGR	POWER	POWER	EFFIC	V.S.W	FORWA	REVER	EFFIC	FIL.
	VOLT	CURR	RD VO	SE VO	CURR	AM R	AM N	(IND	(DIR	IENCY	.R.	RD PO	SE PO	IENCY	VOLTS
	AGE	ENT	LTAGE	LTAGE	ENT			IR.)	ECT)	I		WER	WER	II	XMIT2
15:55	+0.983	+0.2987	OFF	+18.62	+3.677	+37.89	+098.3	OFF	-369.8	+186.2	ON	+29.87	+186.2	ON	+29.87
	+0.983	+0.3789	+29.87	+3.677	+1.862	+2.487	+4.4876	+0.182	+008.6	+023.1	+01.28	+0358.	+005.4	+0947.	+186.2
15:56	+0.983	+0.2986	OFF	+18.61	+3.676	+37.89	+098.3	OFF	-369.7	+186.1	ON	+29.86	+186.1	ON	+29.86
	+0.983	+0.3789	+29.86	+3.676	+1.861	+2.487	+4.4876	+0.182	+008.6	+023.1	+01.28	+0358.	+005.4	+0947.	+186.1

Figure 3.14 Typical 7840 Log

FUNCTION: Lock Alarm Condition on TTY. If locked, the data for a column # will continue to underline even after data has gone from an alarm to non-alarm value. The alarm state is reset by specifying the column #. If not locked, underlining for a column # will stop whenever data for that column # goes to a non-alarm value

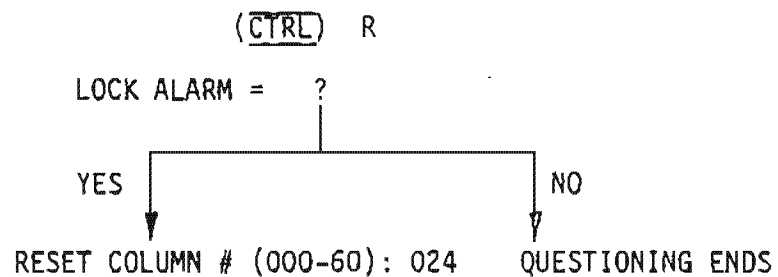


Figure 3-15. 7840 Alarm Lock Programming Flowchart

3.2.4.5 Programming an Alarm Lock (Continued).

If the blank reads NO and the operator presses CR, all column numbers will be taken out of the alarm lock status, and those having values within limits will underlining. If the blank reads YES and the operator presses CR, or if the blank reads NO and the operator types YES, all column numbers will be in an alarm lock status. The Printer will then print

RESET COLUMN # (0-60): _____

If the statement is ignored, all column numbers will remain in an alarm lock status. If the operator types in a column number followed by CR, that column number will be unlocked from the alarm status, and will stop being underlined when its value is within limits.

3.2.4.6 Display of Instructions (Figure 3-16).

If the operator wishes to see the complete set of instructions for setting up the various programs, he can press CTRL and I simultaneously, and the instruction set will be printed on the Printer.

3.2.4.7 Use of the Program Enable Key Switch.

All of the program notes and interrogations described in Subsections 3.2.4.2 through 3.2.4.5 take place only if the key switch on the Model 7840 CPU front panel is in the PROGRAM ENABLE position. In the PROGRAM DISABLE position of the key switch, it is possible to use the CTRL and I to call up the instructions; but no changes in the programs can be made.

FUNCTION: DISPLAY INSTRUCTION SET

(CTRL) I

The CTRL I function causes the instruction set of the 7840 to be printed on the TTY as follows:

```
*****
CTRL & C: TO PROGRAM A DISPLAY NUMBERS PARAMETERS
CTRL & T: TO PROGRAM DATE AND TIME
CTRL & R: TO LOCK OR UNLOCK ALARM STATE
CTRL & L: TO PROGRAM LOG PARAMETERS
CTRL & O: TO MANUALLY LOG ALL LOG COLUMNS
CTRL & H: TO MANUALLY LOG ALL COLUMN HEADINGS
CTRL & A: TO SET ALARM LOG FORMAT
CTRL & F: SEISMETRY FAILURE AUDIBLE ALARM DISABLE
CTRL & N: ENABLE OR DISABLE ATS NARROW LIMIT INPUT
```

Figure 3-16 7840 Display of Instructions

3.2.4.7 Use of the Program Enable Key Switch (Continued).

If the CTRL and C keys are pressed while the key switch is in PROGRAM DISABLE, it will be impossible to change parameters; but if CR is pressed, the Printer will ask

ENTER COLUMN # (1-60) *

If a column number followed by a CR is entered, the computer will step through the normal set of questions, as described in Subsection 3.2.4.2. However, the questions will not be followed by a ?; instead, each will be followed by the value or response that was entered earlier.

In the PROGRAM DISABLE mode, CTRL 0 can be used to print out a line of log, and CTRL H can be used to print out the log headings, and CTRL T will have no effect; but if CTRL L is used, no changes can be made in the logging parameters. The computer will step through the questions, without the ?, showing the responses previously entered. However, if the number of columns to be logged was specified as 0, CTRL L, CTRL 0, and CTRL H will have no effect.

3.2.4.8 Response to Alarms.

In programming each parameter for logging, as described in Subsection 3.2.4.2, the operator can specify whether an alarm is to be turned on when that particular parameter exceeds preset limits. Whenever an alarm-enabled parameter exceeds its limits, the following alarms will be set off:

- a. The ALARM light on the 7840 front panel will light.

3.2.4.8 Response to Alarms (Continued).

- b. An audible alarm will sound.
- c. If the parameter has been designated for logging (Subsection 3.2.4.4), it will be immediately printed out.

When an alarm is set off, the operator can turn off the ALARM light and the audible alarm by depressing the front-panel ALARM RESET switch. The audible alarm must always be reset from the front-panel ALARM RESET switch. Alarm programming is illustrated in Figure 3-17.

3.2.4.9 Battery Alarm.

The 7840 battery will be automatically tested once every hour. If the battery is low, the following alarms will be set off:

- a. The ALARM light on the 7840 front panel will light.
- b. An audible alarm will sound.
- c. BATTERY LOW will be printed on the Printer.

When an alarm is set off, the operator can turn off the ALARM light and the audible alarm by depressing the front-panel ALARM RESET switch.

(CTRL) A

ALARM FORMAT, ALARM COLUMN ONLY (0) ALL COLUMNS (1) = 0?1

(CTRL) F

TELEMETRY FAILURE ALARM ENABLED = NO ?YES

(CTRL) N

ATS NARROW LIMITS INPUT ENABLED = NO ?

CTRL F: "TELEMETRY ALARM" will be printed on the TTY: if no valid telemetry data is received for 3 minutes.

CTRL A: Allows the operator to disable the audible alarm only, for telemetry failures. The message will still be printed every 3 minutes.

CTRL N: IF YES, narrow limits will be input for each log column being set up. (For future ATS use only).

Figure 3-17 Alarm Programming

3.3 Model 7841 Controls, Connectors, and Indicators.

3.3.1 Front-Panel Controls and Indicators.

Fig. 2.11

<u>Ref. No.</u>	<u>Name</u>	<u>Function</u>
1	CALIBRATE illuminated switch	When pressed (illuminated), stops the scanner at the selected channel.
2	TELEMETRY DATA display	Displays data for selected channel.
3	CHANNEL SELECT switch	Selects the channel to be displayed.
4	Calibration potentiometers	Used to calibrate the display of the selected channel.

3.3.2 Rear-Panel Devices.

Fig. 2.12

<u>Ref. No.</u>	<u>Name</u>	<u>Function</u>
1	BCD IN connector	This input port accepts 16 lines of BCD data for transmission to the 7640C.
2	FSK OUT connector	This output port supplies FSK data, normally through the 7610 System, to the 7840.
3	TELCO terminals	This output port supplies TELCO data to the 7840.
4	120/240V connector	Used to connect the 7841 to the primary power source.
5	1/2A fuse	Provides short-circuit protection to the 7841 from the primary power source.

SECTION 4

THEORY OF OPERATION

4.1 General.

Theory of operation is covered here by means of block diagrams. Once the block diagrams are understood, the detailed operation of the circuits shown on the schematic diagrams will be apparent, since the circuits consist essentially of integrated circuits that are arranged in substantially the same way on the schematics as the blocks on the block diagrams. Schematic diagrams for all boards are contained in Section 6.

The 7640 System uses a Model 7640C CPU at the control site, while the 7840 System uses a Model 7840 CPU. The CPUs are similar, and so are described together in Subsection 4.2.

Both systems use the Model 7841 Scanner at the remote site. It is described in Subsection 4.3.

4.2 7640C and 7840 Central Processing Units (Figures 6-1-1)

The Central Processing Unit consists of a CPU Board, an I/O Board, and a power supply. Figures 6-1-5 are the interconnection diagrams.

4.2.1 CPU Board A1.

The CPU block on board A1 is an 8085 microprocessor. On the address data and control buses out of the microprocessor there are two identical sets of buffers. Each set consists of two 74LS244s, one 74LS373, and one 74LS245. One set of buffers outputs to other circuits on board A1, while the other set of buffers outputs to I/O Board A2.

4.2.1 CPU Board A1 (Continued).

The RAM provides 7K of memory, of which 5K for 7640C and 3K for 7840 are used. The RAM stores limits, descriptions, units, log information, and all other programmable information that can be entered by the user. It also has areas that the microprocessor can use for doing its calculations. The RAM is backed up by a battery, which will hold the memory contents for up to 8 hours in case of power failure.

The EPROM contains the program that gives the computer its characteristics. There are 10K maximum of programmable memory. These are programmed at TFT to the customer's specifications.

The three 8155s are parallel I/O ports for reading TTL signals that come in through the rear panel. They can read 30 TTL status inputs and two external BCD inputs. They connect to the data and address buses of the microprocessor, and serve as buffers between the outside world and the computer. When the computer needs to read external inputs, it enables these buffers so that the external data is applied to the data bus. Each 8155 also contains a programmable timer which allows the microprocessor to set up the baud rates for the UARTs on this board.

One UART connects to the Model 43 Printer through an RS232 interface. The RS232 provides signal swings from -12V to +12V rather than between TTL levels, allowing transmission over long distances. A second UART brings in the telemetry information from the FSK modem on the I/O Board. For the 7640C only, the third UART connects to the CRT through an RS232 interface. The UARTs are clocked by the timers in the 8155 I/O ports.

When a UART receives an input, it sends an interrupt to the interrupt controller, which then tells the microprocessor which subroutine to use to service that UART. This is part of the computer program that is stored in the EPROM.

4.2.2 I/O Board A2.

The CMOS 24-hour clock provides the time at the bottom of the CRT screen (Model 7640) or in the printout (Model 7840).

4.2.2 I/O Board A2 (Continued).

The 74LS244 input buffer provides an interface with the key locks and battery check on the power supply.

The D flip-flops perform the battery check and set the alarm.

The modem (Figure 6-1-9) receives FSK data which originates on the 7841 and is sent to the 7640C or 7840 CPU over the 7610 link or, in the case of the 7840 System, directly down the TELCO lines. The FSK modem converts the data into digital format and sends it to a UART on the CPU Board.

4.2.3 Power Supply (Figure 6-1-4)

A 25V center-tapped winding on transformer T1 furnishes the AC for both the +12V and -12V regulated supplies. Full-wave rectifier CR1/CR2, regulator U1, and filter capacitors C1 and C3 constitute the +12V supply. Full-wave rectifier CR3/CR4, regulator U2, and filter capacitors C2 and C4 make up the -12V supply.

Full-wave rectifier CR1, fed from the 14V center-tapped transformer secondary, supplies the V_{CC} T voltage for the I/O Board. The output of this rectifier also supplies V_{CC} RAM voltage (V_{CC} B) through regulator U1, and the V_{CC} voltage to both the I/O Board and the CPU Board through regulator Q1, fuse F1, and regulator U3.

The backup battery is constant voltage charged by CR1 through 10-ohm resistor R13, the normally closed contacts of K1, and fuse F2. In case of AC power failure, the battery supplies V_{CC} power through diode CR5. Once an hour, a signal from the microprocessor on the CPU Board sends a BATTST signal through pin 12 of J2 which energizes K1 through Q3. The relay connects a 22-ohm load (R16) across the battery, and U4 compares the battery's loaded output voltage with a fixed portion of the V_{CC} T voltage. If battery voltage is below normal, U4 outputs a BATTCK signal which causes a BATTERY LOW message to appear in the printout or on the Model 7640's CRT display.

The circuit consisting of CR11, CR12, Q4, and Q5 is an advance power down detector to protect the memories on the CPU Board. In case of power failure, the RAM supply voltage (V_{CC} B) at J1-5 and J1-6, originating at CR1, will stay up for a matter of V_{CC} seconds because of the large capacitance at C1. The MPRO* signal at J2-11, however, will drop quickly; and this signal is used on the I/O Board to prevent anything from being written into memory after the power fails.

4.3 7841 Remote Scanner (Figures 6-2-2 and 6-2-4).

The 7841, located at the remote site in both the 7640 and 7840 Systems, scans through selected DC signals. Associated with the 7841 are up to six relay scanner boards, each of which contains 10 relays. The 7841 turns on one relay at a time, does an A/D conversion, and transmits the resulting digital data to the 7640C or 7840 CPU.

The decade counter, clocked by the clock and timing circuit, turns on each of the 10 relays one at a time. The binary counter selects each of the relay boards, one at a time, up to 6 boards maximum. The total number of relay boards to be scanned are selectable from the Dip switch. Together, the two counters select a particular relay on a particular board. The counter outputs are sent to the boards and relays through relay drivers. The relay drivers are energized by a separate 12-volt supply to prevent interaction with the other circuitry.

The selected relay connects its sampled voltage to a floating A/D converter. The sampled voltage may be as much as 300 volts above or below chassis ground. The A/D converter outputs clock pulses, the number of which is proportional to the voltage sampled. These clock pulses are fed out through optical isolators to allow the floating A/D converter to interface with the rest of the 7841.

Each complete A/D conversion is considered to be one sample, and four of these are done per second. For every sample, six words are sent down the link. The first word consists of all ones (sync code), and tells the 7640C or 7840 CPU that data is coming. The second word is the site code; this comes from the setting of a site-select switch inside the 7841. Logic in the unit enables the site switch data to enter the UART, from where it is sent to the FSK generator. The data may then be sent down the 7610 link or, in the case of the 7840 System, through the TELCO circuit directly down the TELCO lines.

The adder is used in a checksum procedure. At the time the sync code is sent, the adder is set to zero. When the site word is sent, its value is added to the zero in the adder. The next word is the channel number, and its value is added to the site value in the adder. The data from the A/D converter consists of two words; these two words are added to the adder's contents. The sixth word is the sum of all

4.3 7841 Remote Scanner (Continued).

previous words. After the microprocessor in the 7640C or 7840 CPU receives the sync code, it adds the values of the next four words and compares this sum with the sum sent as the sixth word.

External BCD data consists of data plus channel number. When the channel number (third word) is sent, a comparator checks to see if it is the same as the relay number that was just A/D converted. If it is, rather than taking the A/D conversion from the BCD counter, it allows the external data to be transmitted. A switch allows the operator to disable this feature when it is not wanted.

SECTION 5 MAINTENANCE

5.1 Periodic Maintenance.

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

5.2 Calibration.

System A/D calibration is covered in Subsection 2.5.8. The adjustments described in Subsections 5.2.1 and 5.2.2 should be done only if trouble is being experienced with operation of the CPU or Remote Scanner, respectively.

5.2.1 7640C and 7840 Adjustments.

5.2.1.1 Oscillator Frequency.

Using a frequency counter, check the output of W1 on the I/O Board at pin 2 of U23. If it is not 10 MHz, adjust Y1.

5.2.1.2 FSK Detector.

If FSK detector U8 on the FSK modem is replaced or does not appear to be operating correctly, proceed as follows. With the CBU and Remote Scanner operating together, connect an oscilloscope to pin 10 of U8 and adjust the oscilloscope vertical sensitivity to 1 or 2 volts per centimeter. Note the DC level at pin 10; it should be approximately +5 VDC. Move the oscilloscope probe to pin 8 of U8 and observe the switching signal. Adjust R54 on the FSK modem so that the excursions of the switching signal are the same above and below

5.2.1.2 FSK Detector (Continued).

the DC level observed at pin 10.

5.2.2 7841 Adjustments.

5.2.2.1 Baud Rate Clock.

Using a frequency counter, check the TCP input to the UART (pin 40 of U43). If it is not 4800 Hz \pm 100 Hz, adjust R14 in the timing circuit of U45.

5.2.2.2 Modem Transmitter.

- a. Ground the base of Q1.
- b. With a frequency counter, check the frequency at pin 5 of U50. If it is not 600 Hz \pm 10 Hz, adjust R27.

5.3 Troubleshooting

5.3.1 CPU (7640C/7840) Troubleshooting Guide.

The troubleshooting chart (Table 5-1) is presented here as an aid to isolating the cause of a failure. In the case of some lengthy procedures, troubleshooting trees are referenced in the table.

To use the troubleshooting trees, start at the top and do whatever is required to answer the first question. Then proceed to the next operation along the route determined by the answer to the first question. Continue this sequence until the fault is found.

5.3.2 Model 7841 Troubleshooting Guide.

Figure 5- is a troubleshooting tree for the 7841 that should help in isolating the most likely sources of trouble.

If trouble is experienced with the relay switching circuits, perform the check described in Section 2.5.6. If the relays on one or more relay scanner boards do not produce the rapid clicks described, check the operation of U15 and U21. In normal operation, the relay select lines are scanned continuously at a rate of four lines per second. Replace U15 and/or U21 if normal scanning of relays and boards is not occurring. If U15 and U21 appear to be operating normally check the operation of U8, U9, U6 or U16. In normal operation U21 will select 12V to 18V to appear at one of the outputs of U8 or U9. This supplies power to one of the relay boards. U15 will then cause one of the outputs at U6 or U16 to go low energizing one of the 10 relays on the relay scanner board activated by U8 or U9. Because U8 and U9 are open collector devices, at least one relay scanner board must be connected to the 7841 to perform this check.

Table 5-1. CPU Troubleshooting Chart

Problem	Corrective Action										
Telemetry data not being updated on Printer	(See Figure 5-1)										
Telemetry data not being updated on CRT (Model 7640C only)	(See Figure 5-2)										
Operator-entered parameters differ from those displayed or printed.	<p>Check memory ICs on the CPU Board for symptoms indicated:</p> <table> <tr> <td>Description</td><td>U10, U11, U17, U18</td></tr> <tr> <td>Units</td><td>U11, U18</td></tr> <tr> <td>Channel, site, or log heading</td><td>U12, U19</td></tr> <tr> <td>Upper limit</td><td>U13, U20</td></tr> <tr> <td>Lower limit</td><td>U13, U14, U20, U21</td></tr> </table>	Description	U10, U11, U17, U18	Units	U11, U18	Channel, site, or log heading	U12, U19	Upper limit	U13, U20	Lower limit	U13, U14, U20, U21
Description	U10, U11, U17, U18										
Units	U11, U18										
Channel, site, or log heading	U12, U19										
Upper limit	U13, U20										
Lower limit	U13, U14, U20, U21										
Printer does not respond to keyboard.	<ol style="list-style-type: none"> 1. Be sure Printer is set as described in Subsection 3.2.2.3. 2. Hold down key on keyboard. Data should appear at U43-1 and U41-3 on the CPU Board. If not, check for shorts and replace any defective cable or IC. 										
CRT is blank (Model 7640C only)	<ol style="list-style-type: none"> 1. Check power to CRT. 2. Disconnect 7640C from CRT and install test loop cable. Type on keyboard. Data should appear on CRT screen. 3. If data did not appear on screen in step 2, turn power to CRT off, and then turn power back on. Repeat step 2. If data does not appear on CRT screen, CRT is defective. 										

Table 5-1. CPU Troubleshooting Chart (Continued)

Problem	Corrective Action
CRT does no respond to keyboard (7640C only)	<p>1. Disconnect 7640C from CRT and install test loop cable. Type on keyboard. Data should appear on CRT screen. If it does not, CRT is defective.</p> <p>2. If CRT passes loop test, reconnect 7640C to the CRT. Hold key down on keyboard. Data should be present at U43-1 and U41-3 on the CPU Board. If not, check for shorts and replace any defective cable or IC.</p>
One or more status inputs are being monitored incorrectly.	Check that proper status input gets to U45 or U47 on the CPU Board. TTL low is displayed as "on." If signal is present at the IC pins, replace U45 or U47. If not, check for shorts or defective cable.
BCD1 or BCD2 displayed incorrectly.	Check that proper TTL BCD data gets to U45 or U46 on the CPU Board. If signal is present at the IC pins, replace the IC. If not, check for shorts or defective cable.
Clock is not correct.	(See Figure 5-3)
Program keylock does not function.	Check pin 2 of U2 on the I/O Board. It should be high when front-panel key is in the PROGRAM ENABLE position and low when key is on PROGRAM DISABLE. If this is true, replace U2 or U1. If it is not true, repair defective cable at J2.
Power supply not operating properly.	(See Figure 5-4)

Table 5-1. CPU Troubleshooting Chart (Continued).

Problem	Corrective Action
Logging function not operating properly.	(See Figure 5-5)
Audible alarm does not function	Check Pin 6 of U5 on the I/O Board. It should be high when alarm is activated. If not true, replace U8, U12, or U5. If this is true, check that Q1 is on. If not replace Q1. If Q1 is on, repair defective cable at J2.

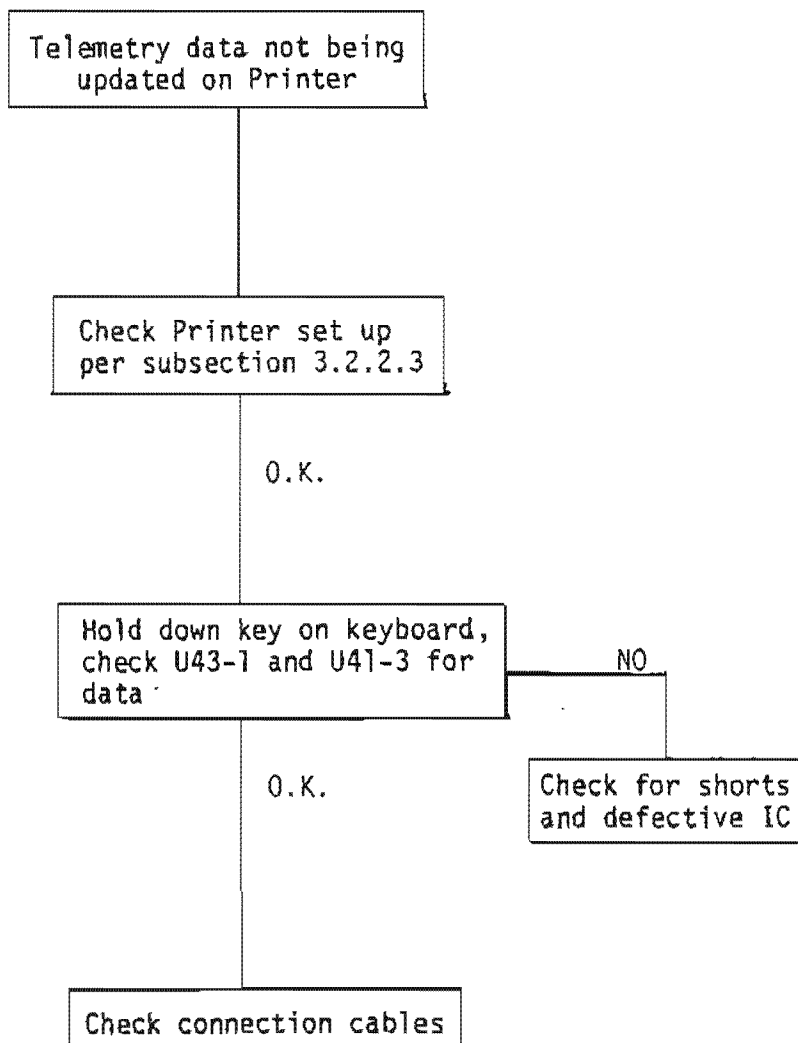


Figure 5-1 Printer Telemetry Update Troubleshooting Tree

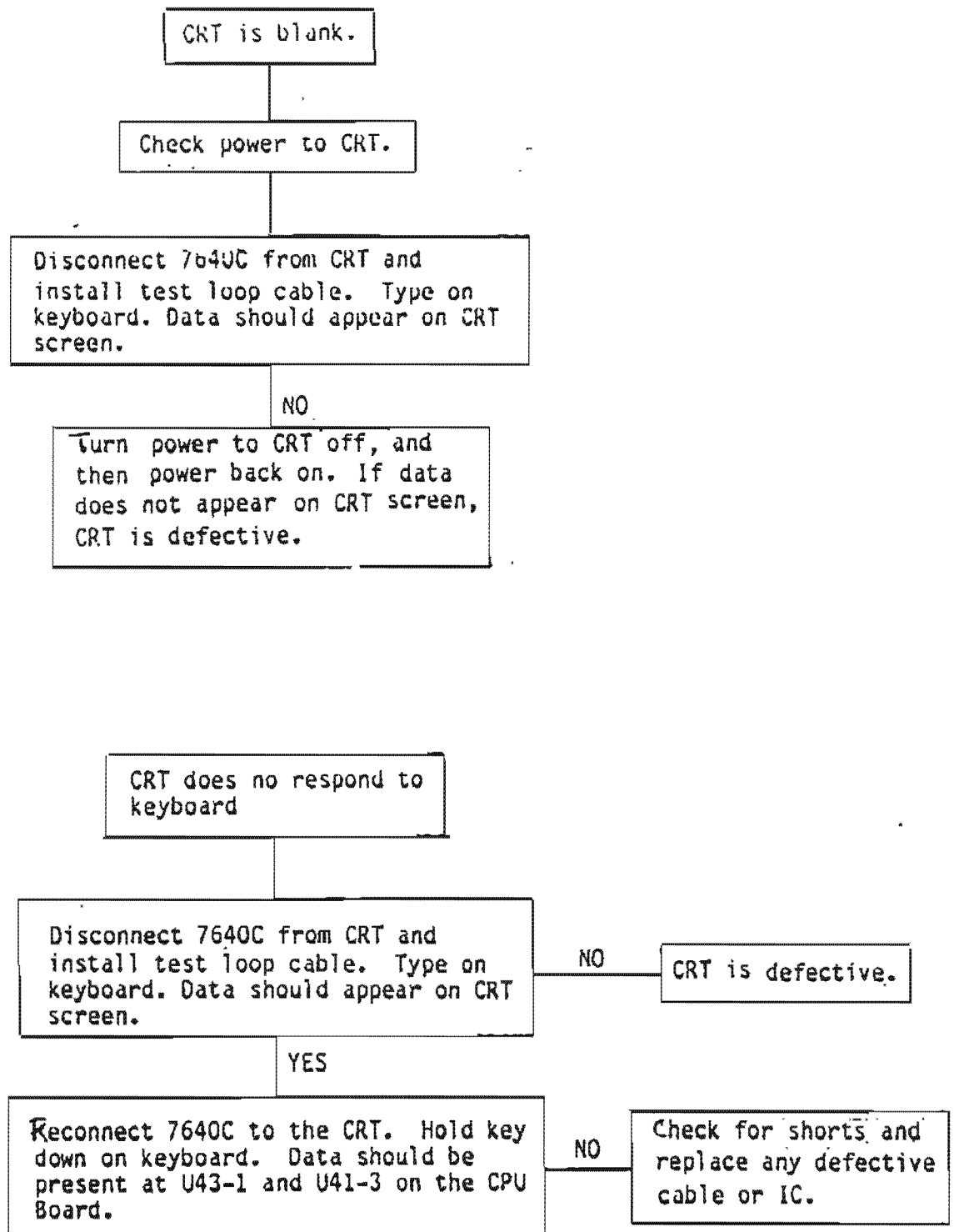


Figure 5-2. CRT Telemetry Update Troubleshooting Tree

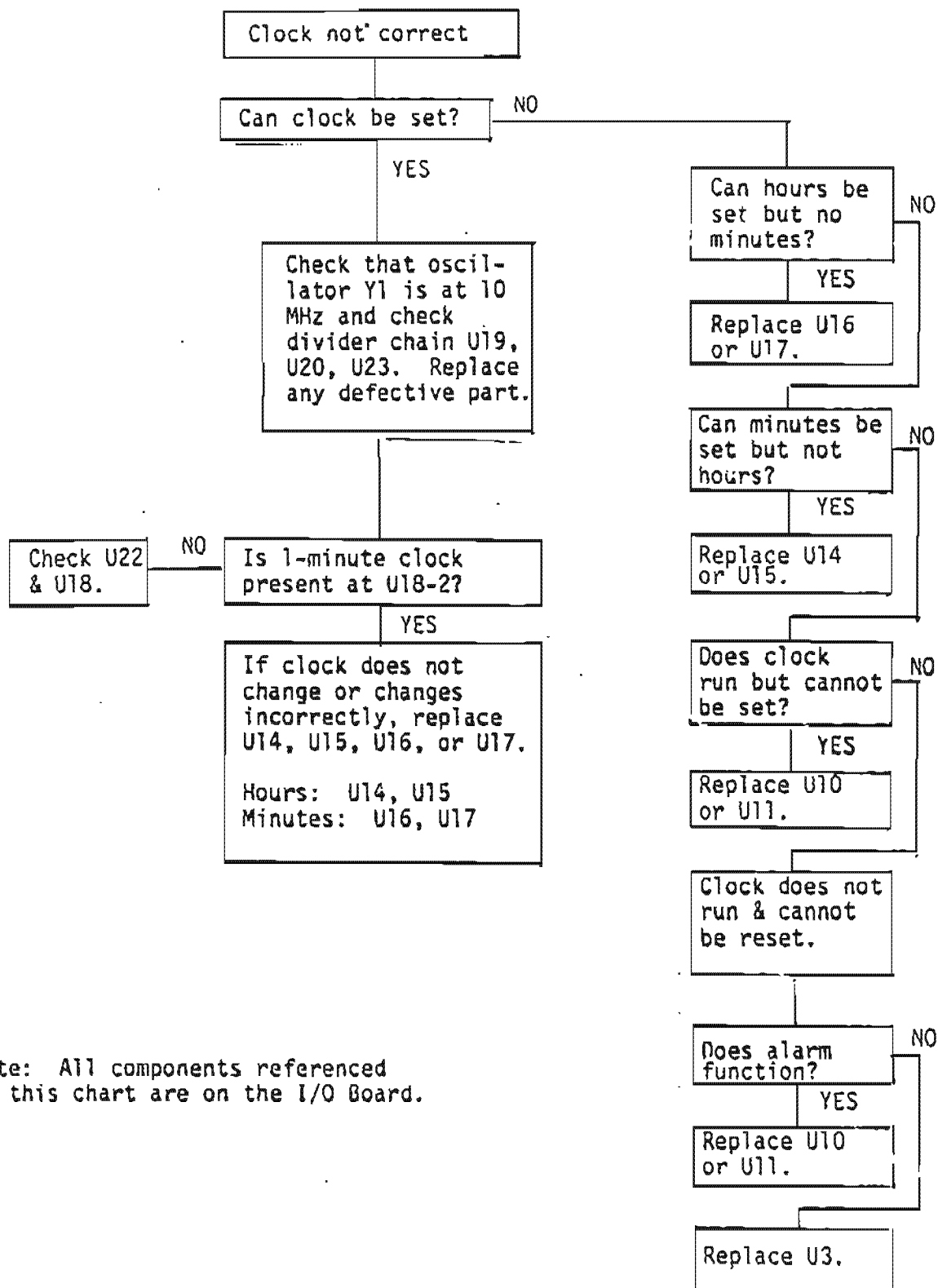
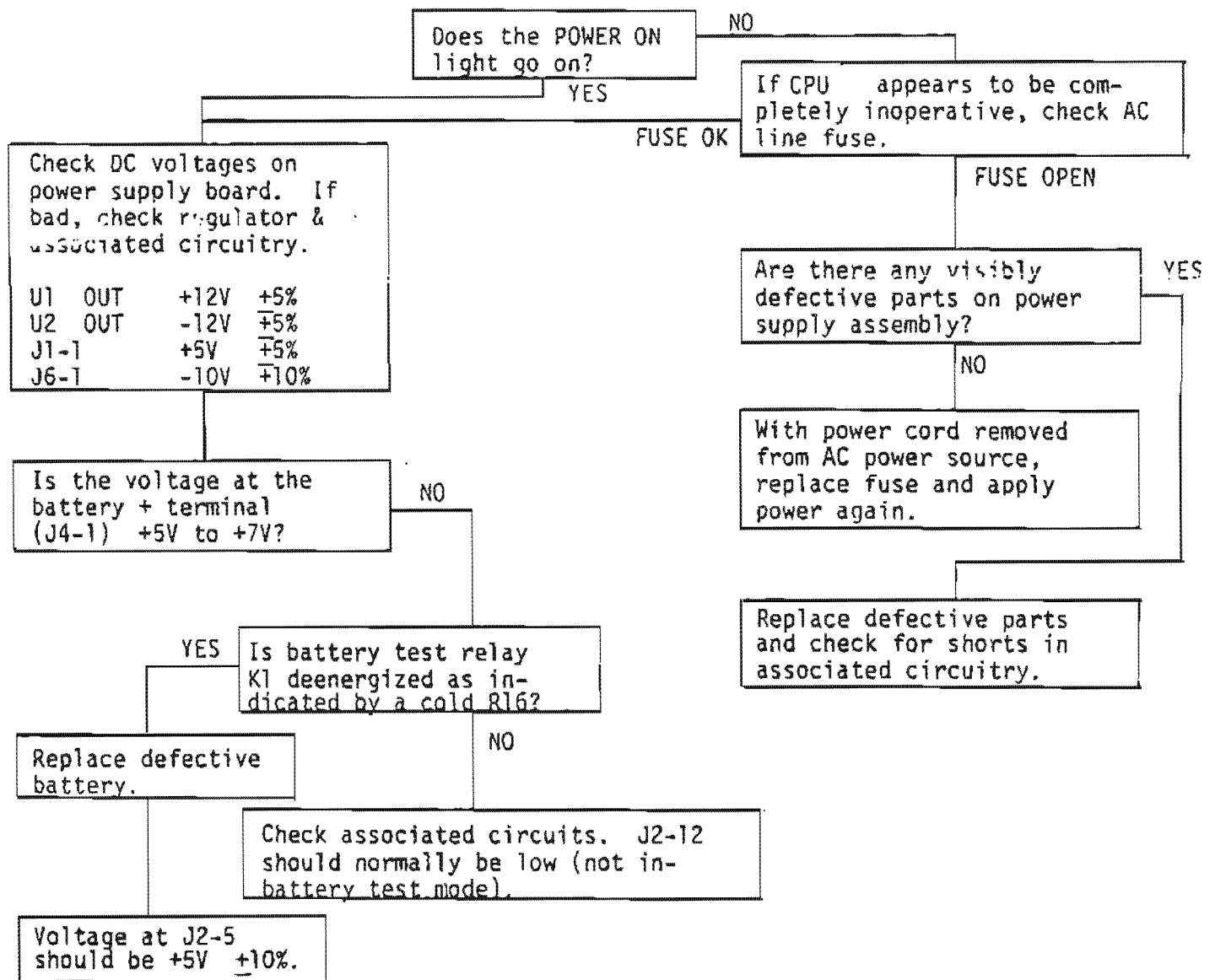


Figure 5-3.

Clock Troubleshooting Tree



WARNING

CR9 and R13 are hot in normal operation.

Figure 5-4

Power Supply Troubleshooting Tree

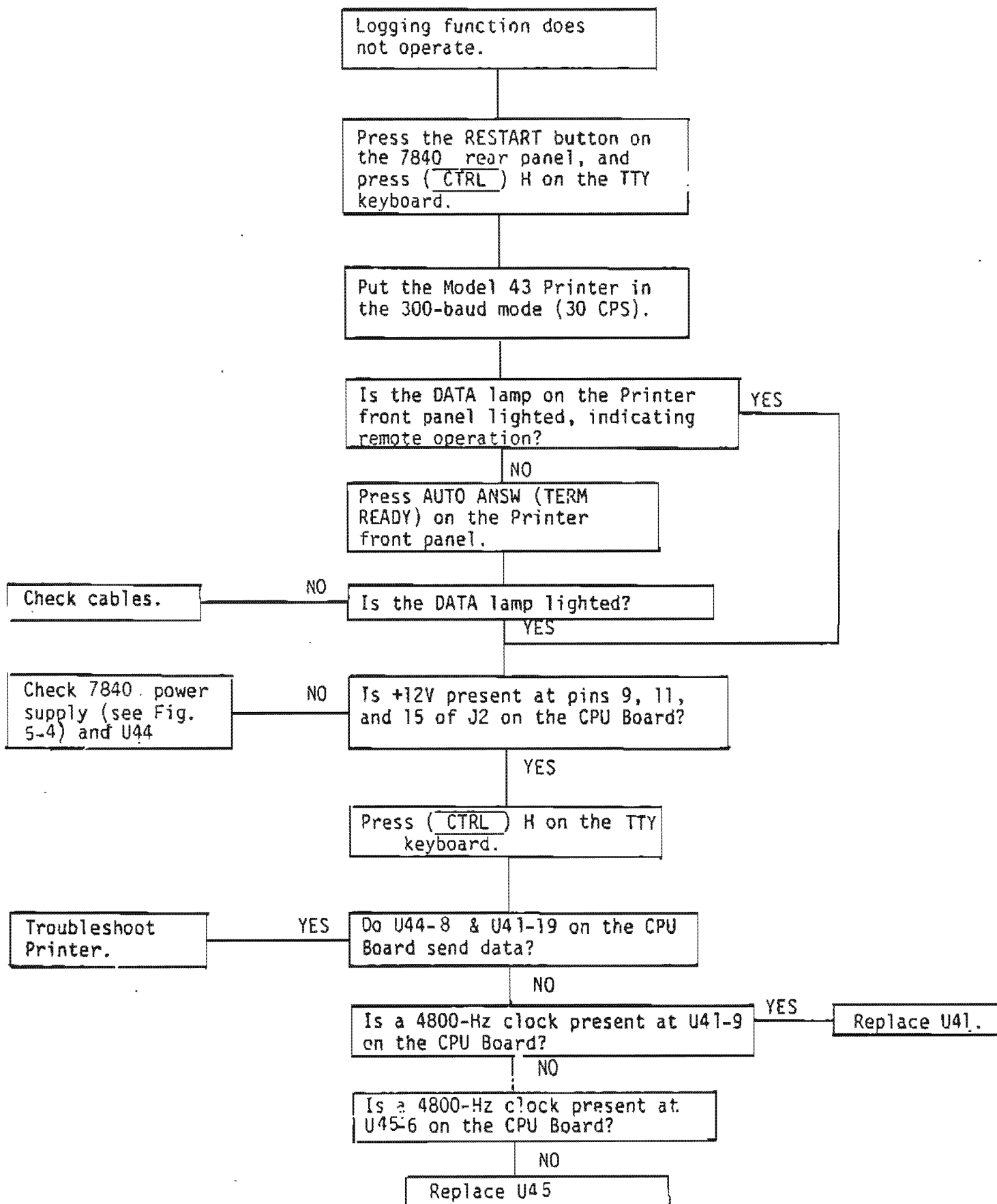


Figure 5-5 Logging Troubleshooting Tree

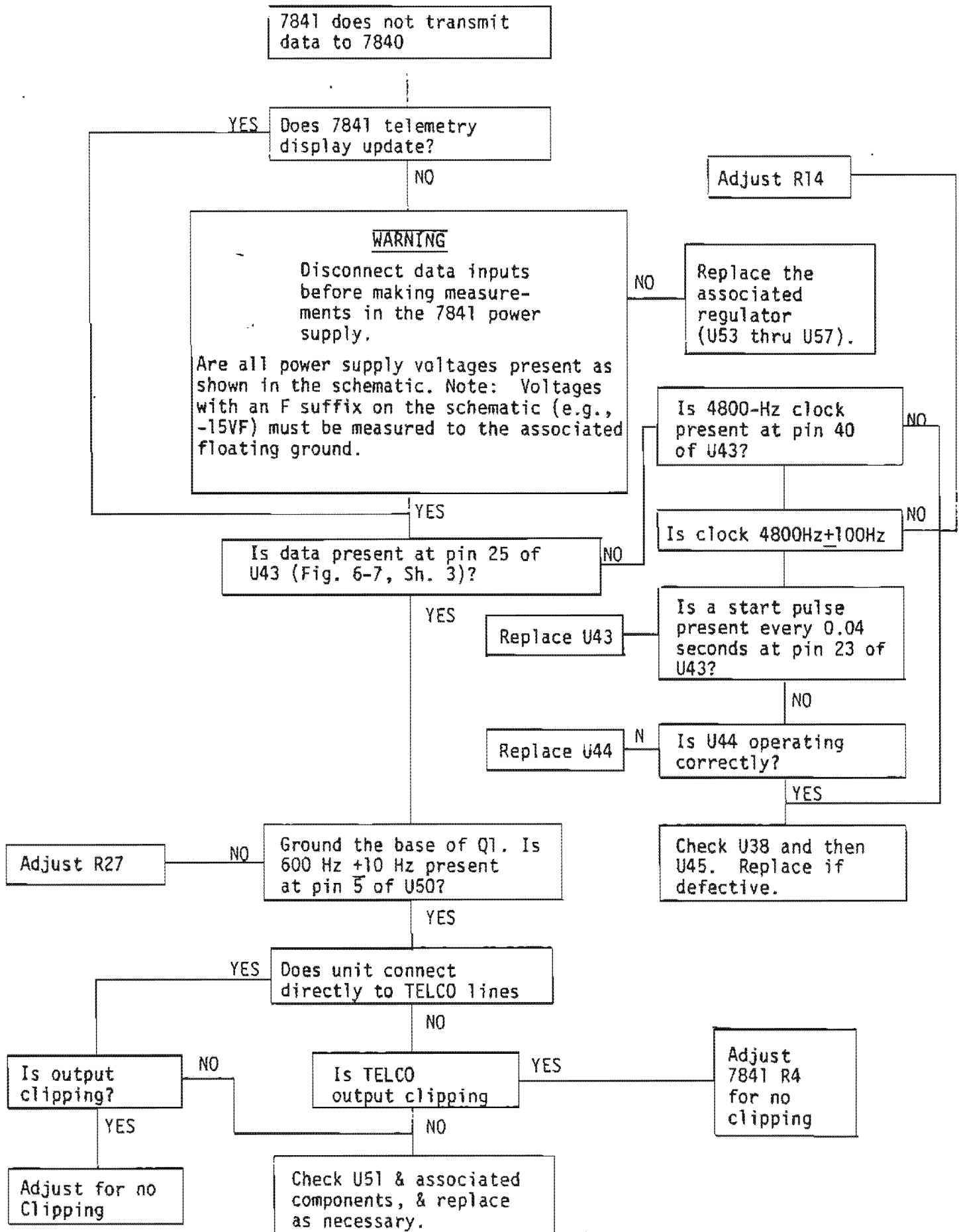
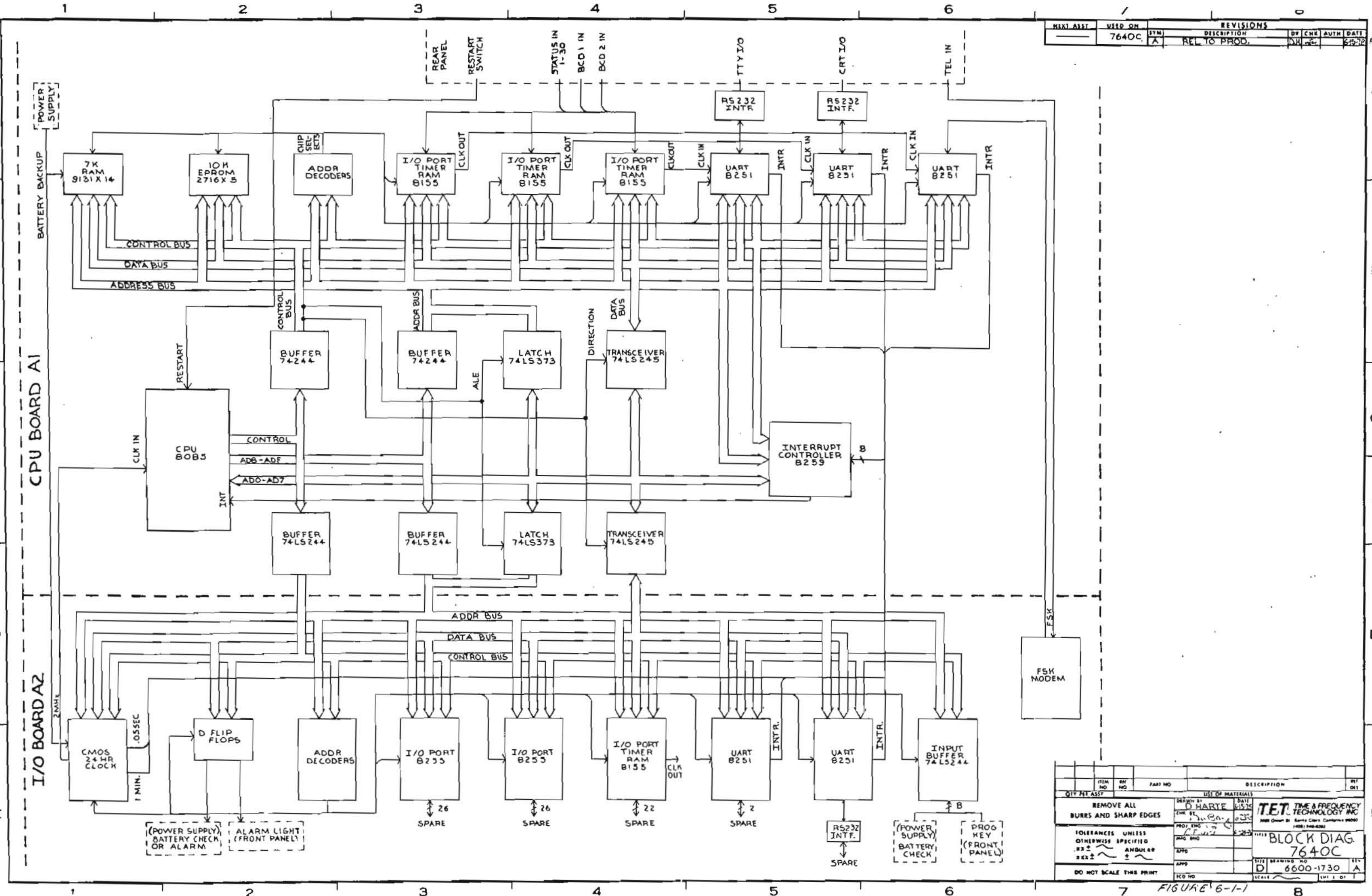


Figure 5-6 7841 Data Transmission Troubleshooting Tree



REVISIONS		DATE	BY	CHK	APP
1	7640C	REL TO PROD.			

ITEM NO	REV NO	PART NO	DESCRIPTION	REV
1	1			
LIST OF MATERIALS				
REMOVE ALL BURS AND SHARP EDGES				
TOLERANCES UNLESS OTHERWISE SPECIFIED				
DO NOT SCALE THIS PRINT				
DRAWN BY: D. HARTY			DATE: 6/15/78	
PROJ. ENG: J. G. HARTY			SCALE: 1:1	
APPD: J. G. HARTY			TITL: BLOCK DIAG. 7640C	
ICD NO: 6600-1730			REV: 1 OF 1	

FIGURE 6-1-1

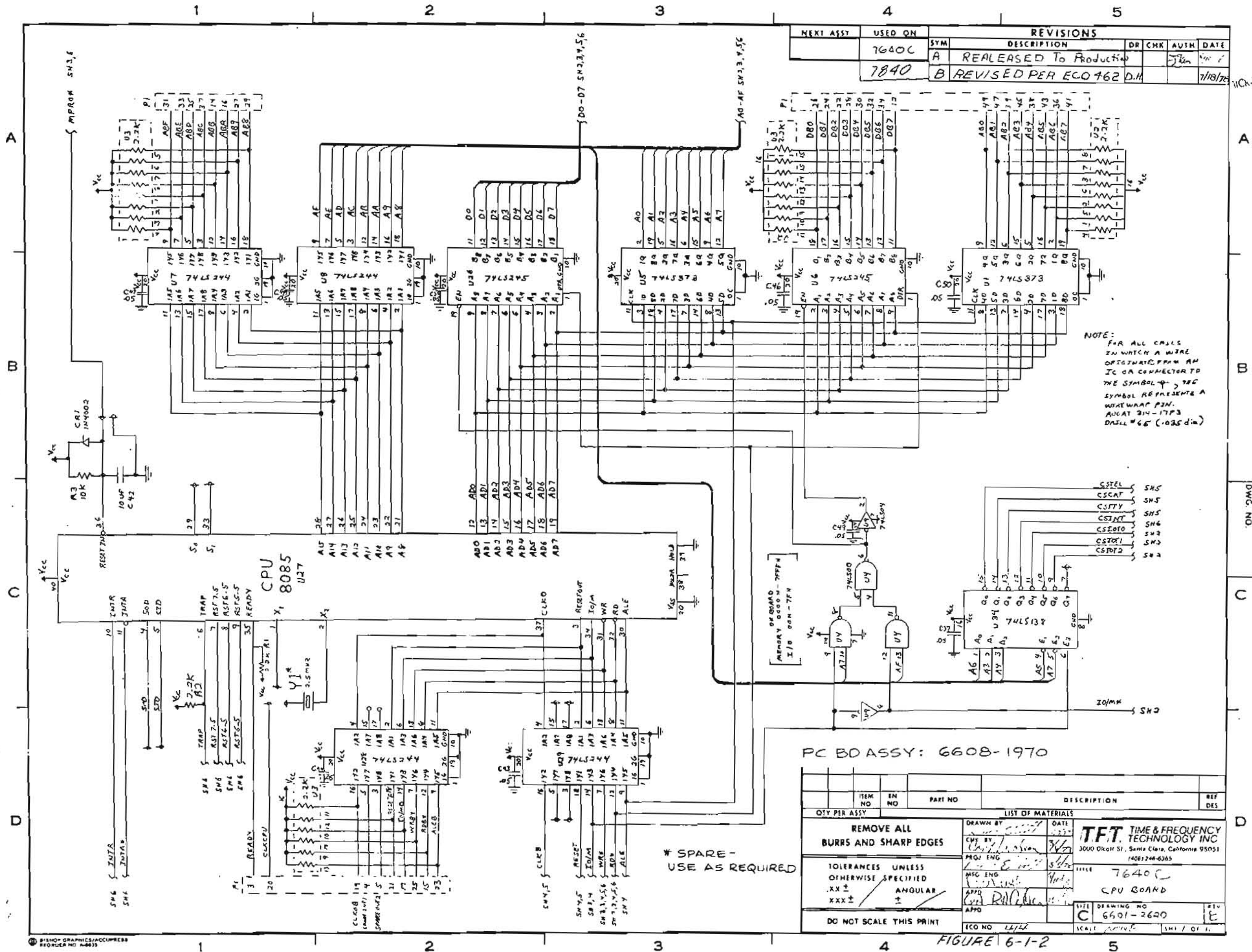
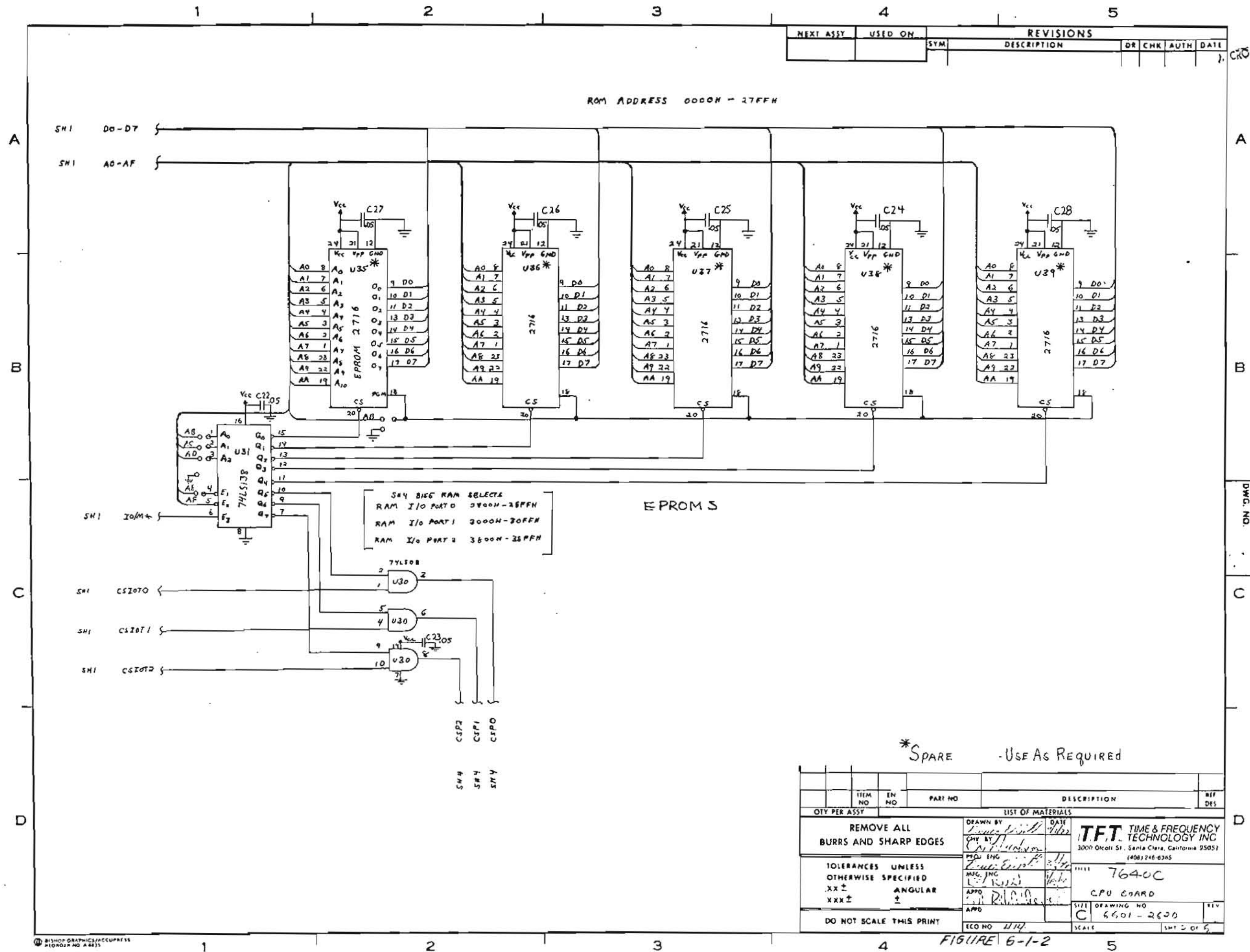


FIGURE 6-1-2

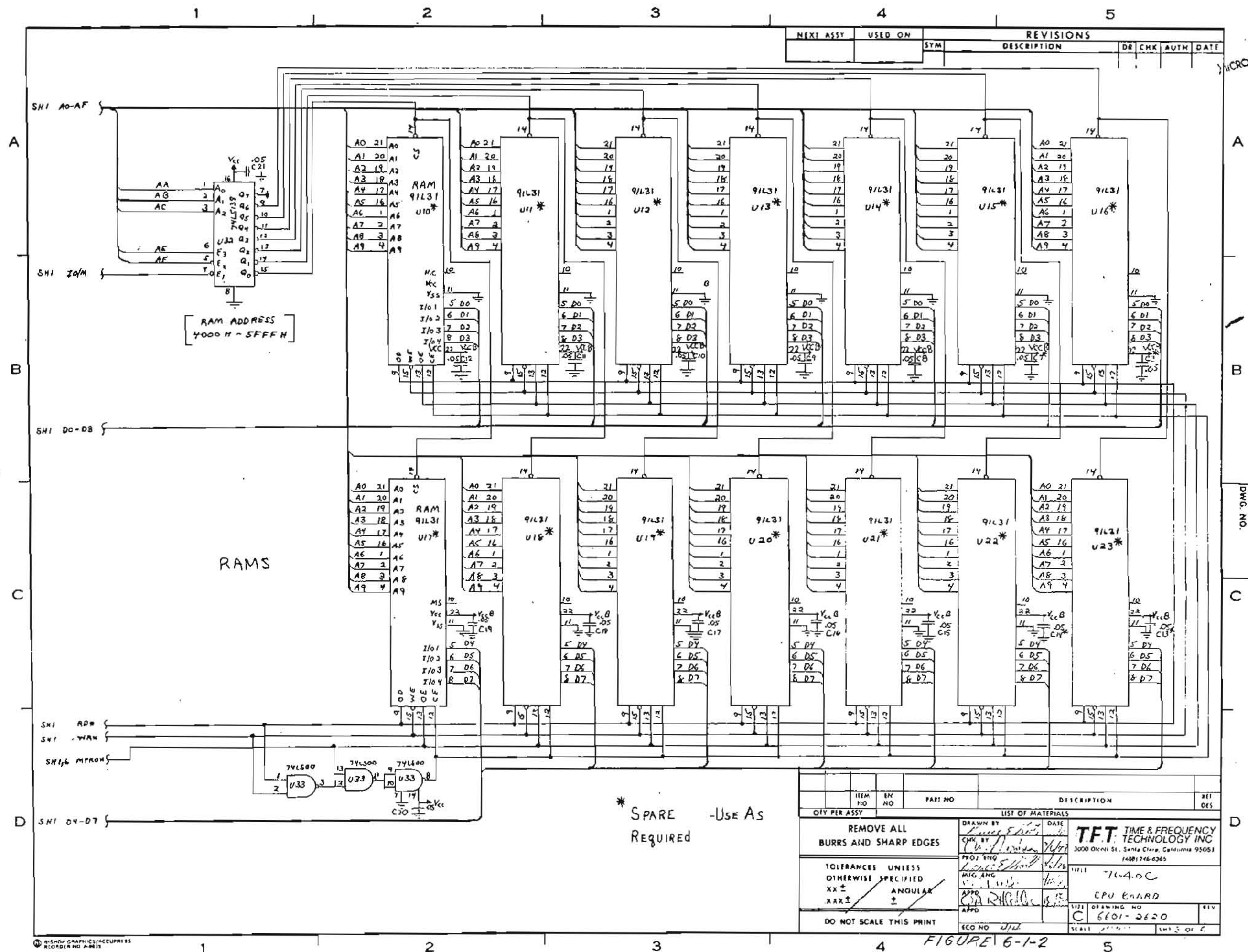


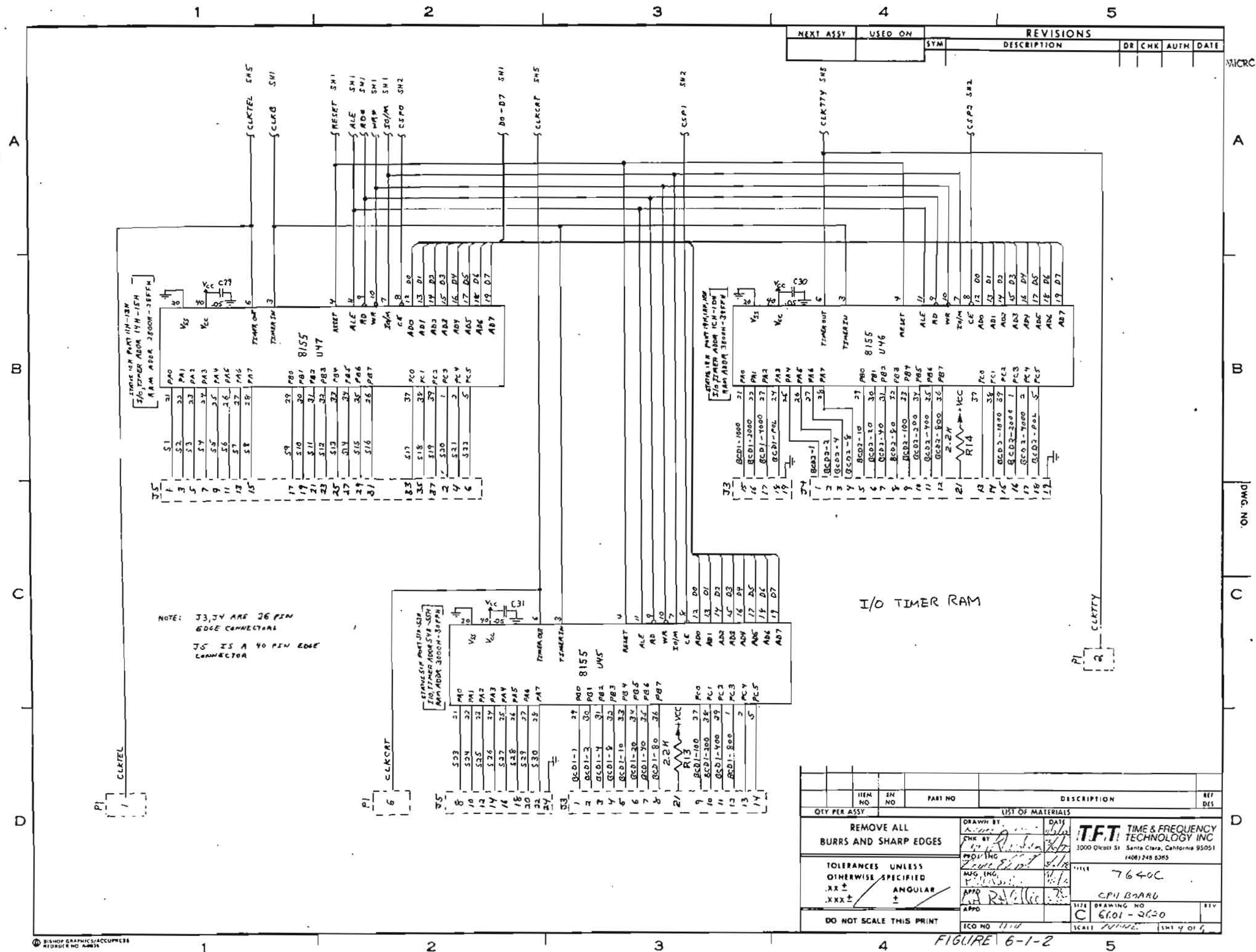
*SPARE - USE AS REQUIRED

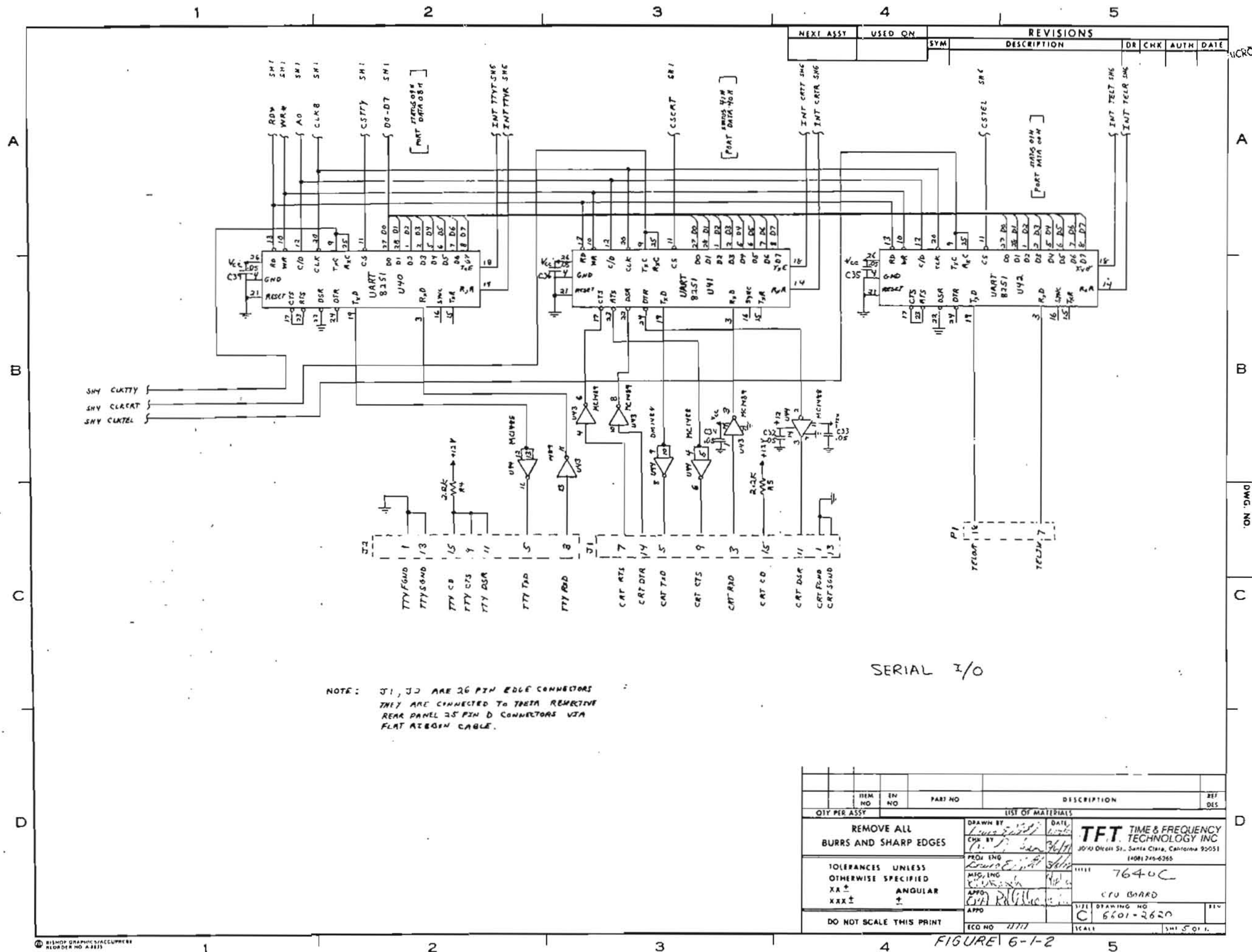
	ITEM NO	EN NO	PART NO	DESCRIPTION	REF DES
QTY PER ASSY	LIST OF MATERIALS				
REMOVE ALL BURRS AND SHARP EDGES			DRAWN BY <i>James Smith</i>	DATE <i>1/18/82</i>	TFT TIME & FREQUENCY TECHNOLOGY INC. 3009 Okcatt St., Santa Clara, California 95051 (408) 248-6345
			CHK BY <i>James Smith</i>		
			PRD ENG <i>James Smith</i>		
			MFG. ENG <i>James Smith</i>		
			APPD <i>James Smith</i>		
TOLERANCES UNLESS OTHERWISE SPECIFIED					7640C CPU BOARD
XX ±	ANGULAR				
XXX ±	±				
DO NOT SCALE THIS PRINT			SIZE C		DRAWING NO 6601-2600
ECO NO <i>11/1/82</i>			SCALE		SMT 2 OF 5

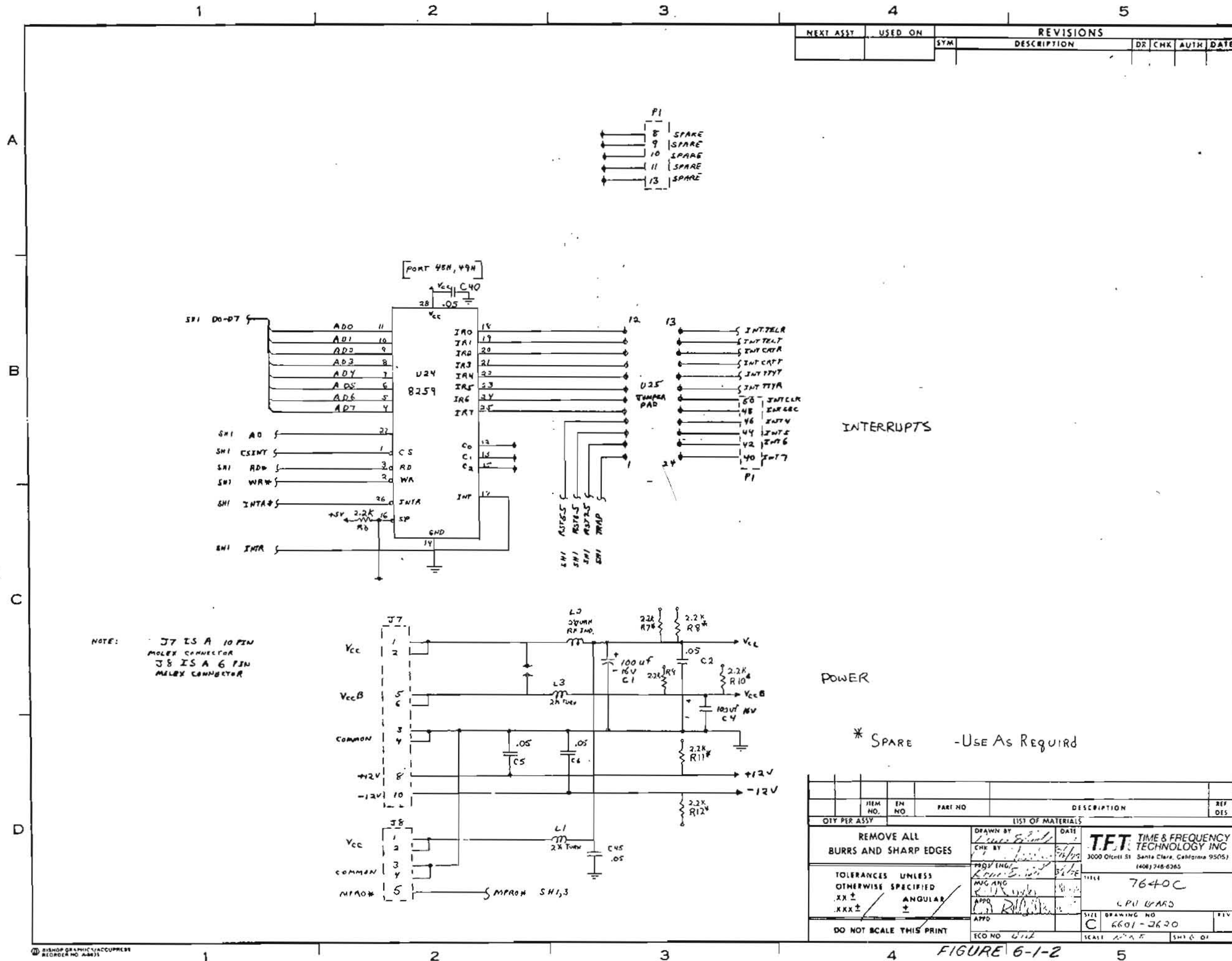
TFT TIME & FREQUENCY TECHNOLOGY INC.
3000 Orcutt St., Santa Clara, California 95051
(408) 246-0365

7640C
CPU BOARD
C 6601-2600
SCALE 1:1
REV 2 OF 5









NEXT ASSY		USED ON		REVISIONS			
SYM	DESCRIPTION	DR	CHK	AUTH	DATE		

P1	
8	SPARE
9	SPARE
10	SPARE
11	SPARE
13	SPARE

INTERRUPTS

POWER

* SPARE -USE AS REQUIRED

ITEM NO.	EN NO.	PART NO.	DESCRIPTION	REF DES
QTY PER ASSY				
LIST OF MATERIALS				
REMOVE ALL BURRS AND SHARP EDGES			DRAWN BY <i>[Signature]</i> CHK BY <i>[Signature]</i> DATE 5/1/93	TFT TIME & FREQUENCY TECHNOLOGY INC 3000 Ocotillo St Santa Clara, California 95051 (408) 248-0265
TOLERANCES UNLESS OTHERWISE SPECIFIED			PROV ENG <i>[Signature]</i> MFG ENG <i>[Signature]</i> APPD <i>[Signature]</i>	
DO NOT SCALE THIS PRINT			ECO NO. 0112	
			SCALE 1:1	
7640C CPU BOARD				REV C
DRAWING NO. 6601-2620				REV

FIGURE 6-1-2

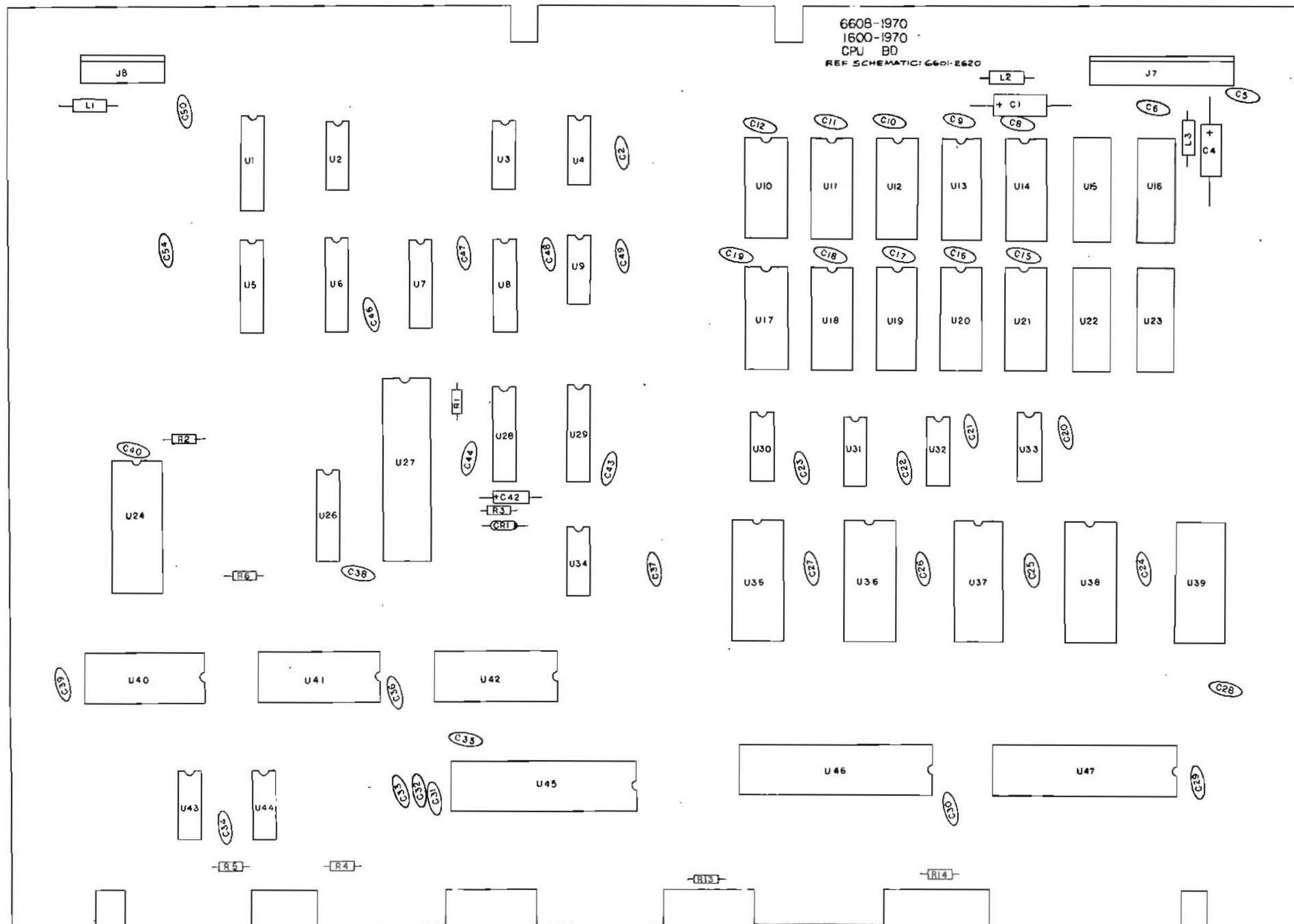


FIGURE 6-1-3

Model 7640C

CPU Assembly

6608-1970

Rev B

CKT. REF.	DESCRIPTION	TFT STOCK NO.
C49	Cap. Cer Disc .05MFD	1005-5039
C50	Cap. Cer Disc .05MFD	1005-5039
CR2	DIO 1N4002	1284-4002
L1	Choke RF 2 1/2T	1530-0025
L2	Choke RF 2 1/2T	1530-0025
L3	Choke RF 2 1/2T	1530-0025
R1	Res. Car Comp 1/4W 5% 2.2K	1065-2201
R2	Res. Car Comp 1/4W 5% 2.2K	1065-2201
R3	Res. Car Comp 1/4W 5% 10K	1065-1002
R4	Res. Car Comp 1/4W 5% 2.2K	1065-2201
R5	Res. Car Comp 1/4W 5% 2.2K	1065-2201
R6	Res. Car Comp 1/4W 5% 2.2K	1065-2201
R13	Res. Car Comp 1/4W 5% 2.2K	1065-2201
R14	Res. Car Comp 1/4W 5% 2.2K	1065-2201
U1	I/C MM74LS373N	1101-0373
U2	Resistor Network 2.2K	1073-2201
U3	Resistor Network 2.2K	1073-2201
U4	I/C SN74LS00N	1101-7400
U5	I/C MM74LS373N	1101-0373
U6	I/C MM74LS245N	1101-0245
U7	I/C MM74LS244N	1101-0244
U8	I/C MM74LS244N	1101-0244
U9	I/C SN74LS04N	1101-7404
U10	I/C AM91L31BDC	1103-9131
U11	I/C AM91L31BDC	1103-9131
U12	I/C AM91L31BDC	1103-9131
U13	I/C AM91L31BDC	1103-9131
U14	I/C AM91L31BDC	1103-9131
U17	I/C AM91L31BDC	1103-9131
U18	I/C AM91L31BDC	1103-9131
U19	I/C AM91L31BDC	1103-9131
U20	I/C AM91L31BDC	1103-9131
U21	I/C AM91L31BDC	1103-9131
U24	I/C P8259	1100-8259
U26	I/C MM74LS245N	1101-0245
U27	I/C P8085	1103-8085
U28	I/C MM74LS244N	1101-0244
U29	I/C MM74LS244N	1101-0244
U30	I.C. 74LS08N	1101-7408
U31	I/C SN7465138N	1101-0138

Model 7640C

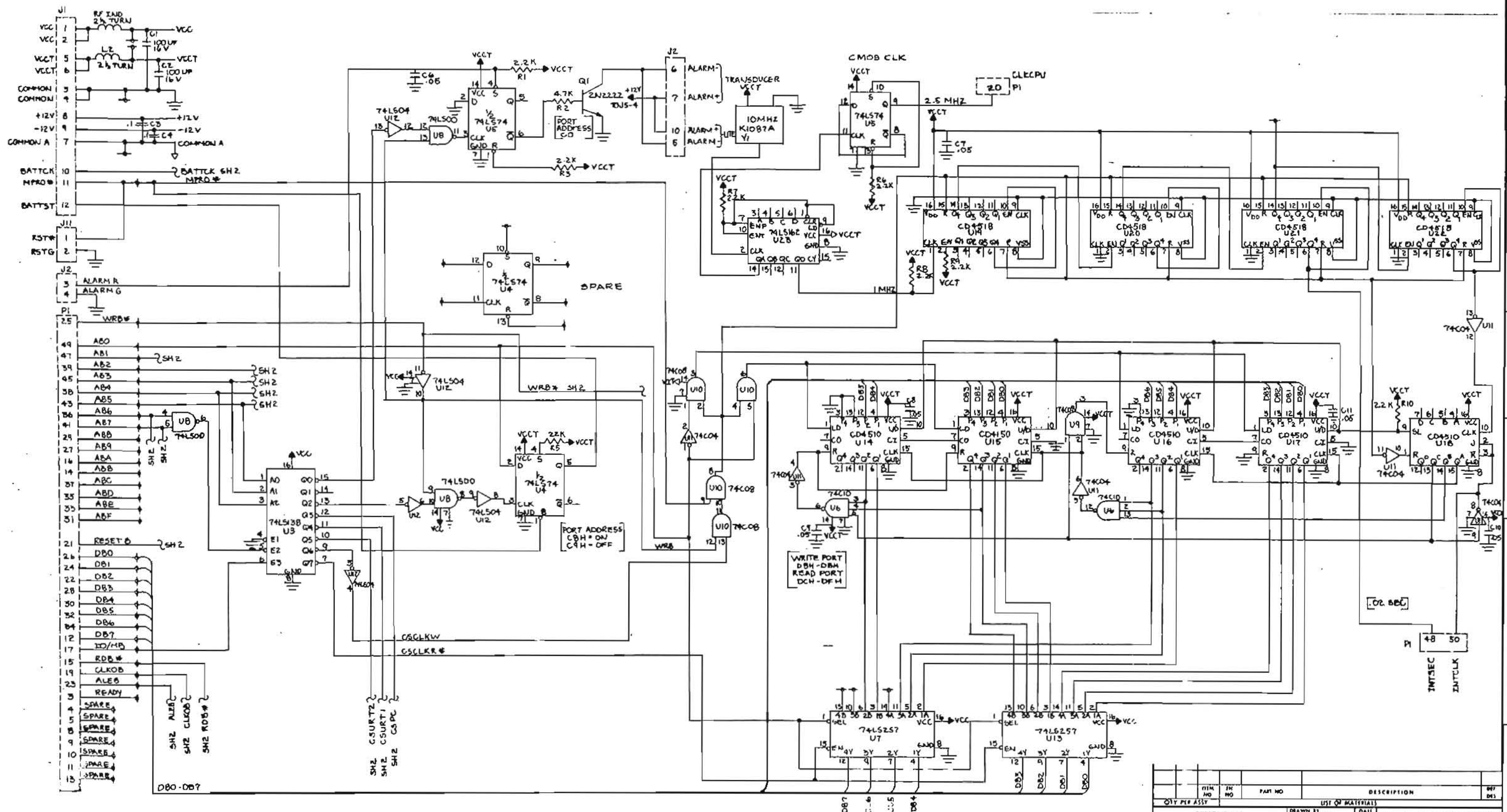
CPU Assembly

6608-1970

Rev B

CKT. REF.	DESCRIPTION	TFT STOCK NO.
C1	Cap. Elect 100MFD	1010-0101
C2	Cap. Cer Disc .05MFD	1005-5039
C4	Cap. Elect 100MFD	1010-0101
C5	Cap. Cer Disc .05MFD	1005-5039
C6	Cap. Cer Disc .05MFD	1005-5039
C8	Cap. Cer Disc .05MFD	1005-5039
C9	Cap. Cer Disc .05MFD	1005-5039
C10	Cap. Cer Disc .05MFD	1005-5039
C11	Cap. Cer Disc .05MFD	1005-5039
C12	Cap. Cer Disc .05MFD	1005-5039
C15	Cap. Cer Disc .05MFD	1005-5039
C16	Cap. Cer Disc .05MFD	1005-5039
C17	Cap. Cer Disc .05MFD	1005-5039
C18	Cap. Cer Disc .05MFD	1005-5039
C19	Cap. Cer Disc .05MFD	1005-5039
C20	Cap. Cer Disc .05MFD	1005-5039
C21	Cap. Cer Disc .05MFD	1005-5039
C22	Cap. Cer Disc .05MFD	1005-5039
C23	Cap. Cer Disc .05MFD	1005-5039
C24	Cap. Cer Disc .05MFD	1005-5039
C25	Cap. Cer Disc .05MFD	1005-5039
C26	Cap. Cer Disc .05MFD	1005-5039
C27	Cap. Cer Disc .05MFD	1005-5039
C28	Cap. Cer Disc .05MFD	1005-5039
C29	Cap. Cer Disc .05MFD	1005-5039
C30	Cap. Cer Disc .05MFD	1005-5039
C31	Cap. Cer Disc .05MFD	1005-5039
C32	Cap. Cer Disc .05MFD	1005-5039
C33	Cap. Cer Disc .05MFD	1005-5039
C34	Cap. Cer Disc .05MFD	1005-5039
C35	Cap. Cer Disc .05MFD	1005-5039
C36	Cap. Cer Disc .05MFD	1005-5039
C37	Cap. Cer Disc .05MFD	1005-5039
C38	Cap. Cer Disc .05MFD	1005-5039
C39	Cap. Cer Disc .05MFD	1005-5039
C40	Cap. Cer Disc .05MFD	1005-5039
C42	Cap. Tan 10MFD	1008-0101
C43	Cap. Cer Disc .05MFD	1005-5039
C44	Cap. Cer Disc .05MFD	1005-5039
C45	Cap. Cer Disc .05MFD	1005-5039
C46	Cap. Cer Disc .05MFD	1005-5039
C47	Cap. Cer Disc .05MFD	1005-5039
C48	Cap. Cer Disc .05MFD	1005-5039

ITEM NO		QTY	PART NO	DESCRIPTION	REV
QTY PER Assy		LIST OF MATERIALS			DWG
REMOVE ALL BURRS AND SHARP EDGES		DRAWN BY A. COOKIN CHECKED BY J. L. [Signature] PROT. ENG APP'D [Signature] APP'D [Signature]		TFT TIME & FREQUENCY TECHNOLOGY INC 30000 Olcott St. Sunnyvale, California 95035 (408) 246-6335 TITLE 7640C- -10 8-ARD	
TOLERANCES UNLESS OTHERWISE SPECIFIED		APP'D [Signature] APP'D [Signature]		TITLE 7640C- -10 8-ARD	
XX ± ANGULAR XXX ± ±		APP'D [Signature] APP'D [Signature]		TITLE 7640C- -10 8-ARD	
DO NOT SCALE THIS PRINT		APP'D [Signature] APP'D [Signature]		TITLE 7640C- -10 8-ARD	



4

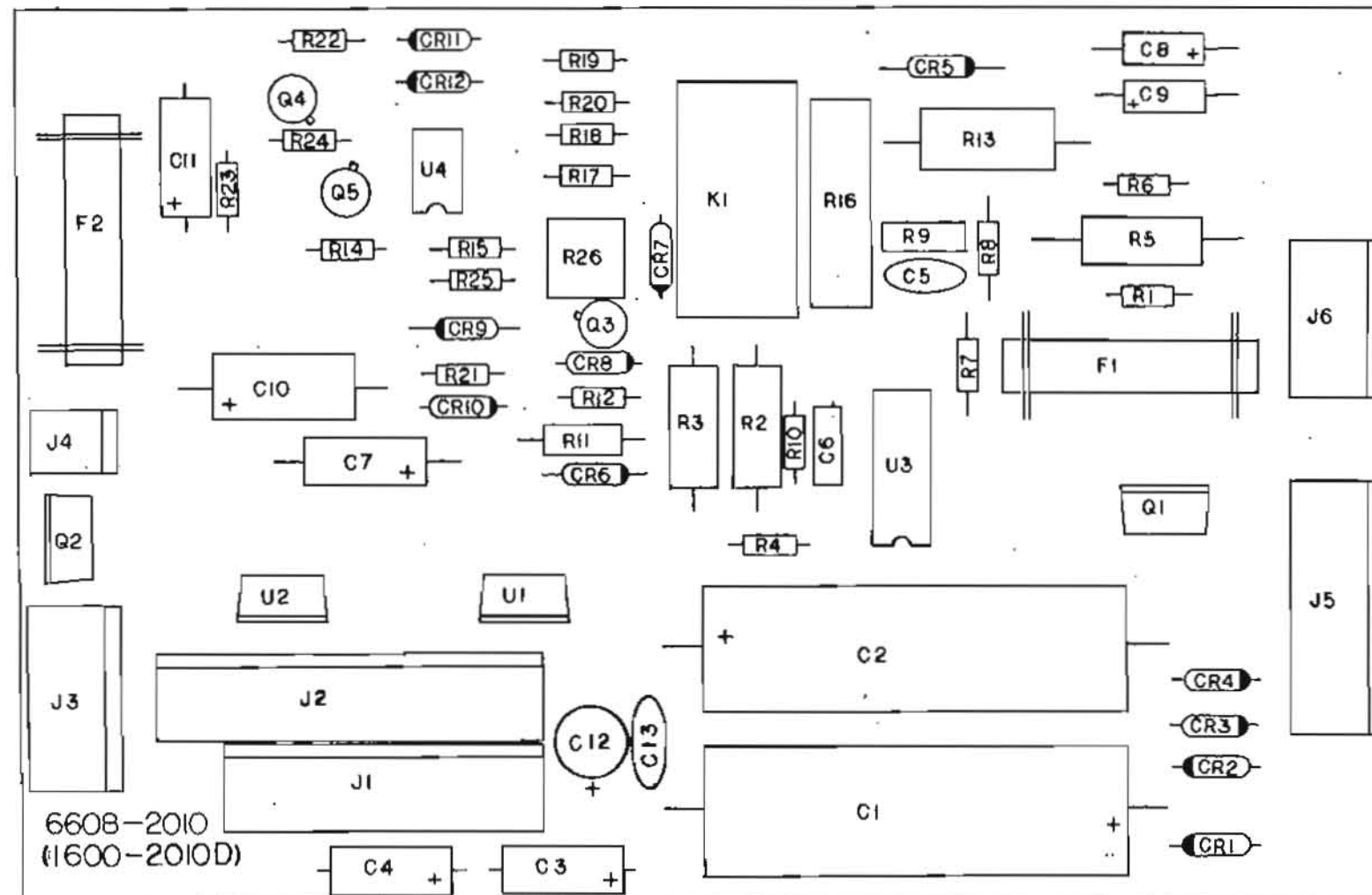
3

2

1

NEXT ASSY
5102-2800USED ON
7640 C
7840

REVISIONS				
REV	DATE	DESCRIPTION	DATE	APPROVED
A	11-30-78	REL TO PROD		Flaw
B	4/27/79	REVISED PER ECO 749		KK



REFERENCE: SCHEMATIC 6601-2640

CONTRACT NO.		TIME & FREQUENCY TECHNOLOGY INC.	
APPROVALS	DATE	POWER SUPPLY 7640C	
DESIGNER	11/30/78	SIZE	PCB NO.
CHECKED		C	6608-2010
ISSUED		SCALE	SHEET 1 OF 1

FIGURE 6-1-7

4

3

2

1

Model 7640C
Model 7840

I/O Board Assembly

6608-1990
Rev C

CKT. REF.	DESCRIPTION	TFT STOCK NO.
C1	Cap. Elect 100MFD	1010-0101
C2	Cap. Elect 100MFD	1010-0101
C3	Cap. Cer Disc .1MFD	1005-0100
C4	Cap. Cer Disc .1MFD	1005-0100
C6	Cap. Cer Disc .05MFD	1005-5039
C7	Cap. Cer Disc .05MFD	1005-5039
C8	Cap. Cer Disc .05MFD	1005-5039
C9	Cap. Cer Disc .05MFD	1005-5039
C10	Cap. Cer Disc .05MFD	1005-5039
C11	Cap. Cer Disc .05MFD	1005-5039
C12	Cap. Cer Disc .05MFD	1005-5039
C13	Cap. Cer Disc .05MFD	1005-5039
C14	Cap. Cer Disc .05MFD	1005-5039
CR1	Dio 1N4737 Zener	1283-4737
CR2	Dio 1N4737 Zener	1283-4737
L1	Choke RF 2 1/2 T	1530-0025
L2	Choke RF 2 1/2 T	1530-0025
Q1	Trans 2N2222	1271-2222
R1	Res. Car Comp 1/4W 5% 2.2K	1065-2201
R2	Res. Car Comp 1/4W 5% 4.7K	1065-4701
R3	Res. Car Comp 1/4W 5% 2.2K	1065-2201
R5	Res. Car Comp 1/4W 5% 2.2K	1065-2201
R6	Res. Car Comp 1/4W 5% 2.2K	1065-2201
R7	Res. Car Comp 1/4W 5% 2.2K	1065-2201
R8	Res. Car Comp 1/4W 5% 2.2K	1065-2201
R9	Res. Car Comp 1/4W 5% 2.2K	1065-2201
R10	Res. Car Comp 1/4W 5% 2.2K	1065-2201
R11	Res. Car Comp 1/4W 5% 2.2K	1065-2201
U1	I/C SN7465138N	1101-0138
U2	I/C MM74LS244N	1101-0244
U3	I/C SN7465138N	1101-0138
U4	I/C MM74LS74N	1101-7474
U5	I/C MM74LS74N	1101-7474
U6	I/C MM74C10N	1102-7410
U7	I/C MM74LS5257	1101-0257
U8	I/C SN74LS00N	1101-7400
U9	I/C MM74C08N	1102-7408
U10	I/C MM74C08N	1102-7408
U11	I/C MM74C04	1102-7404

Model 7640C
Model 7840

I/O Board Assembly

6608-1990

Rev C

CKT. REF.	DESCRIPTION	TFT STOCK NO.
U12	I/C SN74LS04N	1101-7404
U13	I/C MM74LS5257	1101-0257
U14	I/C CD4510BE	1102-4510
U15	I/C CD4510BE	1102-4510
U16	I/C CD4510BE	1102-4510
U17	I/C CD4510BE	1102-4510
U18	I/C MM74C195	1102-4195
U19	I/C CD4518BE	1102-4518
U20	I/C CD4518BE	1101-4518
U21	I/C CD4518BE	1102-4518
U22	I/C CD4518BE	1102-4518
U23	I/C MM74LS162	1101-0162
Y1	Crystal OSC TCXO 10MHZ	2450-1002
J1	Conn 12 Pin	2250-6012
J2	Conn 10 Pin	2250-6010
J4	Plug 3 Pin	2250-6003
J5	Conn 12 Pin	2250-6012
J10	Plug 2 Pin	2250-6002
J11	Plug 2 Pin	2250-6002
J12	Plug 4 Pin	2250-6004
T1	XFMR 600 OHM 1.1	1500-0600
	Socket I/C 14 Pin	2250-1014
	Socket I/C 16 Pin	2250-1016
	Socket I/C Dip-2C Pin	2250-1020
	PC Board I/O 7640C	1600-1990
	PC BD Assy FSK Det 7640C	6608-1604
	Cable Assy A2A1J to A2J5	4750-0083
	Reference Schematic	6601-2630

Model 7640C

Power Supply Board Assy

6608-2010
Rev B

CKT. REF.	DESCRIPTION	TFT STOCK NO.
C1	Cap. Elect 1000 MFD 25V	1010-1001
C2	Cap. Elect 1000 MFD 25V	1010-1001
C3	Cap. Tan 10 MFD 20V 10%	1008-0101
C4	Cap. Tan 10 MFD 20V 10%	1008-0101
C5	Cap. Cer Disc .01UF	1005-1039
C6	Cap. Mica 100 PF	1001-0101
C7	Cap. Elect 15 MFD 25V	1010-0150
C8	Cap. Tan 10 MFD 20V 10%	1008-0101
C9	Cap. Tan 10 MFD 20V 10%	1008-0101
C10	Cap. Elect 100 MFD 16V	1010-0101
C11	Cap. Tan 10 MFD 20V 10%	1008-0101
CR1	Dio IN4002 Rect.	1284-4002
CR2	Dio IN4002 Rect.	1284-4002
CR3	Dio IN4002 Rect.	1284-4002
CR4	Dio IN4002 Rect.	1284-4002
CR5	Dio MR501	1281-0501
CR6	Dio IN5525B Zener	1283-5525
CR7	Dio IN4002 Rect.	1284-4002
CR8	Dio IN4002 Rect.	1284-4002
CR9	Dio IN5341 Zener	1283-5341
CR10	Dio IN4733 Zener	1283-4733
CR11	Dio IN4002 Rect.	1284-4002
CR12	Dio IN4002 Rect.	1284-4002
F1	Fuse 5A FB	1900-0015
K1	Relay A2530-08	1880-0003
Q1	Trans MJE521 NPN	1271-0521
Q2	SCR TIC-116V	1273-4441
Q3	Trans 2N2222	1271-2222
Q4	Trans 2N4275	1271-4275
Q5	Trans 2N4275	1271-4275
R1	Res. Car Comp 1/4W 5% 1K	1065-1001
R2	Res. WW 3W 5% .1	1068-0191
R3	Res. WW 3W 5% .1	1068-0191
R4	Res. Car Comp 1/4W 5% 470	1065-0470
R5	Res. Car Comp 2W 5% 51	1067-1551
R6	Res. Car Comp 1/4W 5% 1K	1065-1001
R7	Res. MT FLM 1/8W 1% 1K	1061-1001
R8	Res. MT FLM 1/8W 1% 2K	1061-2001
R9	Res. VAR PC MT 500 1T	1072-0500

Model 7640C

Power Supply Board Assy

6608-2010

Rev B

CKT. REF.	DESCRIPTION	TFT STOCK NO.
R10	Res. Car Comp 1/4W 5% 680	1065-0680
R11	Res. Car Comp 1/2W 5% 10.	1066-0010
R12	Res. Car Comp 1/4W 5% 4.7K	1065-4701
R13	Res. Car Comp 2W 5% 10	1068-0014
R14	Res. Car Comp 1/4W 5% 2.2K	1065-2201
R15	Res. Car Comp 1/4W 5% 10K	1065-1002
R16	Res. Car Comp 5W 5% 22	1068-0022
R17	Res. Car Comp 1/4W 5% 1.2K	1065-1201
R18	Res. Car Comp 1/4W 5% 1K	1065-1001
R19	Res. Car Comp 1/4W 5% 1K	1065-1001
R20	Res. Car Comp 1/4W 5% 1K	1065-1001
R21	Res. Car Comp 1/4W 5% 22	1065-0022
R22	Res. Car Comp 1/4W 5% 4.7K	1065-4701
R23	Res. Car Comp 1/4W 5% 4.7K	1065-4701
R24	Res. Car Comp 1/4W 5% 10K	1065-1002
R25	Res. Car Comp 1/4W 5% 4.7K	1065-4701
R26	Res. Var PC MT 100 1T	1072-0100
U1	I/C Reg 1/2 Amp + 12V	1100-4212
U2	I/C Reg 1/2 Amp 12V	1100-2012
U3	I/C LM723CN	1100-0723
U4	I/C LM311	1100-0311
J1	Conn 10 Pin Polerized	2250-6010
J2	Conn 12 Pin Molex	2250-6012
J3	Plug 6 Pin	2250-6006
J4	Plug 2 Pin	2250-6002
J5	Conn 8 Pin Molex	2250-6008
J6	Conn Molex Pol 5 Pin	2250-6005
	Fuse Clip	1910-0005
	P.C.B.	1600-2010
	Cable Assy 4 Wire	4750-0086

NEXT ASSY	USED ON	REVISIONS					
	K640C	SYM	DESCRIPTION	DR	CHK	AUTH	DATE
		A	RELEASED TO PRODUCTION		Stan	414	3/6/75
	7840	B	REVISED PER EQ 762	DW	Stan	Stan	7/26/75

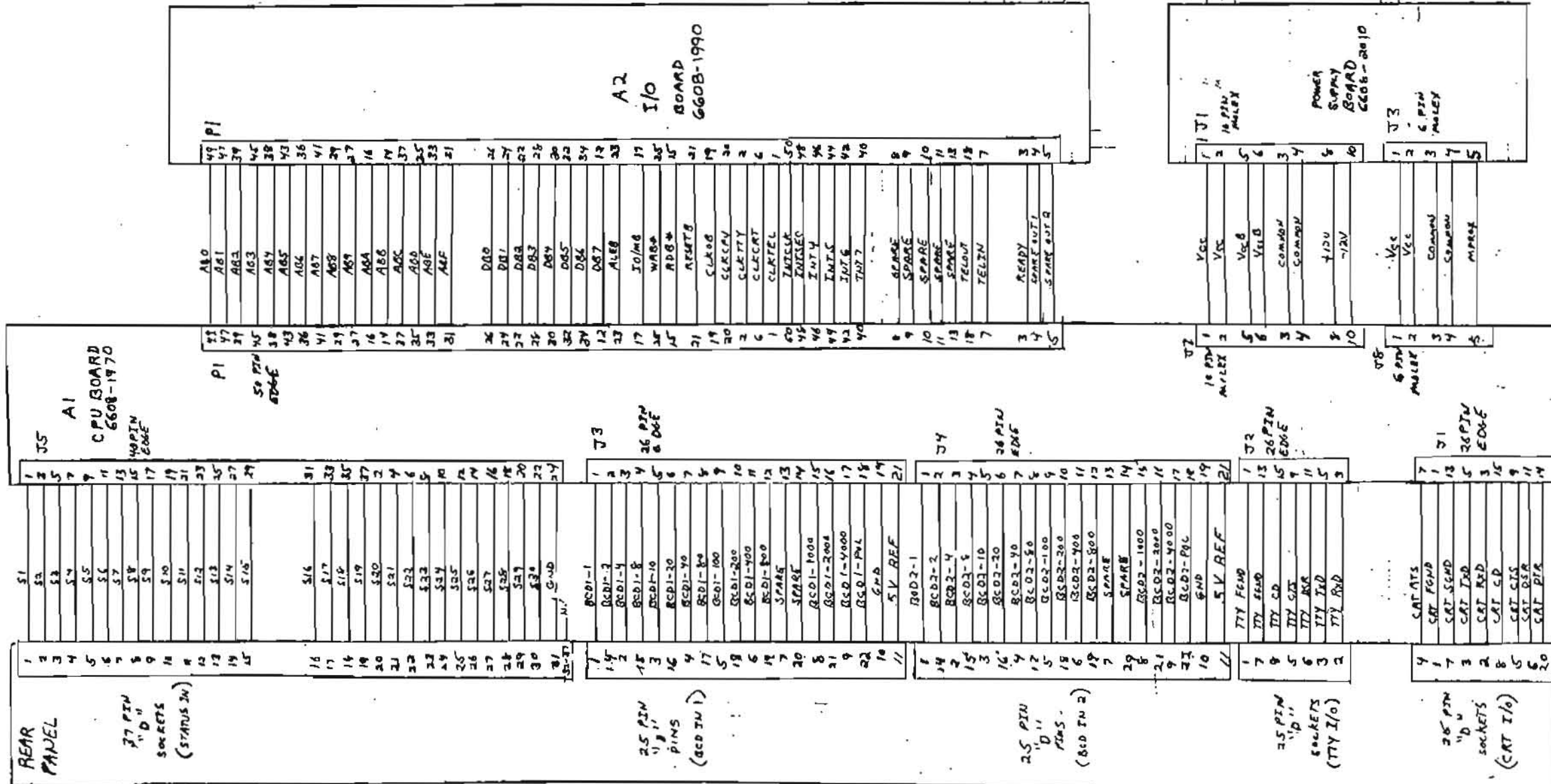
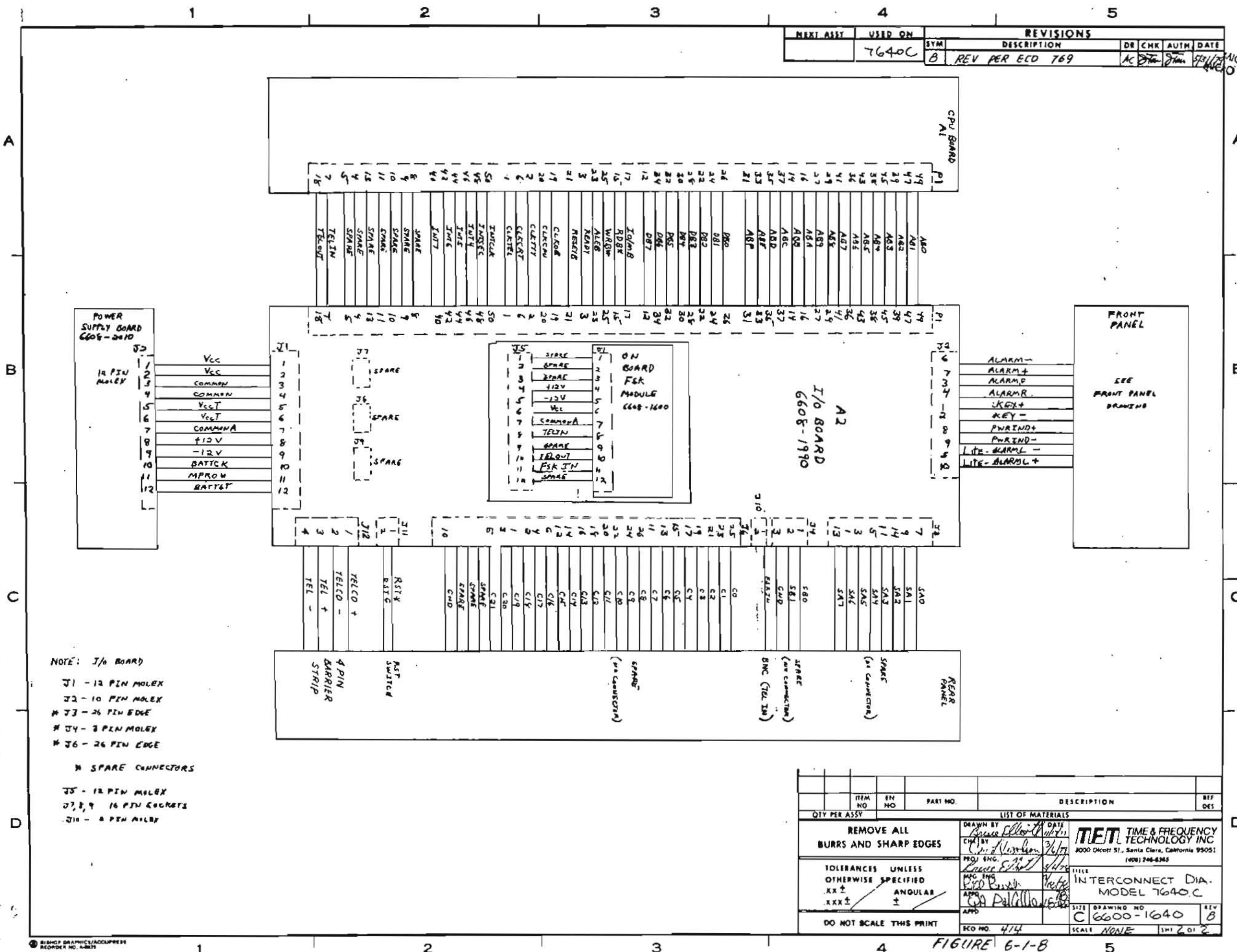
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FIGURE 6-1-8

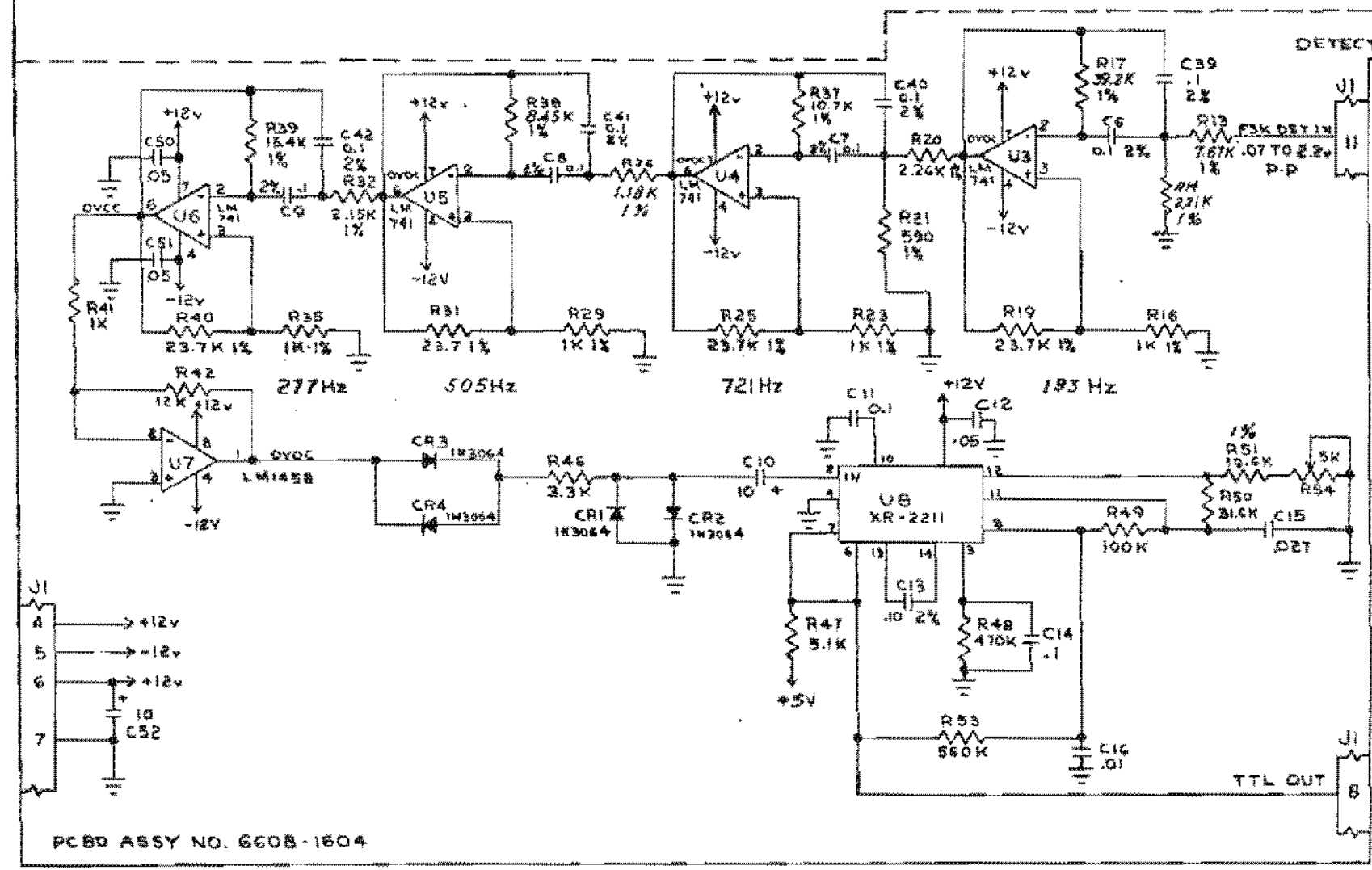


NOTE: I/O BOARD
J1 - 12 PIN MOLEX
J2 - 10 PIN MOLEX
J3 - 26 PIN EDGE
J4 - 3 PIN MOLEX
J5 - 26 PIN EDGE
J6 - 26 PIN EDGE
J7 - 12 PIN MOLEX
J8, J9 - 16 PIN EDGE
J10 - 8 PIN MOLEX

REVISIONS			
REV	DESCRIPTION	DR	CHK
1	REV PER ECD 769	AC	ST

ITEM NO	EN NO	PART NO	DESCRIPTION	REV
LIST OF MATERIALS				
REMOVE ALL BURRS AND SHARP EDGES				
TOLERANCES UNLESS OTHERWISE SPECIFIED				
DO NOT SCALE THIS PRINT				

NEXT ASSY		USED ON		REVISIONS		
6608-1604		7840C		DATE	APPROVED	
		7840				
		A		REL TO PROD	12-8-78	
		B		REVISED PER ECO 460	6-26-78	
		C		REVISED PER ECO 462	7-18-78	
		D		REVISED PER ECO 778	5-29-79	



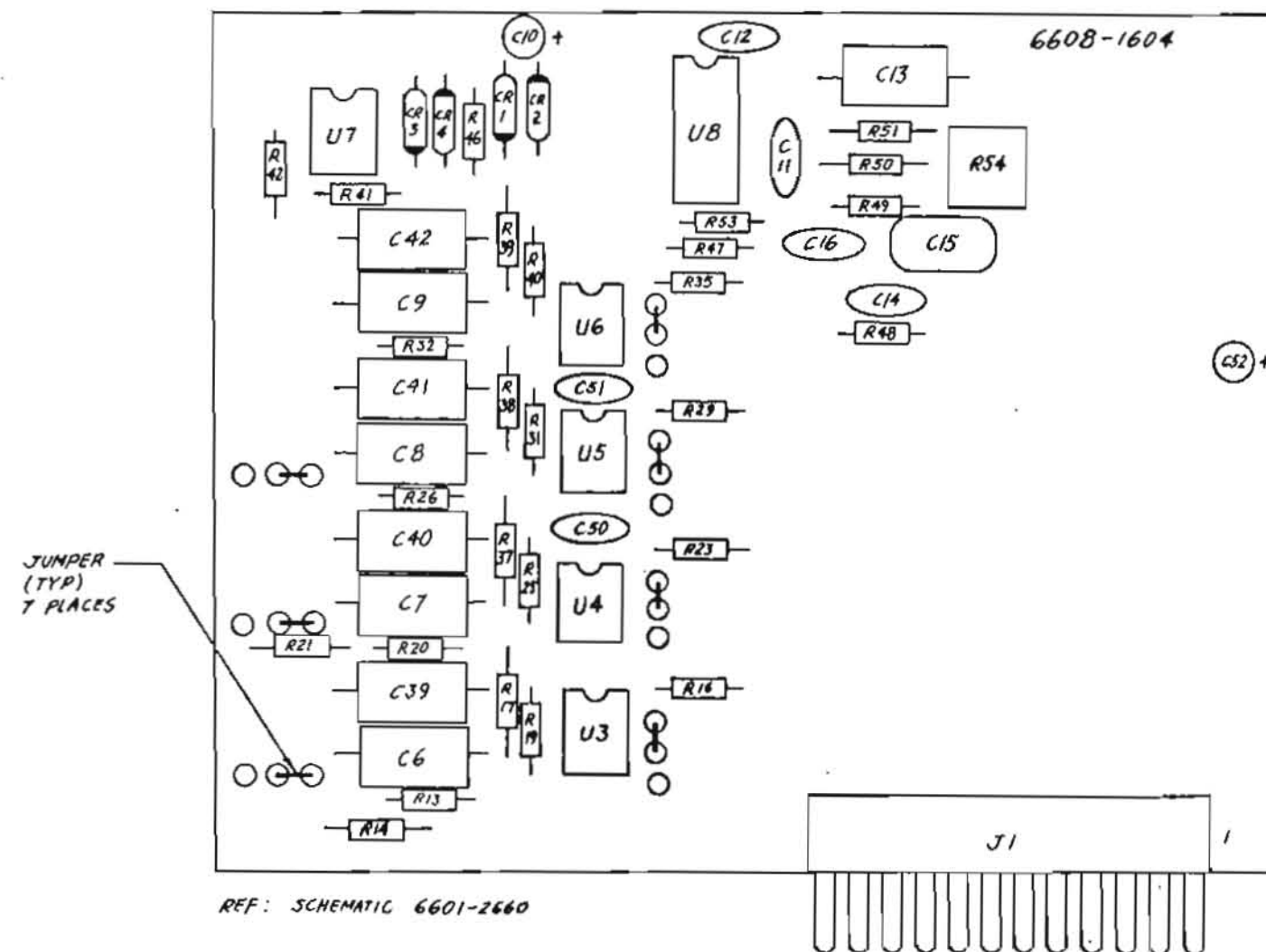
LAST USED	NOT USED
C52	C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C31, C32, C33, C34, C35, C36, C37, C38, C39, C40, C41, C42, C43, C44, C45, C46, C47, C48, C49
CR4	
J1	
R54	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23, R24, R25, R26, R27, R28, R29, R30, R31, R32, R33, R34, R35, R36, R37, R38, R39, R40, R41, R42, R43, R44, R45, R46, R47, R48, R49, R50, R51, R52, R53, R54, R55, R56, R57, R58, R59, R60, R61, R62, R63, R64, R65, R66, R67, R68, R69, R70, R71, R72, R73, R74, R75, R76, R77, R78, R79, R80, R81, R82, R83, R84, R85, R86, R87, R88, R89, R90, R91, R92, R93, R94, R95, R96, R97, R98, R99, R100
U8	U1, U2

2 CAPACITOR VALUES ARE IN MICROFARADS
 1 RESISTOR VALUES ARE IN OHMS, 1/4 W, 5%
 NOTES: UNLESS OTHERWISE SPECIFIED:

APPROVALS		DATE		TIME & FREQUENCY TECHNOLOGY INC.	
DESIGNED	11-8-78	SCHEMATIC FSK MODEM			
CHECKED	12-8-78				
DATE	12-8-78				
SCALE		FIG. NO.	6601-2660	REV.	D
12-8-78		C			

FIGURE 6-1-9

REVISIONS				
DATE	REV	DESCRIPTION	DATE	APPROVED
	D	Revised per ECO 462	7/5/78	
	C	Redrawn and revised per ECO 780	5/29/79	G. E. H. V. M.



REF: SCHEMATIC 6601-2660

QTY IN QTY	QTY IN QTY	PART OR IDENTIFYING NO	DESCRIPTION OR DESCRIPTION	MATERIAL SPECIFICATION
PARTS LIST				
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES FRACTIONS DECIMALS ANGLES JOINTS JOINTS			CONTRACT NO.	
MATERIAL			APPROVALS	DATE
6608-1990 7640 C			APPROVED Ames Lam	5/29/79
PART NO.			DATE	DATE
5/29/79			5/29/79	5/29/79
APPLICATION			DO NOT SCALE DRAWING	SCALE
			SCALE	SCALE
			SCALE	SCALE

FIGURE 6-1-10

Model 7640C

FSK Modem

Assembly 6608-1604

Rev D

CKT. REF.	DESCRIPTION	TFT STOCK NO.
C6	Cap. Poly Carb 0.1 MFD	1006-0101
C7	Cap. Poly Carb 0.1 MFD	1006-0101
C8	Cap. Poly Carb 0.1MFD	1006-0101
C9	Cap. Poly Carb 0.1MFD	1006-0101
C10	Cap. Tan 10MFD	1008-0100
C11	Cap. Cer Disc 0.1MFD	1005-0100
C12	Cap. Cer Disc .05MFD	1005-5039
C13	Cap. Poly Carb 0.1MFD	1006-0010
C14	Cap. Cer Disc 0.1MFD	1005-0100
C15	Cap. Poly 0.027MFD	1002-0271
C16	Cap. Cer Disc .01MFD	1005-1039
C39	Cap. Poly Carb 0.1MFD	1006-0101
C40	Cap. Poly Carb 0.1MFD	1006-0101
C41	Cap. Poly Carb 0.1MFD	1006-0101
C42	Cap. Poly Carb 0.1MFD	1006-0101
C50	Cap. Cer Disc .05MFD	1005-5039
C51	Cap. Cer Disc .05MFD	1005-5039
C52	Cap. Tan 10MFD	1008-0100
CR1	Diode 1N3064	1281-3064
CR2	Diode 1N3064	1281-3064
CR3	Diode 1N3064	1281-3064
CR4	Diode 1N3064	1281-3064
R13	Res MT FLM 1/8W 1% 7.87K	1061-7871
R14	Res MT FLM 1/8W 1% 2.21K	1061-2221
R16	Res MT FLM 1/8W 1% 1K	1061-1001
R17	Res MT FLM 1/8W 1% 39.2K	1061-3922
R19	Res MT FLM 1/8W 1% 23.7K	1061-2372
R20	Res MT FLM 1/8W 1% 2.26K	1061-2261
R21	Res MT FLM 1/8W 1% 590K	1061-5900
R23	Res MT FLM 1/8W 1% 1K	1061-1001
R25	Res MT FLM 1/8W 1% 23.7K	1061-2372
R26	Res MT FLM 1/8W 1% 1.18K	1061-1181
R29	Res MT FLM 1/8W 1% 1K	1061-1001
R31	Res MT FLM 1/8W 1% 23.7K	1061-2372
R32	Res MT FLM 1/8W 1% 2.15K	1061-2151
R35	Res MT FLM 1/8W 1% 1K	1061-1001
R37	Res MT FLM 1/8W 1% 10.7K	1061-1072
R38	Res MT FLM 1/8W 1% 8.45K	1061-8451
R39	Res MT FLM 1/8W 1% 15.4K	1061-1542
R40	Res MT FLM 1/8W 1% 23.7K	1061-2372

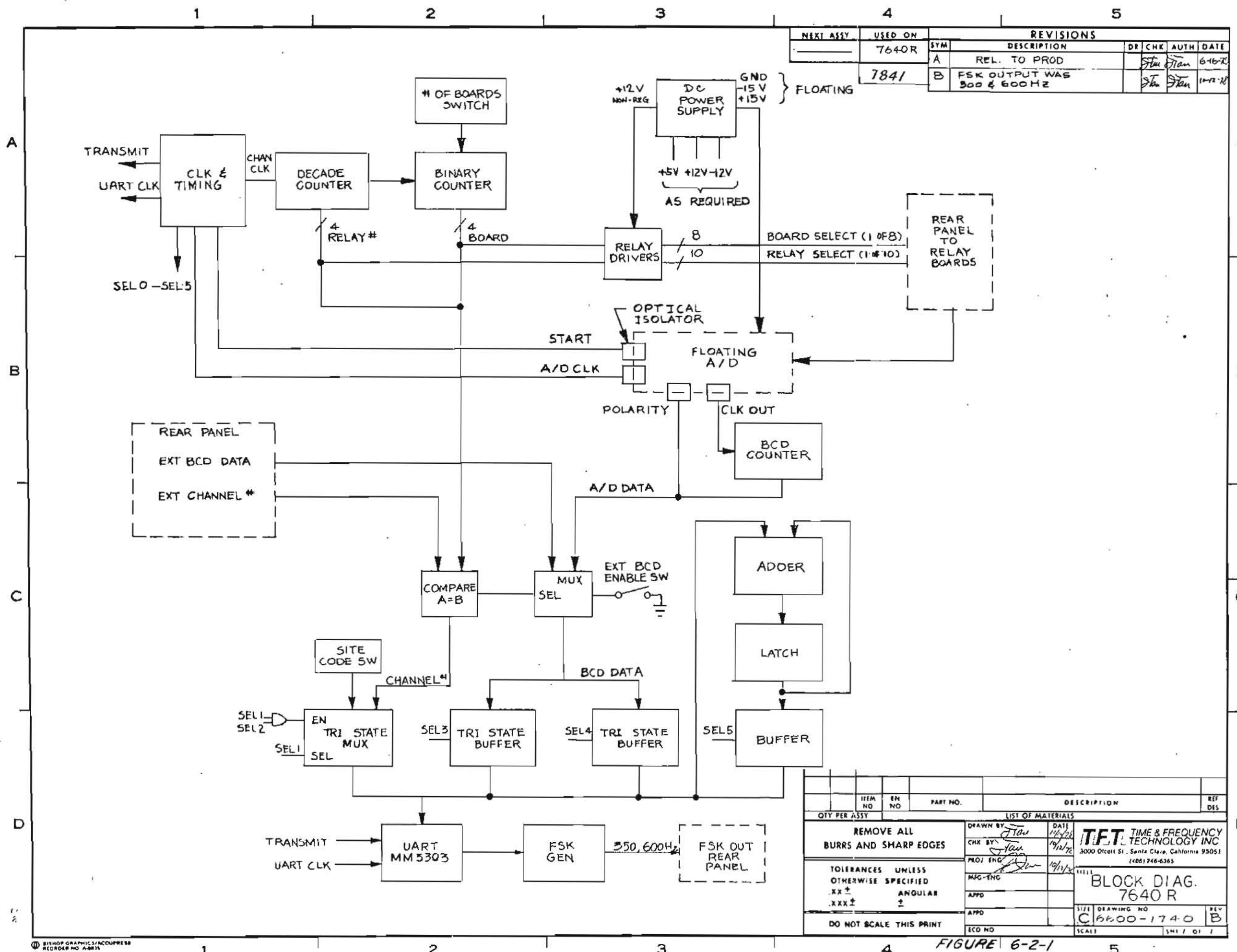
Model 7640C

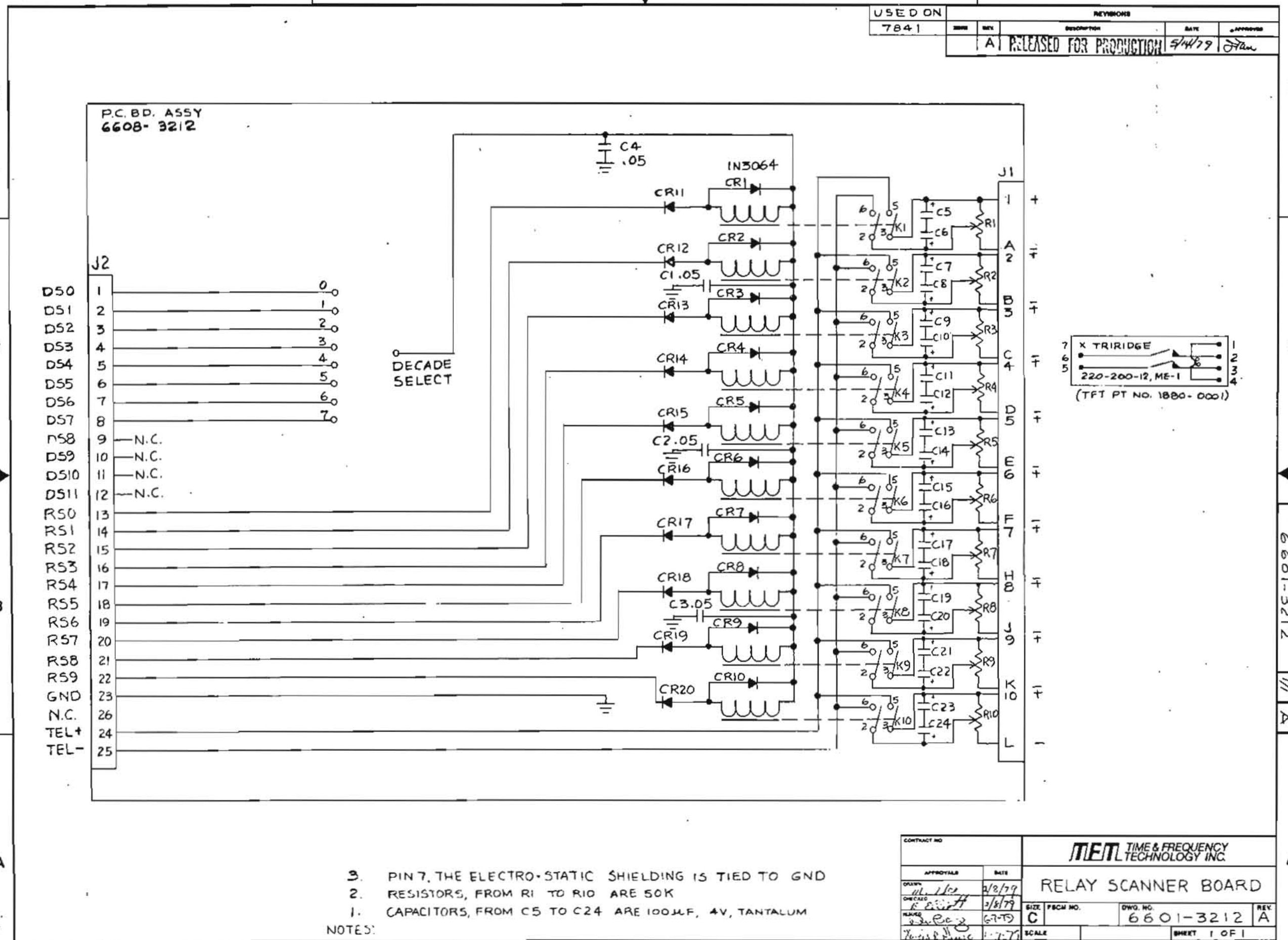
FSK Modem

Assembly 6608-1604

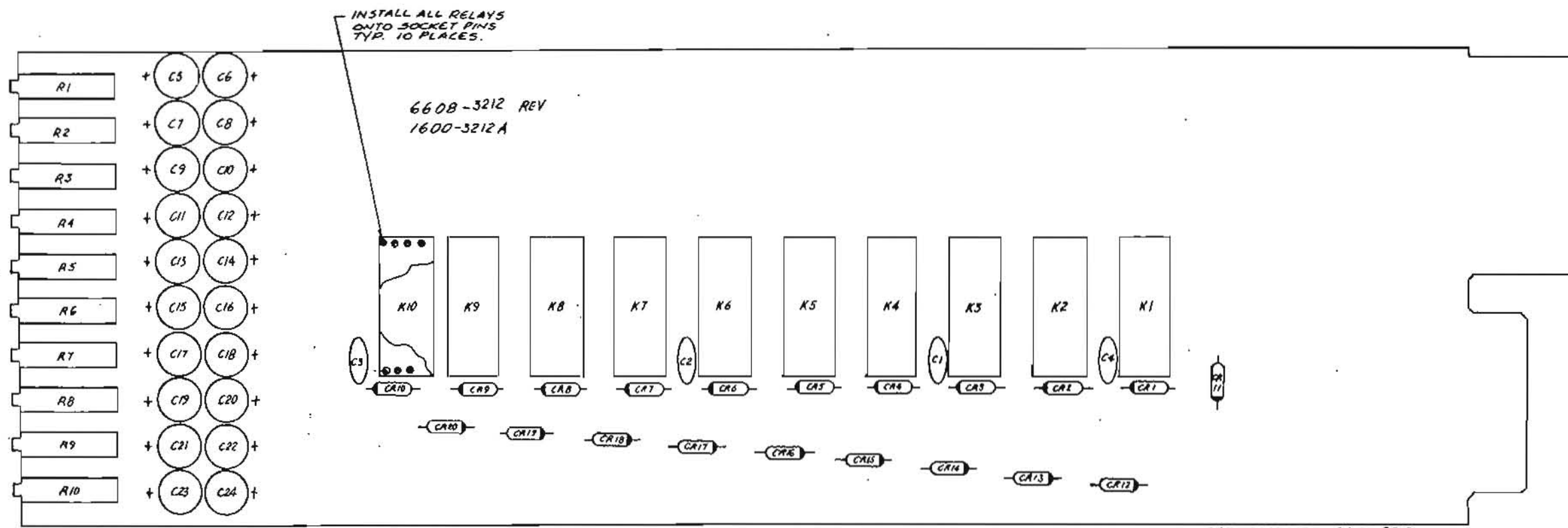
Rev D

CKT. REF.	DESCRIPTION	TFT STOCK NO.
R41	Res Car Comp 1/4W 5% 1K	1065-1001
R42	Res Car Comp 1/4W 5% 12K	1065-1202
R46	Res Car Comp 1/4W 5% 3.3K	1065-3301
R47	Res Car Comp 1/4W 5% 5.1K	1065-5101
R48	Res Car Comp 1/4W 5% 470K	1065-4703
R49	Res Car Comp 1/4W 5% 100K	1065-1003
R50	Res MT FLM 1/8W 1% 31.6K	1061-3162
R51	Res MT FLM 1/8W 1% 19.6K	1061-1962
R53	Res Car Comp 1/4 W 5% 560K	1065-5603
R54	Res Var PC MT 5K 1T	1072-5001
U3	I/C LM741CN	1100-0741
U4	I/C LM741CN	1100-0741
U5	I/C LM741CN	1100-0741
U6	I/C LM741CN	1100-0741
U7	I/C MC1458CG	1100-1458
U8	I/C XR2211CP	1100-2211
	PC Board 7610 Modem	1600-1600
	Socket, I/C 8 Pin	2250-1008
	Socket, I/C 14 Pin	2250-1014
J1	Plug 12 Pin	2250-8812
	Schematic	6601-2660C





REV. NO.	DATE	DESCRIPTION	BY	CHE	DATE
5802-3266	7841	A	REL. FOR PRODUCTION	AC	ST



ITEM NO.	QTY. REL. ASSY	DATE	DESCRIPTION	REV.
5802-3266	7841	7/8/79	REL. FOR PRODUCTION	A

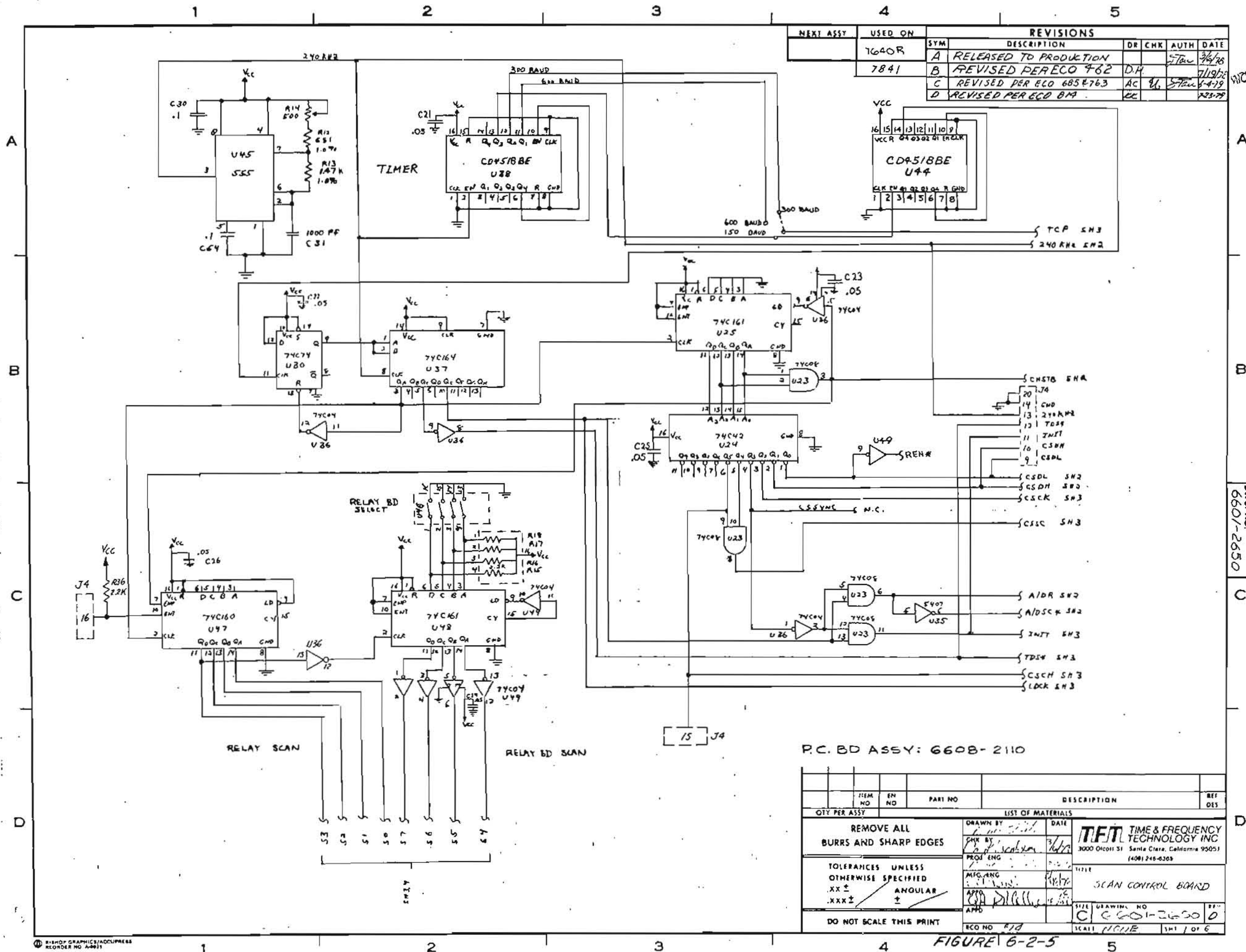
REMOVE ALL BURRS AND SHARP EDGES	TOLEANCES UNLESS OTHERWISE SPECIFIED .XX ± .XXX ±	ANGULAR ±	DO NOT SCALE THIS PRINT
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DRAWN BY Ann G. Eijer	DATE 7/8/79	TIME & FREQUENCY TECHNOLOGY INC. 3800 Olson Dr. Santa Clara, California 95050 (408) 246-8206
CHK BY JLT	DATE 7/8/79	TITLE P.C. ASSY RELAY SCANNER BOARD
PROJ. NO. 6601-3212	REV. A	SIZE D
APPD.	SCALE 2/1	1 OF 1

FIGURE 6-2-3 8

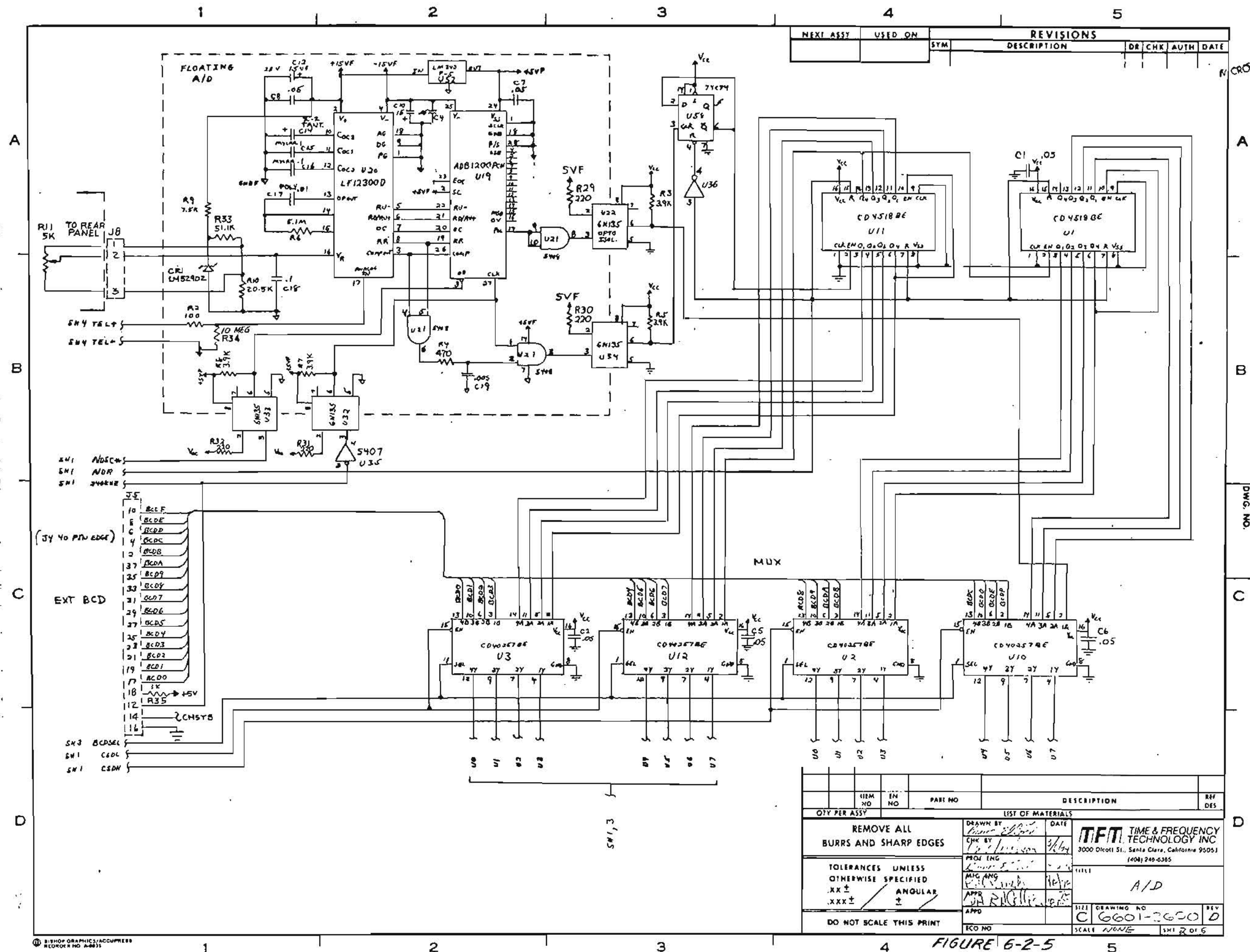
CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
C1	Cap Cer Disc .05 MFD	1	1005-5039
C2	Cap Cer Disc .05 MFD	1	1005-5039
C3	Cap Cer Disc .05 MFD	1	1005-5039
C4	Cap Cer Disc .05 MFD	1	1005-5039
C5	Cap Tant 100 MF 4V	1	1008-0112
C6	Cap Tant 100 MF 4V	1	1008-0112
C7	Cap Tant 100 MF 4V	1	1008-0112
C8	Cap Tant 100 MF 4V	1	1008-0112
C9	Cap Tant 100 MF 4V	1	1008-0112
C10	Cap Tant 100 MF 4V	1	1008-0112
C11	Cap Tant 100 MF 4V	1	1008-0112
C12	Cap Tant 100 MF 4V	1	1008-0112
C13	Cap Tant 100 MF 4V	1	1008-0112
C14	Cap Tant 100 MF 4V	1	1008-0112
C15	Cap Tant 100 MF 4V	1	1008-0112
C16	Cap Tant 100 MF 4V	1	1008-0112
C17	Cap Tant 100 MF 4V	1	1008-0112
C18	Cap Tant 100 MF 4V	1	1008-0112
C19	Cap Tant 100 MF 4V	1	1008-0112
C20	Cap Tant 100 MF 4V	1	1008-0112
C21	Cap Tant 100 MF 4V	1	1008-0112
C22	Cap Tant 100 MF 4V	1	1008-0112
C23	Cap Tant 100 MF 4V	1	1008-0112
C24	Cap Tant 100 MF 4V	1	1008-0112
C25	Cap Tant 100 MF 4V	1	1008-0112
CR1	Diode 1N3064	1	1281-3064
CR2	Diode 1N3064	1	1281-3064
CR3	Diode 1N3064	1	1281-3064
CR4	Diode 1N3064	1	1281-3064
CR5	Diode 1N3064	1	1281-3064
CR6	Diode 1N3064	1	1281-3064
CR7	Diode 1N3064	1	1281-3064
CR8	Diode 1N3064	1	1281-3064
CR9	Diode 1N3064	1	1281-3064
CR10	Diode 1N3064	1	1281-3064
CR11	Diode 1N3064	1	1281-3064
CR12	Diode 1N3064	1	1281-3064
CR13	Diode 1N3064	1	1281-3064
CR14	Diode 1N3064	1	1281-3064
CR15	Diode 1N3064	1	1281-3064
CR16	Diode 1N3064	1	1281-3064
CR17	Diode 1N3064	1	1281-3064
CR18	Diode 1N3064	1	1281-3064
CR19	Diode 1N3064	1	1281-3064

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
CR20	Diode 1N3064	1	1281-3064
K1	Relay DPST	1	1880-0001
K2	Relay DPST	1	1880-0001
K3	Relay DPST	1	1880-0001
K4	Relay DPST	1	1880-0001
K5	Relay DPST	1	1880-0001
K6	Relay DPST	1	1880-0001
K7	Relay DPST	1	1880-0001
K8	Relay DPST	1	1880-0001
K9	Relay DPST	1	1880-0001
K10	Relay DPST 220-200-12 ME (1)	1	
R1	Res Variable 50K 10T	1	1069-5002
R2	Res Variable 50K 10T	1	1069-5002
R3	Res Variable 50K 10T	1	1069-5002
R4	Res Variable 50K 10T	1	1069-5002
R5	Res Variable 50K 10T	1	1069-5002
R6	Res Variable 50K 10T	1	1069-5002
R7	Res Variable 50K 10T	1	1069-5002
R8	Res Variable 50K 10T	1	1069-5002
R9	Res Variable 50K 10T	1	1069-5002
R10	Res Variable 50K 10T	1	1069-5002
	PC Board	1	1600-3212
	Connector, Jack .025 Pin	70	2250-3703
ASCH	Ref: Schematic		6601-3212



NEXT ASSY		USED ON		REVISIONS			
SYM	DESCRIPTION	DR	CHK	AUTH	DATE		
A	RELEASED TO PRODUCTION			JTB	3/4/78		
B	REVISED PER ECO 762	DH			7/19/78		
C	REVISED PER ECO 685E763	AC			6-4-79		
D	REVISED PER ECO 814	KK			7-23-79		

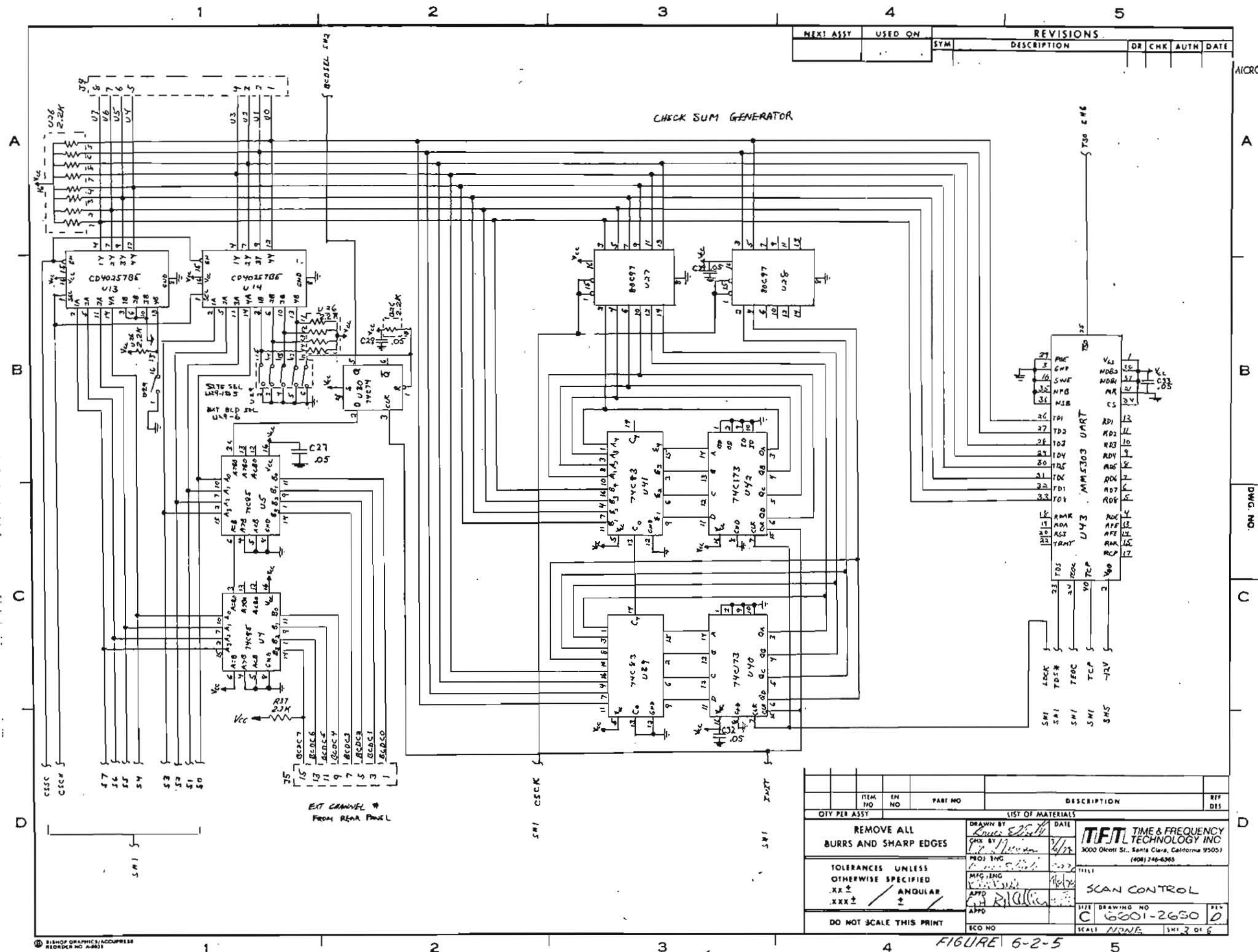
P.C. BD ASSY: 6608-2110									
		ITEM NO	EN NO	PART NO	DESCRIPTION				REF DES
QTY PER ASSY		LIST OF MATERIALS							
REMOVE ALL BURRS AND SHARP EDGES				DRAWN BY	DATE	TFT TIME & FREQUENCY TECHNOLOGY INC 3000 Orcott St Santa Clara, California 95051 (408) 246-0309			
				CHECK BY	3/1/78				
TOLERANCES UNLESS OTHERWISE SPECIFIED .XX ± ANGULAR .XXX ± ±				PROD ENG	3/1/78	TITLE SCAN CONTROL BOARD			
				MFG. ENG	3/1/78				
DO NOT SCALE THIS PRINT				APP'D	3/1/78	SIZE C 6601-2650			
				APP'D					
				ECO NO	210	SHEET 1 OF 6			

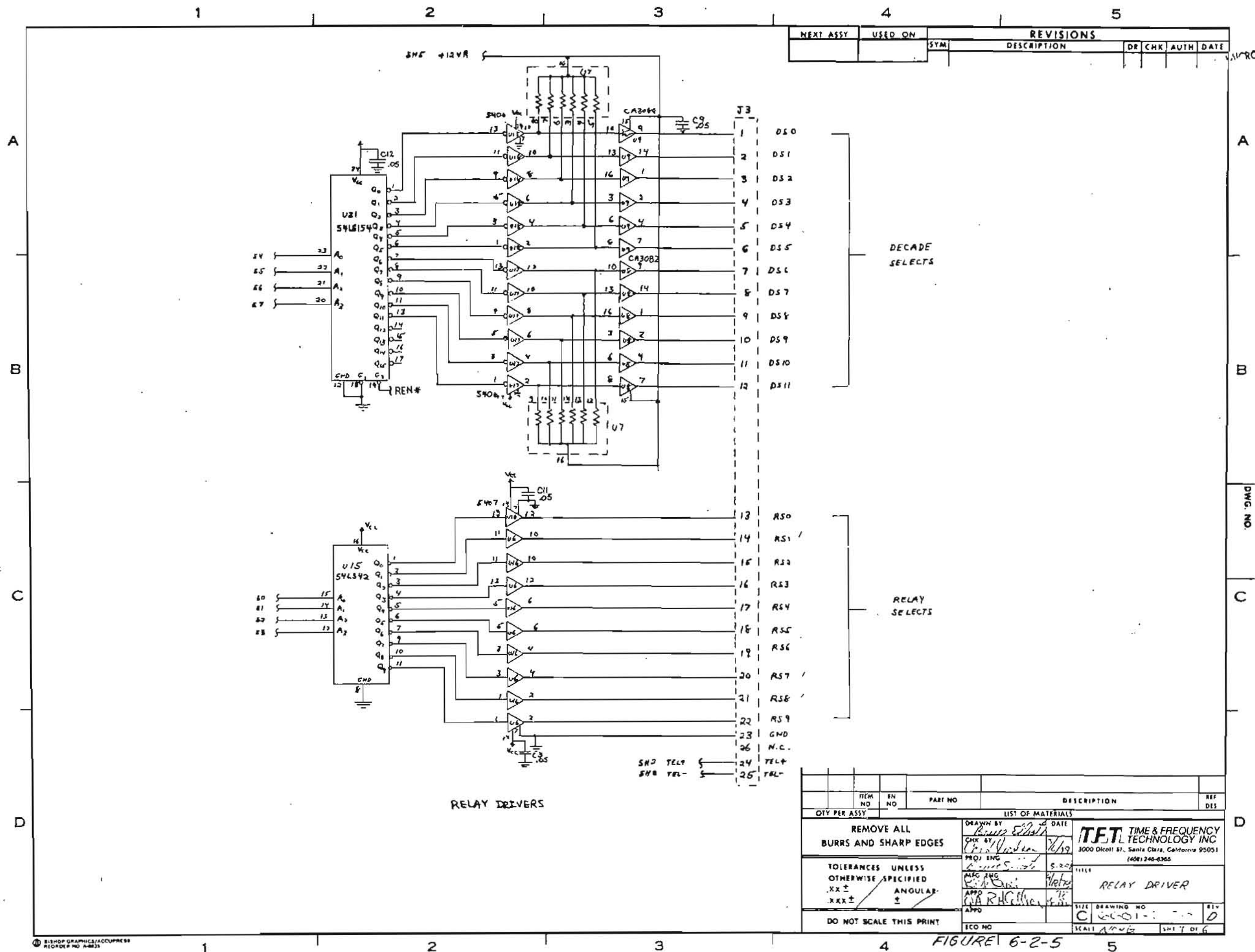


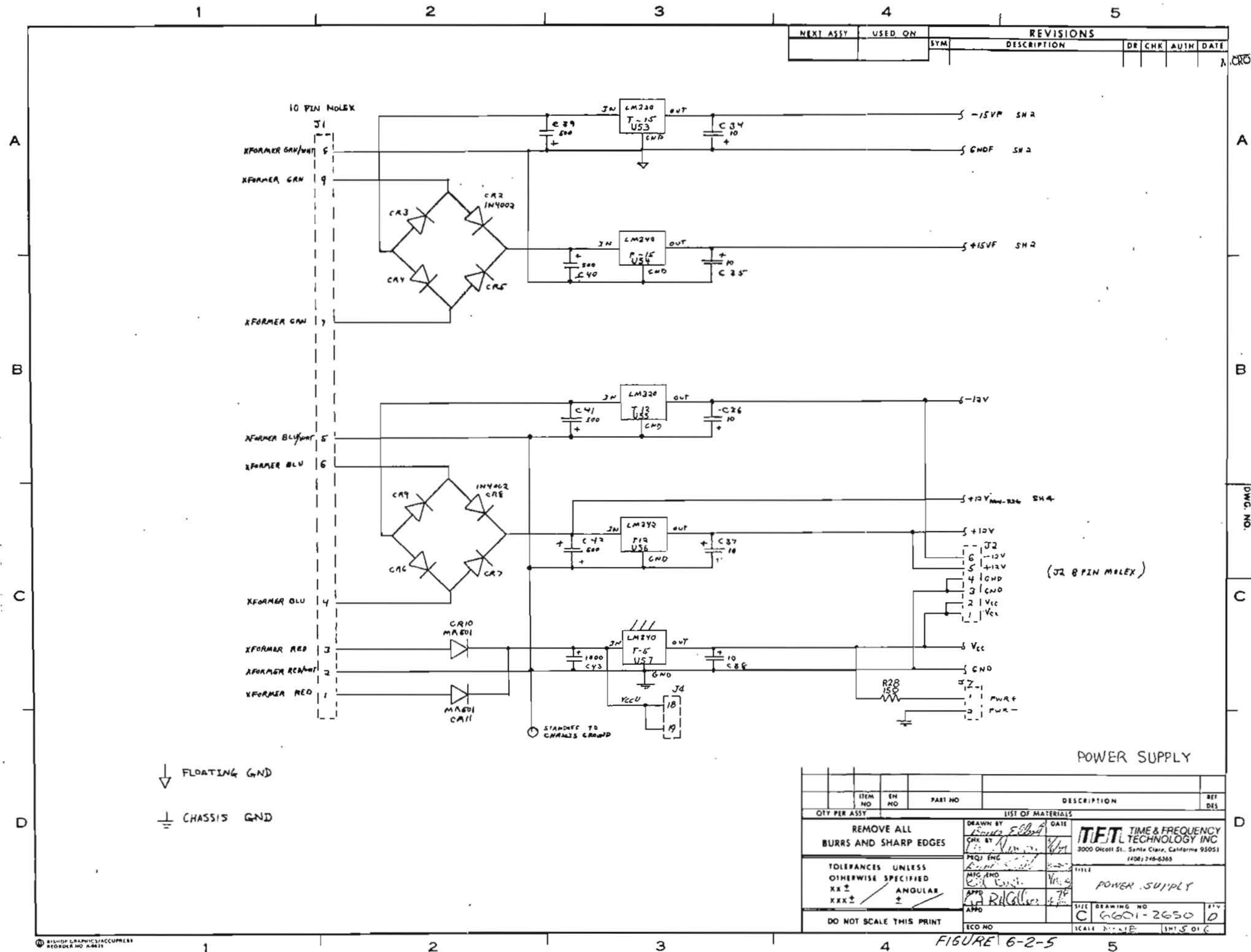
NEXT ASSY		USED ON		REVISIONS			
SYM	DESCRIPTION	DR	CHK	AUTH	DATE		

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

FIGURE 6-2-5







MODEL	REV	DESCRIPTION	DR	CHK	AUTH	DATE
7841	C	REV PER ECO 66/75	AC	JPM	AS	8-4-79

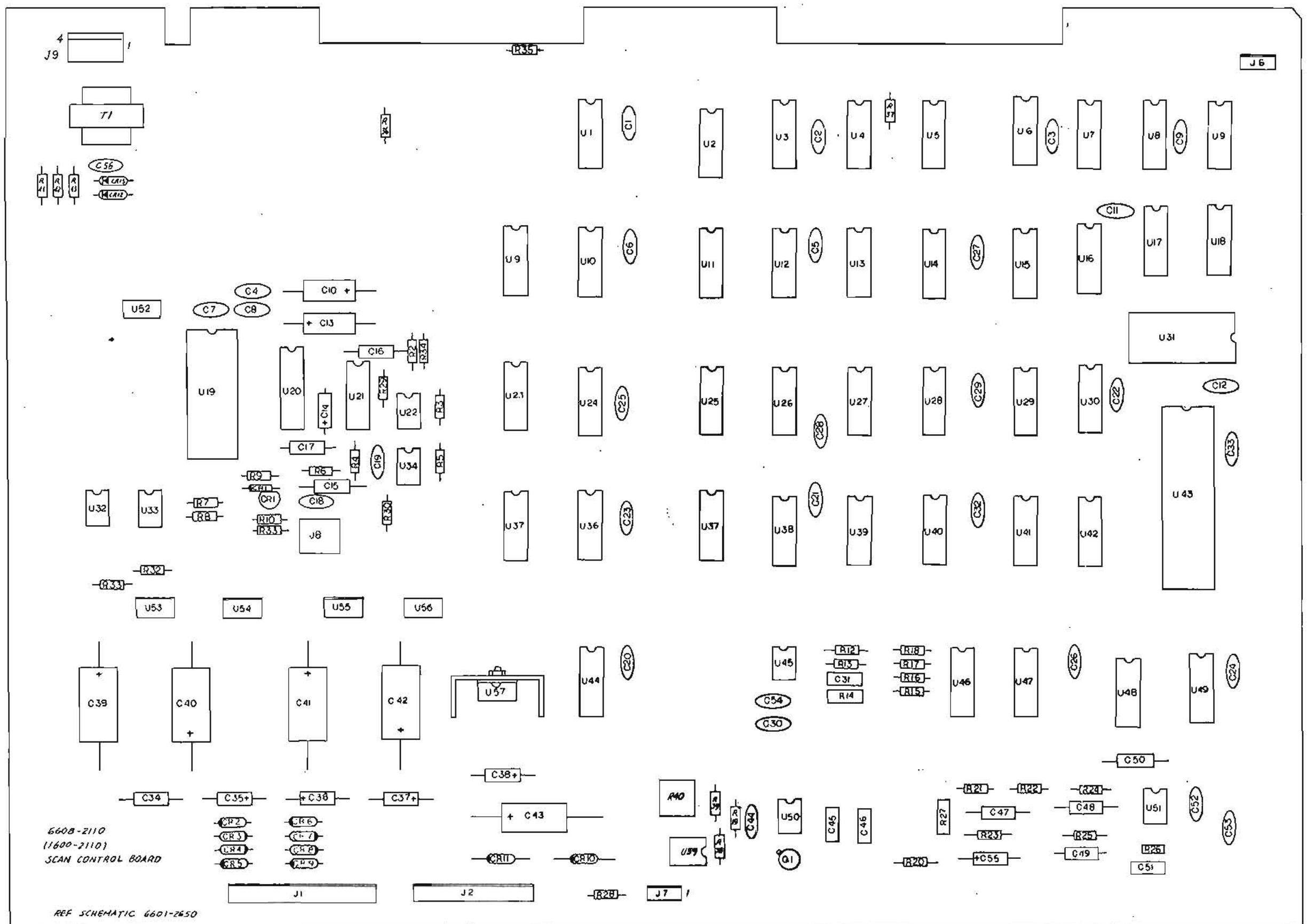


FIGURE 6-2-6

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
C1	Cap Cer Disc .05MFD	1	1005-5039
C2	Cap Cer Disc .05MFD	1	1005-5039
C3	Cap Cer Disc .05MFD	1	1005-5039
C4	Cap Cer Disc .05MFD	1	1005-5039
C5	Cap Cer Disc .05MFD	1	1005-5039
C6	Cap Cer Disc .05MFD	1	1005-5039
C7	Cap Cer Disc .05MFD	1	1005-5039
C8	Cap Cer Disc .05MFD	1	1005-5039
C9	Cap Cer Disc .05MFD	1	1005-5039
C10	Cap Elect 15MFD 25V	1	1010-0150
C11	Cap Cer Disc .05MFD	1	1005-5039
C12	Cap Cer Disc .05MFD	1	1005-5039
C13	Cap Elect 15MFD 25V	1	1010-0150
C14	Cap Tan 2.2MFD 20V 10%	1	1008-0022
C15	Cap Poly Carb .1MFD 50V	1	1006-0010
C16	Cap Poly Carb .1MFD 50V	1	1006-0010
C17	Cap Poly Carb .01MF 5V 2%	1	1006-0001
C18	Cap Cer Disc .1MFD 12V	1	1005-0100
C19	Cap Cer Disc .005MFD	1	1005-5049
C20	Cap Cer Disc .05MFD	1	1005-5039
C21	Cap Cer Disc .05MFD	1	1005-5039
C22	Cap Cer Disc .05MFD	1	1005-5039
C23	Cap Cer Disc .05MFD	1	1005-5039
C24	Cap Cer Disc .05MFD	1	1005-5039
C25	Cap Cer Disc .05MFD	1	1005-5039
C26	Cap Cer Disc .05MFD	1	1005-5039
C27	Cap Cer Disc .05MFD	1	1005-5039
C28	Cap Cer Disc .05MFD	1	1005-5039
C29	Cap Cer Disc .05MFD	1	1005-5039
C30	Cap Cer Disc .1MFD 12V	1	1005-0100
C31	Cap Mica 1000 PF	1	1001-0102
C32	Cap Cer Disc .05MFD	1	1005-5039
C33	Cap Cer Disc .05MFD	1	1005-5039
C34	Cap Tan 10MFD 20V 10%	1	1008-0101
C35	Cap Tan 10MFD 20V 10%	1	1008-0101
C36	Cap Tan 10MFD 20V 10%	1	1008-0101
C37	Cap Tan 10MFD 20V 10%	1	1008-0101
C38	Cap Tan 10MFD 20V 10%	1	1008-0101
C39	Cap Elect 500 MFD 25V	1	1010-0511
C40	Cap Elect 500 MFD 25V	1	1010-0511
C41	Cap Elect 500 MFD 25V	1	1010-0511
C42	Cap Elect 500 MFD 25V	1	1010-0511

Model 7640R

Scan Control Assembly

Assembly 6608-2110

Rev C

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
C43	Cap Elect 1000MFD 15V	1	1010-0102
C44	Cap Cer Disc .1MFD 12V	1	1005-0100
C45	Cap Poly Carb .068MFD 50V	1	1006-0680
C46	Cap Poly Carb .1MFD 50V	1	1006-0010
C47	Cap Poly Carb .047MFD 50V	1	1006-0470
C48	Cap Poly Carb .1MFD 50V	1	1006-0010
C49	Cap Poly Carb .0047MFD	1	1006-0047
C50	Cap Poly Carb .1MFD 50V	1	1006-0010
C51	Cap Poly Carb .0012MFD	1	1006-0012
C52	Cap Cer Disc .05MFD	1	1005-5039
C53	Cap Cer Disc .05MFD	1	1005-5039
C54	Cap Cer Disc .1MFD 12V	1	1005-0100
C55	Cap Tan 10MFD 20V 10%	1	1008-0101
CR1	DIO LM 329DZ RECT	1	1281-0329
CR2	DIO 1N4002 RECT	1	1284-4002
CR3	DIO 1N4002 RECT	1	1284-4002
CR4	DIO 1N4002 RECT	1	1284-4002
CR5	DIO 1N4002 RECT	1	1284-4002
CR6	DIO 1N4002 RECT	1	1284-4002
CR7	DIO 1N4002 RECT	1	1284-4002
CR8	DIO 1N4002 RECT	1	1284-4002
CR9	DIO 1N4002 RECT	1	1284-4002
CR10	DIO MR501	1	1281-0501
CR11	DIO MR501	1	1281-0501
CR12	Diode Zener 1N4737	1	1283-4737
CR13	Diode Zener 1N4737	1	1283-4737
J1	Conn 10 Pin Polarized	1	2250-6010
J2	Conn 8 Pin Molex	1	2250-6008
J6	Plug 2 Pin	1	2250-6002
J7	Plug 2 Pin	1	2250-6002
J8	Plug 3 Pin	1	2250-6003
J9	Plug 4 Pin	1	2250-6004
Q1	TRANS 2N4275	1	1271-4275
R2	Res Car Comp 1/4W 5% 100	1	1065-0100
R3	Res Car Comp 1/4W 5% 3.9K	1	1065-3901
R4	Res Car Comp 1/4W 5% 470	1	1065-0470
R5	Res Car Comp 1/4W 5% 3.9K	1	1065-3901
R6	Res Car Comp 1/4W 5% 1M	1	1065-5104
R7	Res Car Comp 1/4W 5% 3.9K	1	1065-3901

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
R8	Res Car Comp 1/4W 5% 3.9K	1	1065-3901
R9	Res MT FLM 1/8W 1% 7.5K	1	1061-7501
R10	Res MT FLM 1/8W 1% 20.5K	1	1061-2052
R12	Res MT FLM 1/8W 1% 681	1	1061-0681
R13	Res MT FLM 1/8W 1% 1.4K	1	1061-1471
R14	Res Var PC MT 500 1T	1	1072-0500
R15	Res Car Comp 1/4W 5% 2.2K	1	1065-2201
R16	Res Car Comp 1/4W 5% 2.2K	1	1065-2201
R17	Res Car Comp 1/4W 5% 2.2K	1	1065-2201
R18	Res Car Comp 1/4W 5% 2.2K	1	1065-2201
R19	Res Car Comp 1/4W 5% 4.7K	1	1065-4701
R20	Res MT FLM 1/8W 1% 13K	1	1061-1302
R21	Res Car Comp 1/4W 5% 100K	1	1065-1003
R22	Res MT FLM 1/8W 1% 14.7K	1	1061-1472
R23	Res MT FLM 1/8W 1% 14.7K	1	1061-1472
R24	Res MT FLM 1/8W 1% 20.5K	1	1061-2052
R25	Res MT FLM 1/8W 1% 14.7K	1	1061-1472
R26	Res MT FLM 1/8W 1% 20.5K	1	1061-2052
R27	Res Var PC MT 1K 1T	1	1072-1001
R28	Res Car Comp 1/4W 5% 150	1	1065-0150
R29	Res Car Comp 1/4W 5% 220	1	1065-0220
R30	Res Car Comp 1/4W 5% 220	1	1065-0220
R31	Res Car Comp 1/4W 5% 220	1	1065-0220
R32	Res Car Comp 1/4W 5% 220	1	1065-0220
R33	Res MT FLM 1/8W 1% 51.1K	1	1061-5112
R35	Res Car Comp 1/4W 5% 1K	1	1065-1001
R36	Res Car Comp 1/4W 5% 2.2K	1	1065-2201
R37	Res Car Comp 1/4W 5% 2.2K	1	1065-2201
R38	Res Car Comp 1/4W 5% 4.7K	1	1065-4701
R39	Res Car Comp 1/4W 5% 1K	1	1065-1001
R40	Res Var PC MT 10K 1T	1	1072-1002
R41	Res Car Comp 1/4W 5% 390	1	1065-0390
R42	Res Car Comp 1/4W 5% 470	1	1065-0470
R43	Res Car Comp 1/4W 5% 390	1	1065-0390
T1	Transformer, 600 ohm	1	1500-0600
U1	I/C CD 45188E	1	1102-4518
U2	I/C CD 40257BE	1	1102-4025
U3	I/C CD 40257BE	1	1102-4025
U4	I/C MM74C85N	1	1102-7485
U5	I/C MM74C85N	1	1102-7485
U6	I/C 7407N	1	1100-7407
U7	Resistor Network 10K	1	1073-1003
U8	I/C CA3082	1	1100-3082

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
U9	I/C CA3082	1	1100-3082
U10	I/C CD40257BE	1	1102-4025
U11	I/C CD4518BE	1	1102-4518
U12	I/C CD40257BE	1	1102-4025
U13	I/C CD40257BE	1	1102-4025
U14	I/C CD40257BE	1	1102-4025
U15	I/C DM74LS42N	1	1101-7442
U16	I/C 7407NDM	1	1100-7407
U17	I/C 7406N	1	1100-7406
U18	I/C 7406N	1	1100-7406
U19	I/C ADB1200PCN	1	1100-1200
U20	I/C LF12300D	1	1100-1230
U21	I/C 7408N	1	1100-7408
U22	Optic Isolator 5082-4350	1	1099-0002
U23	I/C MM74C08N CMOS	1	1102-7408
U24	I/C MM74C42	1	1102-7442
U25	I/C MM74C161N	1	1102-0161
U26	Resistor Network 2.2K	1	1073-2201
U27	I/C Natl MM80C97N	1	1102-8097
U28	I/C Natl MM80C97N	1	1102-8097
U29	Switch, 16 Pin Dip	1	1800-2068
U30	I/C MM74C74N	1	1102-7474
U31	I/C DM74LS4N	1	1101-7154
U32	Optic Isolator 5082-4350	1	1099-0002
U33	Optic Isolator 5082-4350	1	1099-0002
U34	Optic Isolator 5082-4350	1	1099-0002
U35	I/C DM7407N	1	1100-7407
U36	I/C MM74C04	1	1102-7404
U37	I/C MM74C164	1	1102-0164
U38	I/C CD4518BE	1	1102-4518
U39	I/C MM74C83	1	1102-7483
U40	I/C MM74C173N	1	1102-4173
U41	I/C MM74C83	1	1102-7483
U42	I/C MM74C173N	1	1102-4173
U43	I/C MM5303	1	1100-5303
U44	I/C CD4518BE	1	1102-4518
U45	I/C LM555CN	1	1100-0555
U46	Switch, 16 Pin Dip	1	1800-2068
U47	I/C MM74C160	1	1102-0160
U48	I/C MM74C161N	1	1102-0161
U49	I/C MM74C04	1	1102-7404
U50	I/C LM567CN	1	1100-0567
U51	I/C LM1458N	1	1101-1458
U52	I/C LM342P-5.0	1	1100-4205
U53	I/C LM320MP	1	1100-7816

CKT REF	DESCRIPTION	QTY	TFT STOCK NO.
U54	I/C LM342P	1	1100-7817
U55	I/C Reg 1/2 Amp 12V	1	1100-2012
U56	I/C Reg 1/2 Amp +12V	1	1100-4212
U57	I/C LM340T-05	1	1100-7805
U58	I/C MM74C74N CMOS	1	1102-7474
U59	I/C LM741CN	1	1100-0741
U60	Not Used		
	PC BD. Scan Cont	1	1600-2110
	Socket I/C 18 Pin	1	2250-1001
	Socket I/C 8 Pin	8	2250-1008
	Socket I/C 14 Pin	12	2250-1014
	Socket I/C 16 Pin	29	2250-1016
	Socket I/C 24 Pin	1	2250-1024
	Socket I/C Dip-28 Pin	1	2250-1028
	Socket I/C 40 Pin	1	2250-1040
	Heatsink Vert. Mt.	1	2010-6030
	Screw P. H. 4-40 x 1/4	1	2104-0001
	Ref: Schematic		6601-2650