



**VI.B.4M-2**

**CUSTOMER ENGINEERING**

**PRODUCT MAINTENANCE MANUAL**

**TELECOMMUNICATIONS  
PROCESSOR**

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**JANUARY 1982**

**REORDER NUMBER  
729-1043**

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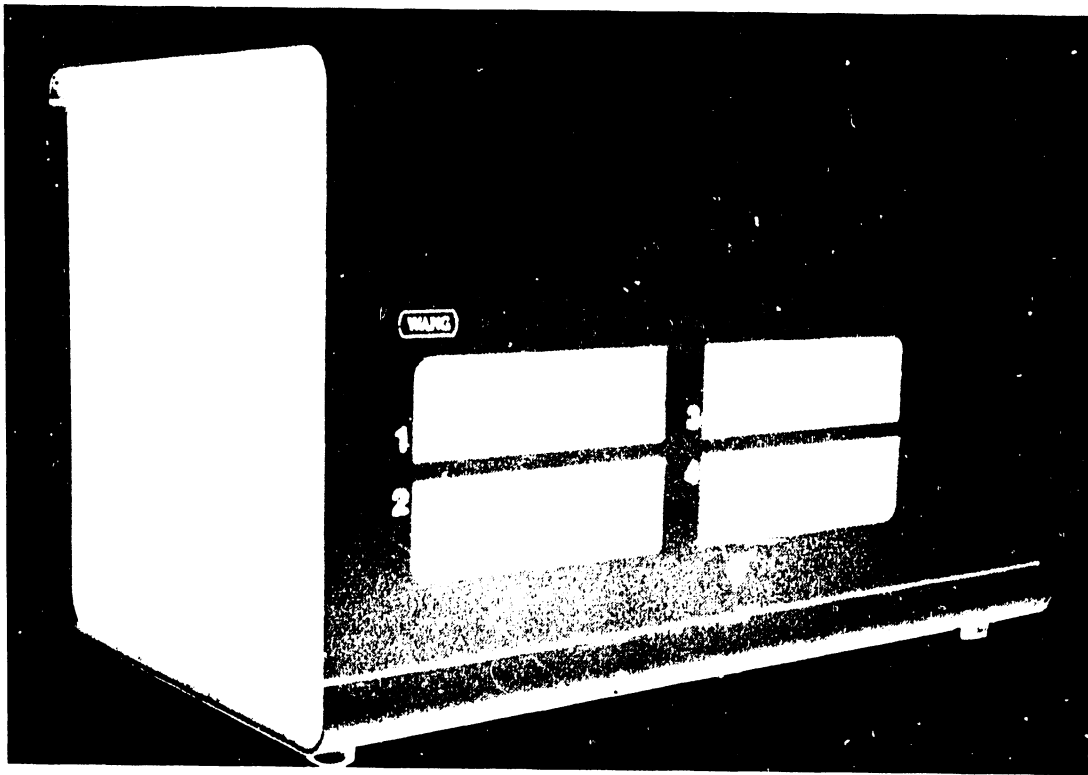
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**SECTION**

**1**

**INTRO-**

**DUCTION**

SECTION 1  
INTRODUCTION

1.1 SCOPE

This document provides field personnel with the information necessary to install, operate and troubleshoot the WANG Telecommunications Processor (herein after referred to as the TCP).

1.2 ORGANIZATION

This New Product Phase (NPP) Maintenance Manual is organized as follows:

Section 1	INTRODUCTION: Provides the reader with the scope, organization and reference documentation for the TCP NPP Maintenance Manual
Section 2	DESCRIPTION: A general description of the TCP and its related modems.
Section 3	REMOVAL/REPLACEMENT/INSTALLATION: Includes removal/replacement of all the TCP major components, a procedure for installing the TC-B1 into the TCP, and installation and interconnection with modems.
Section 5	TROUBLESHOOTING: By performing the diagnostics and tests provided in this section the Service Representative can locate system faults to the board level.

1.3 REFERENCE DOCUMENTATION

For additional information, refer to the following:

1.3.1 Wang Documents

OIS 140	729-0664 (V.A.3M)
OIS 105/115	729-0886 (V.A.5M-2)
Product Service Teleprocessing Guide	729-0830 (I.B.O)
TC-B1	729-0887 (V.B.1M)
VS 80	729-0822 (VI.A.1M)
VS 100	729-0871 (VI.A.2M)
VS 100 Update PSN	729-0964 (VI.A.2)
VS 100 Schematics	729-0872 (VI.A.2M)
VS 100 Schematics Update PSN	729-0488 (VI.A.2)
Diagnostic Handbook	To Be Supplied

1.3.2 Bell Documentation

#40000	Technical Reference Catalog
#40001	Technical Reference Ring Binder
#41001	Complete Set Of Data Communication Technical References
#41004	Data Communications Using Voiceband Private Line Channels
#41005	Switched Telecommunications Network
#41008	Affecting Voiceband Data Transmission--Description of Parameters
#41009	Transmission Parameters Affecting Voiceband Data Transmission--Measuring Techniques
#41021	Interface Specification
#41101	Data Set 103A Interface Specification
#41102	Data Set 103A3 Data Set 103E Data Set 103G



#41103	Data Set 103H Interface Specification
#41105	Data Set 103F Interface Specification 113 Type Data Station Interface Specification
#41201	Data Sets 201A and 201B
#41202	Data Sets 202C and 202D Interface Specification
#41209	Data Set 208A Interface Specification
#41210	Data Set 201C Interface Specification
#41211	Data Set 208B Interface Specification
#41212	Data Sets 202S and 202T Interface Specification
#41213	Data Set 209A Interface Specification
#41214	Data Set 212A Interface Specification
#41450	Data Service Unit Interface Specification
#41601	Data Auxiliary Set 801A (Automatic Calling Unit)
#41602	Data Auxiliary Set 801C (Automatic Calling Unit)
#41603	801C-L 1/2 Data Auxiliary Set Interface Specification
#41802	Data Couplers CBS And CBT For Automatic Terminals

**NOTE:**

WRITTEN INQUIRIES RELATED TO THESE TECHNICAL REFERENCES SHOULD BE  
FORWARDED TO:

AMERICAN TELEPHONE AND TELEGRAPH COMPANY  
INFORMATION DISTRIBUTION CENTER, ROOM C190  
ATTN: TECHNICAL REFERENCES  
P.O. BOX 3513  
NEW BRUNSWICK NEW JERSEY 08903

1.4 SPECIFICATIONS

The specifications for the TCP are listed below:

Power Requirements:

Input Power:                    115 Vac, 60 Hz  
                                     220/240 Vac, 50 Hz

Running Current:                0.5 to 5.0 amperes

Environmental Requirements (Operating):

Temperature:                    50° to 90° F  
                                     10° to 32° C

Humidity:                        15% to 95%

Edvironmental Requirements (Non-Operating):

Temperature:                    -49° to 158° F  
                                     -40° to 70° C

Humidity:                        5% to 95%

Altitude:                        0 to 50,000 feet

**SECTION**

**2**

**TELECOMMUNICA-  
TION**

**PROCESSOR**

**DESCRIPTION**

## SECTION 2

### TELECOMMUNICATION PROCESSOR DESCRIPTION

#### 2.1 SYSTEM OVERVIEW

The Remote WangNet (RWN) was designed to allow OIS systems, with the appropriate hardware and software to communicate interactively or in a batch mode with a VS system. The RWN provides the OIS user with remote access to the data processing resources of the VS system; and gives the VS user the ability to gain remote access to cluster systems that provide both data processing power and word processing capabilities of the OIS system.

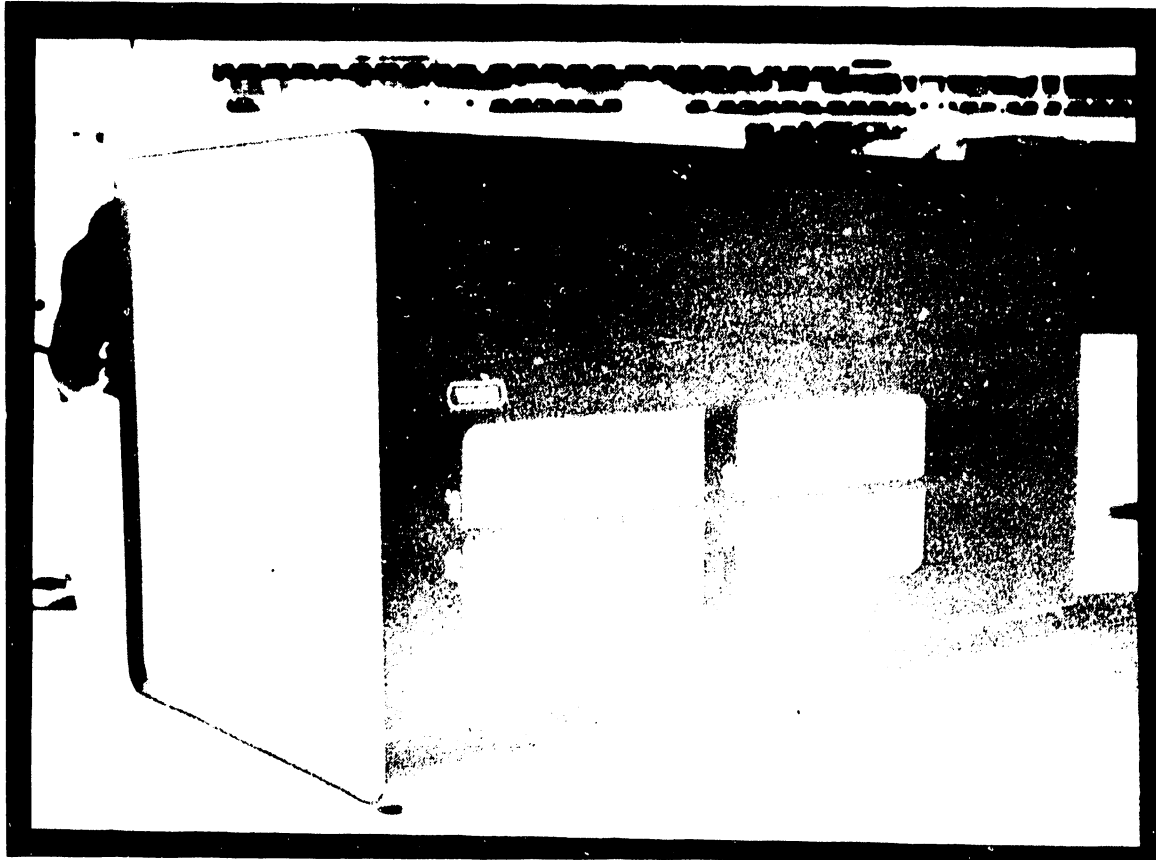
Communications between VS and OIS systems is made possible with the use of a TeleCommunications Processor (TCP). The TCP (see figure 2-1) is a small cabinet which contains a power supply, regulator PCB, motherboard, and can house (internally) up to four TC-B1 PCBs.

The protocol used between the systems is High-Level Data-Link Control (HDLC). Using HDLC protocol, each VS TC-B1 can support 24 virtual circuits and each OIS TC-B1 can support 6 virtual circuits.

The TC-B1 is a combination motherboard/daughterboard Z80 microprocessor-based telecommunications controller, capable of supporting a variety of protocols over a single synchronous data link. The TC-B1 will be used on OIS 105/115/125A/130A/140/145 systems and on VS 80/100 systems.

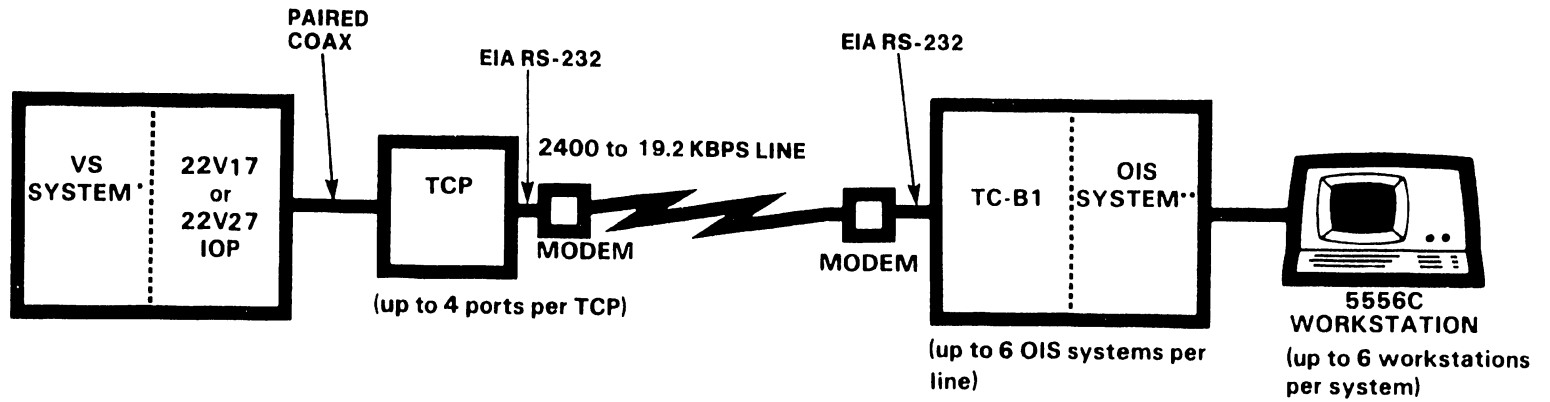
Once a TC-B1 is installed into a TCP, it is connected to the VS by a paired coax cable assembly. The TCP is then connected to a modem or null modem using a standard EIA cable. There is a modem or null modem for each of the four TC-B1's installed into the TCP (refer to figure 2-2).

The first item to be installed going from the VS end of the RWN, is the 22V17 serial IOP. (E.C.O. #19783 has to be implemented, see Appendix I.) This board is installed into the VS cabinet. Connected to the 22V17/27 is a coax



**FIGURE 2-1 TELECOMMUNICATIONS PROCESSOR**

FIGURE 2-2 REMOTE CLUSTER FACILITY



- ANY VS SYSTEM
- \*\* ANY OIS SYSTEM WITH MORE THAN 5 MEGABYTES OF DISK STORAGE

connector panel which is connected to the rear of the VS cabinet. Connecting the VS to the TCP is done by a paired coaxial cable (refer to figure 2-2). A modem is installed at the OIS and connected via a standard EIA cable.

Installed in the OIS system is a TC-B1 which is connected to the modem by a standard EIA cable and to the OIS system by a short coax cable (not shown in figure 2-2).

## 2.2 TC-B1 TELECOMMUNICATIONS CONTROLLER

The controller used with the TCP is the TC-B1. This controller provides a RS-232-C interface and a RS-449-C interface via a 25 pin and 37 pin male connector respectively. The RS-449-C interface will be multiplexed along with the RS-232-C interface. With RS-449-C interface, cable lengths and baud rates are significantly increased over RS-232-C interface. Depending upon the baud rate, a maximum of 4000 feet (1219 meters) of cable between the data terminal (DTE) and the data communication equipment (DCE) can be achieved.

An additional interface with the RS-366 Automatic Calling Unit (ACU) will be available. The ACU permits any terminal or host to call any telephone number in the switched telephone network and to transfer the circuit to the associated modem for the automatic transfer of data.

The memory organization for the TC-B1 has 4K of PROM memory (for power-up diagnostics) and 60K of RAM (for memory). The 4K power-up diagnostic PROM is located on the 7663 motherboard. There is also a light board consisting of "8 LEDES". Which are located on the front panel and indicate the status of the TC-B1.

## 2.3 MODEMS

The modem, or dataset, used with the system may be rented from the telephone company or purchased from any one of several modem vendors. In either case, the telephone company must connect the modem to the telephone network via telephone company installed data access arrangement (DAA). The

DAA consists of a telephone handset and a modem interface rented from the telephone company. Usually a modem or DAA is permanently wired to a wall; therefore, it should be installed as close as possible to the Wang word processing system.

#### NOTE

Ordering a modem for a Wang Customer is not the responsibility of a Wang Salesman nor is the installation of a modem the responsibility of a Wang Serviceman.

The modems used at both ends of a communications line must be compatible. For example, if a BELL 201C type modem is used at one end, another BELL 201C or equivalent must be used at the other end (not a 201A, 208B, 202C, or 202S). The modems listed in Appendix H or their equivalents may be used.

#### 2.3.1 MODEM INTERFACE RS-232-C

The TC-B1 conforms to the nationally recognized EIA RS-232-C and the internationally recognized CCITT V.24 standards for voltage levels and pin connections (refer to PRODUCT SERVICE TELEPROCESSING GUIDE, page 76). The signal polarity and the voltage of driven and detected signals are as follows:

<u>Logic Level</u>	<u>Applied Voltage</u>	<u>Detected Voltage</u>
0 or ON (Spacing)	+8 vdc	+5 to +15 vdc
1 or OFF (Marking)	-8 vdc	-5 to -15 vdc

The pin assignments are listed in Appendix E with both the EIA and the CCITT designations given for the circuit associated with each pin. Also, the signal descriptions and sources are included in Appendix E.



### 2.3.2 MODEM INTERFACE RS-449-C

The familiar RS-232-C interface standard has been used on almost all data communication terminals and modems manufactured since its adoption by the Electronic Industries Association (EIA). However, the RS-232-C has serious shortcomings for use in modern data communications systems--the most critical being speed and distance limitations.

To overcome these shortcomings, the EIA has developed a successor to RS-232-C, called RS-449-C, which has improved performance specifications. For example, data rates have been increased from 20K bps in RS-232-C to 2M bps in RS-449-C. Also, maximum-transmission distances have been extended from 50 ft. to 200 ft (6.09 meters to 15.24 meters). In addition, RS-449-C supports remote loopback testing, and other control functions missing in RS-232-C.

The federal government has recently adopted RS-449-C as a federal standard. Therefore, RS-449-C is expected to come into widespread use during the 1980's and eventually replace RS-232-C altogether.

#### Differences between RS-232-C and RS-449-C

RS-449-C incorporates substantial changes from RS-232-C, for example:

**NEW ELECTRICAL INTERFACE:** The electrical characteristics of the RS-232-C interface are redefined in RS-449-C to allow greater transmission rates and distances.

**NEW CONNECTOR:** A 37-pin connector replaces the 25-pin connector used in the RS-232-C. This enables the use of the extra lines required by the expanded RS-449-C interface.

The RS-449-C interface differs mostly from RS-232-C in the electrical characteristics of the signals passing across the communications interface. For one thing, RS-449-C uses both balanced and unbalanced circuits to carry interface signals, with the balanced circuits carrying the most critical signals. The RS-232-C uses only unbalanced circuits. A balanced RS-449-Circuit, as defined in the RS-422-C standard, consists of a pair of

wires connecting a balanced generator with a differential receiver (see Figure 2-3). An unbalanced circuit, as defined in the RS-423-C standard, comprises a single wire connecting an unbalanced generator with a differential receiver (see Figure 2-3), with electrical ground serving as a common return path for interface signals. The unbalanced circuit configuration is less expensive to implement, because it requires only one wire and connector pin for each interface function. The balanced configuration, however, offers better circuit performance in terms of distance and data rates transmitted.

The maximum transmission rates supported by RS-422-C and RS-423-C circuits differ with circuit length as shown in Fig. 2-2. RS-449-C sets nominal speed limits of 20K bps unbalanced circuits and 2M bps for balanced circuits. The distance limitation is 200 ft., but this limit can be exceeded in special applications by trading off speed for distance, or vice-versa.

The pin assignments are listed in Appendix F with both the CCITT designations given for the circuit associated with each pin.

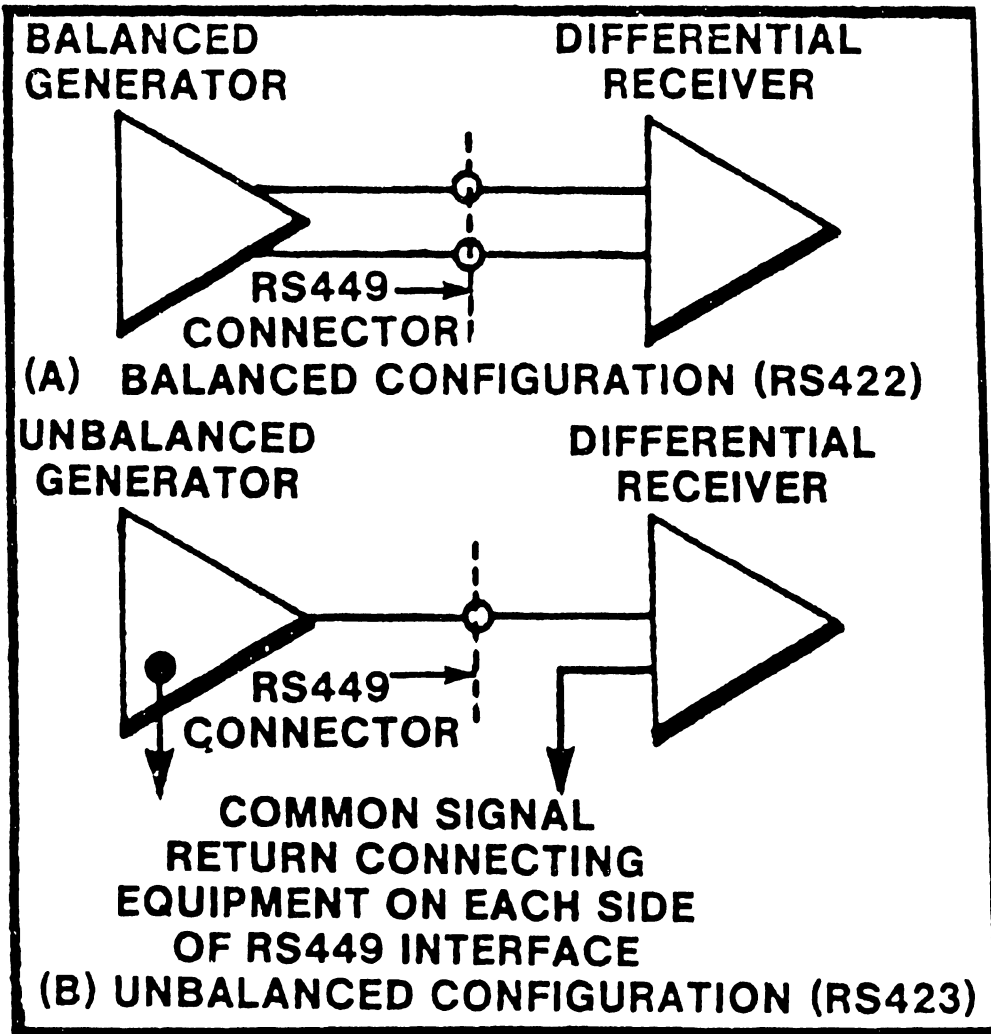


FIGURE 2-3 RS 449 INTERFACE CIRCUIT CONFIGURATION

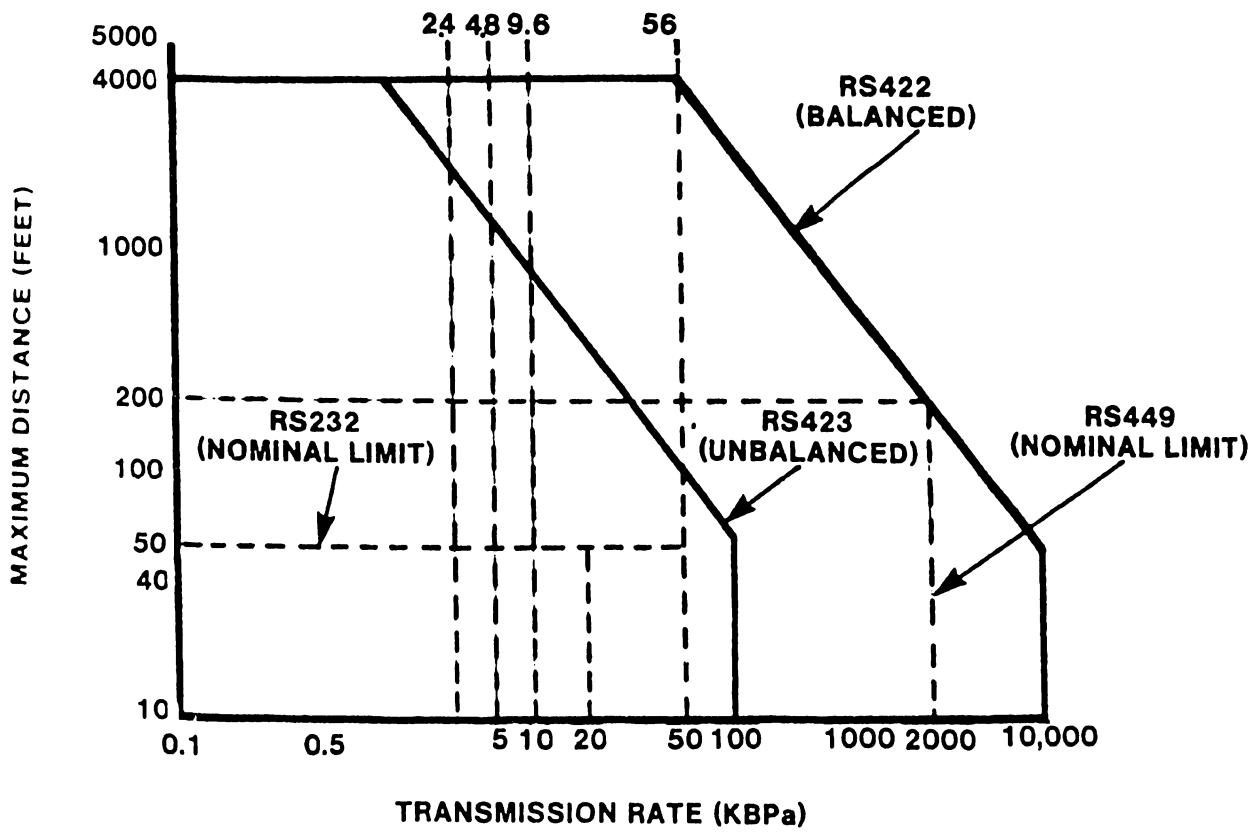


FIGURE 2-4 PERFORMANCE PARAMETERS OF RS 449 AND RS 232 CIRCUITS

### 2.3.3 AUTOMATIC CALLING UNIT (ACU) INTERFACE (RS-366)

Automatic dialing via a Bell 801 Automatic Calling Unit (ACU) or similar device requires a unique interface between the TC-B1 and the ACU. This interface is defined in the EIA specifications RS-366/CCITT V.11. The signal polarity and the voltage of driven and detected signals are as follows:

<u>Logic Level</u>	<u>Applied Voltage</u>	<u>Detected Voltage</u>
0 or ON (Spacing)	+12 vdc	+5 to +15 vdc
1 or OFF (Marking)	-12 vdc	-5 to -15 vdc

The pin assignments are listed in Appendix G with the CCITT designations given for the circuit associated with each pin.

The two most widely used ACU's are the BELL 801A and 801C. The 801A is used in areas where rotary (pulse) dial telephone service is provided. The 801C is used in areas where Touch Tone telephone service is provided. The customer options are listed in Appendix H.

Basically the ACU permits any terminal or host to call any telephone number in the switched telephone network and transfer the circuit to the associated modem for the automatic transfer of data. Typically, the 801A will take 15 seconds to dial a 10-digit number while the 801C will only take 1 second.

### 2.3.4 COMPATIBLE BELL MODEMS

Initially the TC-B1 will be released to the field supporting HDLC and 3270 emulation which are used in a leased line environment. Therefore, the 201C and 208A are two of the compatible Bell Modems. At a later date other asynchronous/synchronous protocols currently used on the TC-B (Black Box) will be available. The 201C and 208A modems are located in Appendix H along with the modems which will be used when additional protocols become available.

**SECTION**

**3**

**REMOVAL**

**REPLACEMENT**

**INSTALLATION**

SECTION 3  
REMOVAL/REPLACEMENT/INSTALLATION

### 3.0 INTRODUCTION

The chassis layout of the TeleCommunications Processor (TCP) allows the field service representative easy access to all major parts and assemblies internal to the TCP. This easy access simplifies installation of the TC-B1 PCB. The following paragraphs describe the procedures to be used for removing, replacing, or installing components into or out of the TCP.

### 3.1 REQUIRED PARTS

<u>PART NUMBER</u>	<u>DESCRIPTION</u>
212-3014	TC-B1 CONT.
210-7865	LIGHT BD.
220-3171	LIGHT PANEL CABLE
270-0662	REAR PANEL ASSY.
220-1710	BNC/TNC CABLE
220-3178	RS-449 FLAT CABLE
220-3179	RS-232 FLAT CABLE
220-3180	RS-366 FLAT CABLE
270-0660	MOTHER BD. ASSY.
210-7760	REGULATOR BOARD
270-0661	FRONT PANEL ASSY.
270-0658	POWER SUPPLY ASSY. 50/60 HZ
300-3050	124K UF 15V. CAP
360-1031	FUSE, 3 AMP.

### 3.2 TOP COVER REMOVAL/REPLACEMENT

- a. Remove the three cover screws at the rear of the unit (see figure 3-1). These screws secure the top cover to the main chassis.
- b. Slide the cover forward and lift off (see figure 3-2).
- c. Reinstall cover by reversing steps a and b.

### 3.3 TC-B1 INSTALLATION/REMOVAL

Prior to installing the TC-B1 into an OIS System or VS System (TCP), SW 1 and SW 2 (located on the Motherboard) must be set. Paragraphs 3.3.1 and 3.3.2 gives instruction for setting these two switches.

#### 3.3.1 OIS SWITCH SETTINGS

To set SW1 and SW 2, refer to the TC-B1 Telecommunication Controller Products Maintenance Manual (V.B.1-M, 729-0887) paragraph 3.1 "Switch Settings".

**NOTE**

Switch 1 located on PCB 7763 has a bank of eight switches to identify the type of device, set them as specified in figure 3-3 to Hex 10. Switch 2 on PCB 7763 has a bank of five device type micro-switches, to be set to specify that a TC-B1 model is connected to the master CPU (device type = Hex 8).

#### 3.3.2 VS SWITCH SETTINGS

Switch settings for TC-B1's used in the VS are as follows (see figure 3-3 for switch locations):

##### 3.3.2.1 SWITCH SW 1

When using a leased-line modem, set SW 1 switches 1, 2, 3, 4, 6, 7 and 8 to OFF; set switch 5 to ON.

When using a null modem, set SW 1 switches 3, 4, 6, 7 and 8 to OFF; set switch 5 to ON. Set switches 1 and 2 as follows:

<u>Switch 1</u>	<u>Switch 2</u>	<u>Baud Rate</u>
OFF	OFF	64.0K (Not Supported)
ON	OFF	19.2K
OFF	ON	9.6K
ON	ON	4.8K



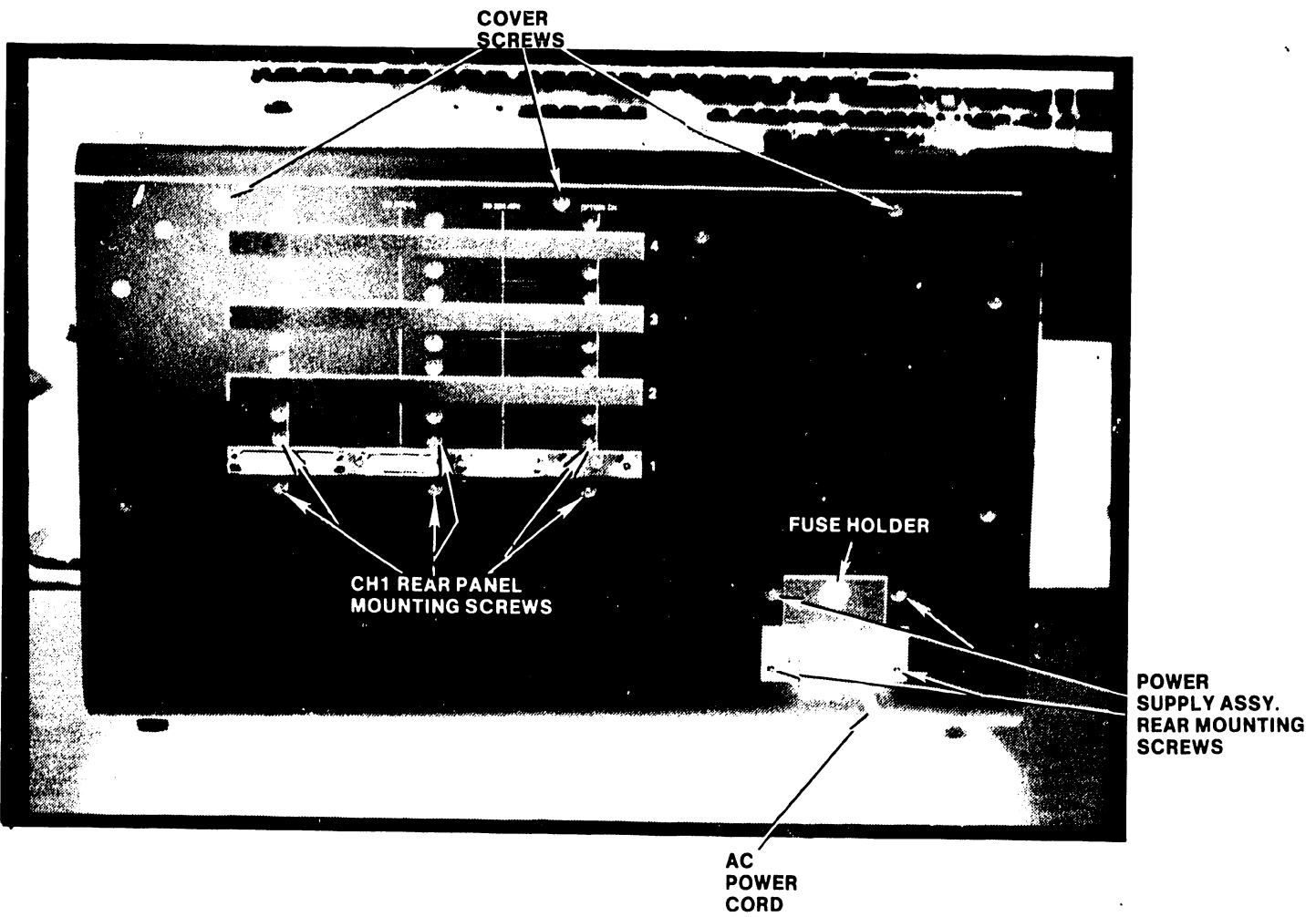


FIGURE 3-1 TCP (REAR VIEW)

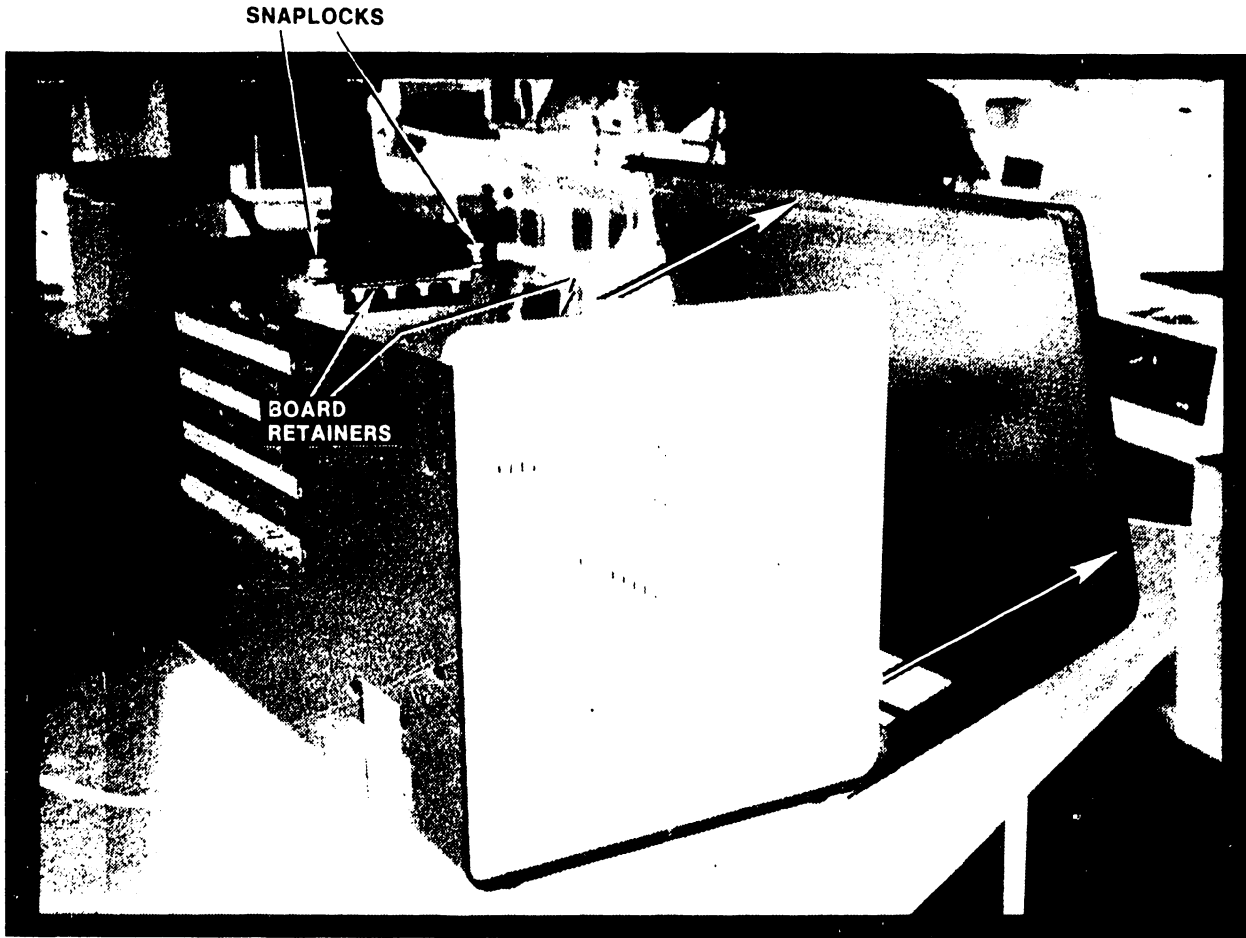
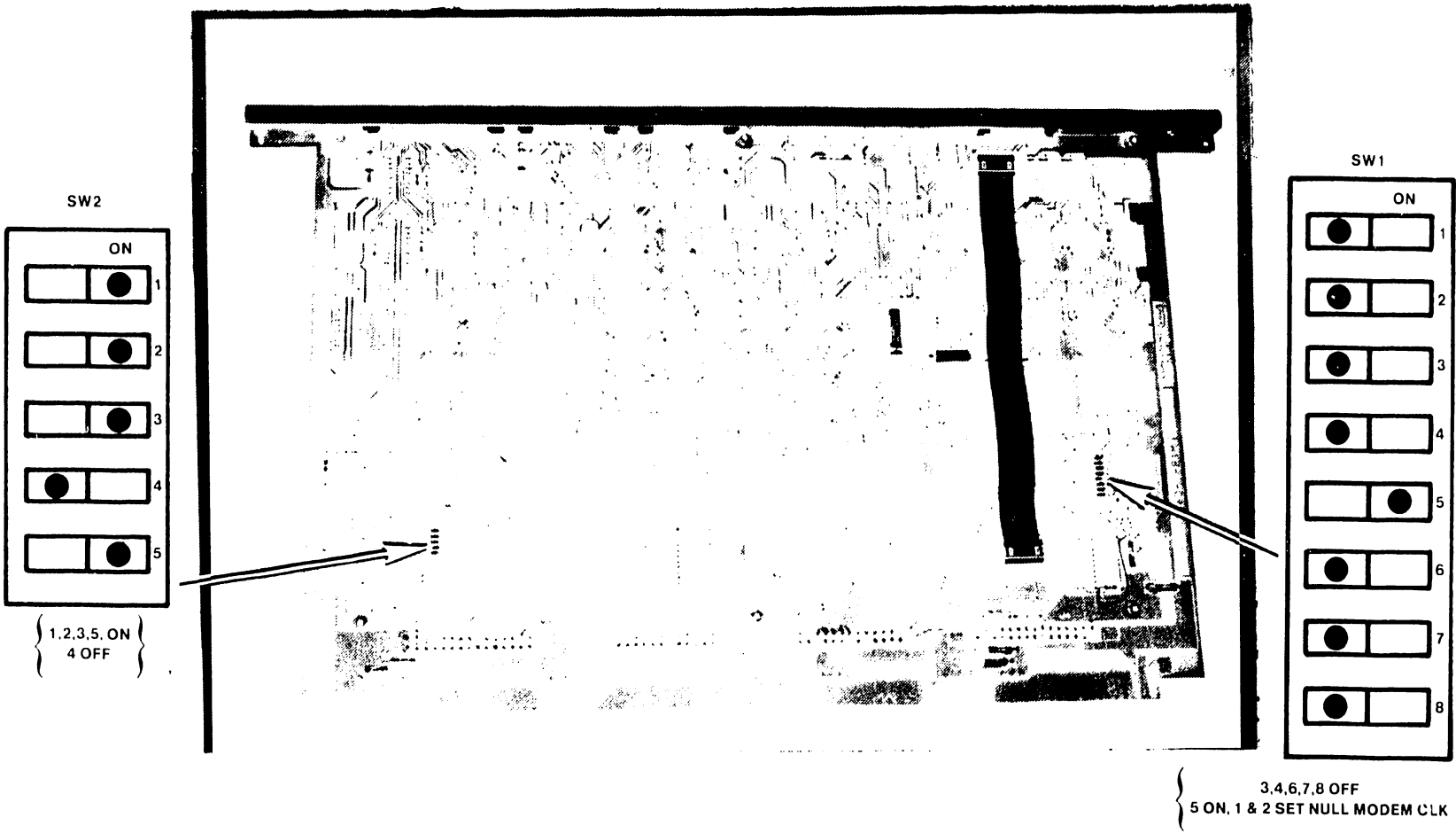


FIGURE 3-2 TCP (SIDE VIEW)

FIGURE 3-3 TC-B1 SWITCH SETTINGS



### 3.3.2.2 SWITCH SW 2

To set switch SW 2, refer to the TC-B1 Telecommunication Controller Products Maintenance Manual (V.B.1-M, 729-0887) paragraph 3.1 "Switch Settings".

### 3.3.3 TC-B1 Installation/Removal

- a. Remove the 2 board retainers by releasing the snap locks (see figure 3-2).
- b. Install the TC-B1 into CH #1 I/O slot (see figure 3-4). The board connectors on the motherboard have card guides to ease insertion.
- c. Replace the board retainers.
- d. Route the BNC/TNC Cable over the cable bracket and Plug it into the J4 connector on the TC-B1 mounting bracket. The BNC/TNC Cable is held in place by a snap-in clamp (see figure 3-5).
- e. Plug the Light Panel Cable into the J5 connector on the TC-B1 mounting bracket (see figure 3-5).
- f. Connect the RS366 Cable into J1, the RS232 Cable into J2, and the RS449 Cable into J3 on the TC-B1 mounting bracket. All three cables must be routed over the cable bracket as shown in figure 3-5. This prevents the cables from blocking the flow of air from the fan.

#### NOTE

RS cable length corresponds to the Channel in which the TC-B1 is mounted. For example, figure 3-1 shows the Rear Panel located in CH #1. The cable length for this Rear Panel is exactly the right length to reach the TC-B1 mounted in CH #1 I/O slot (see figure 3-4 for the location of CH #1 I/O slot).

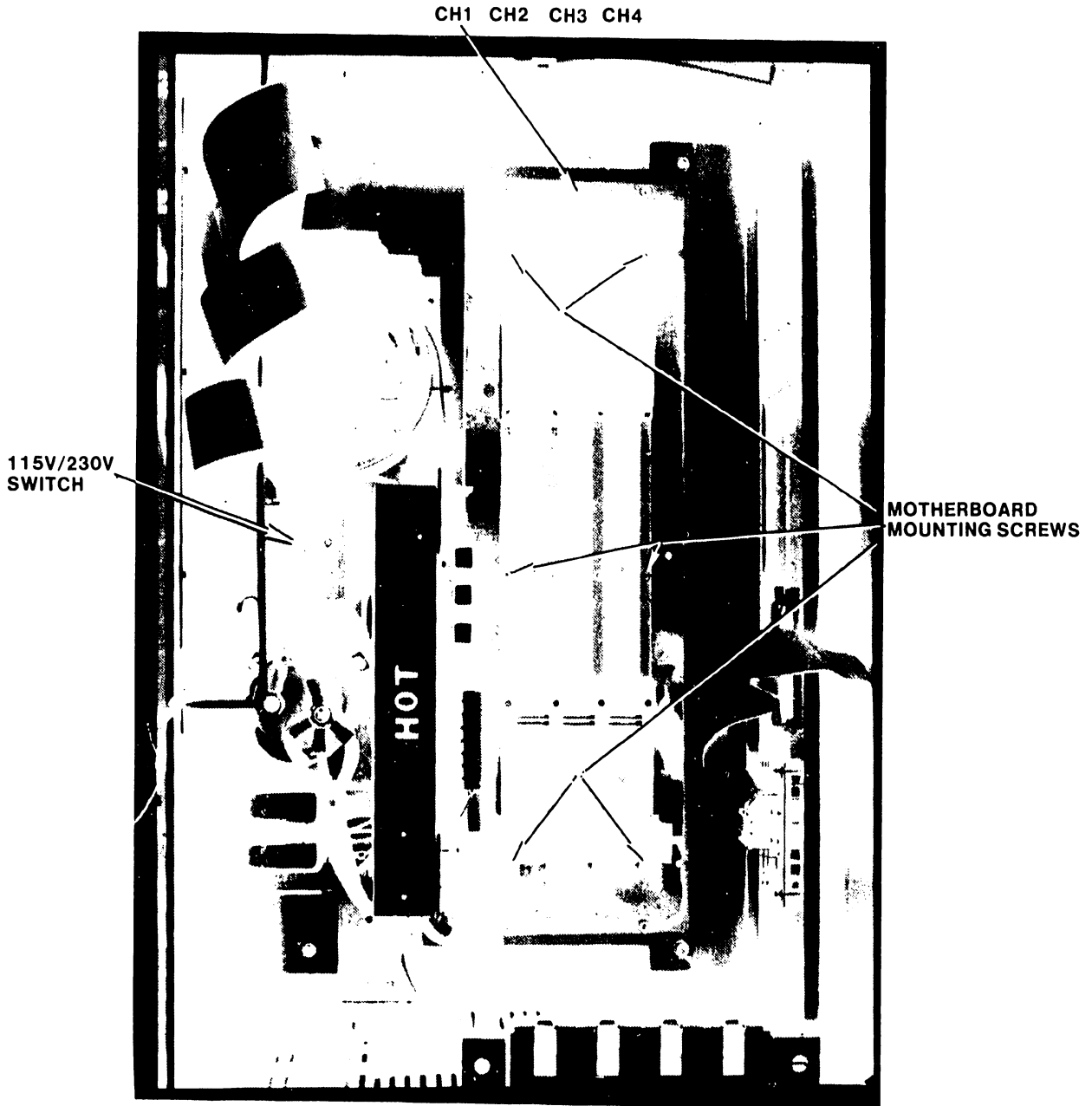


FIGURE 3-4 TCP (TOP INSIDE VIEW)

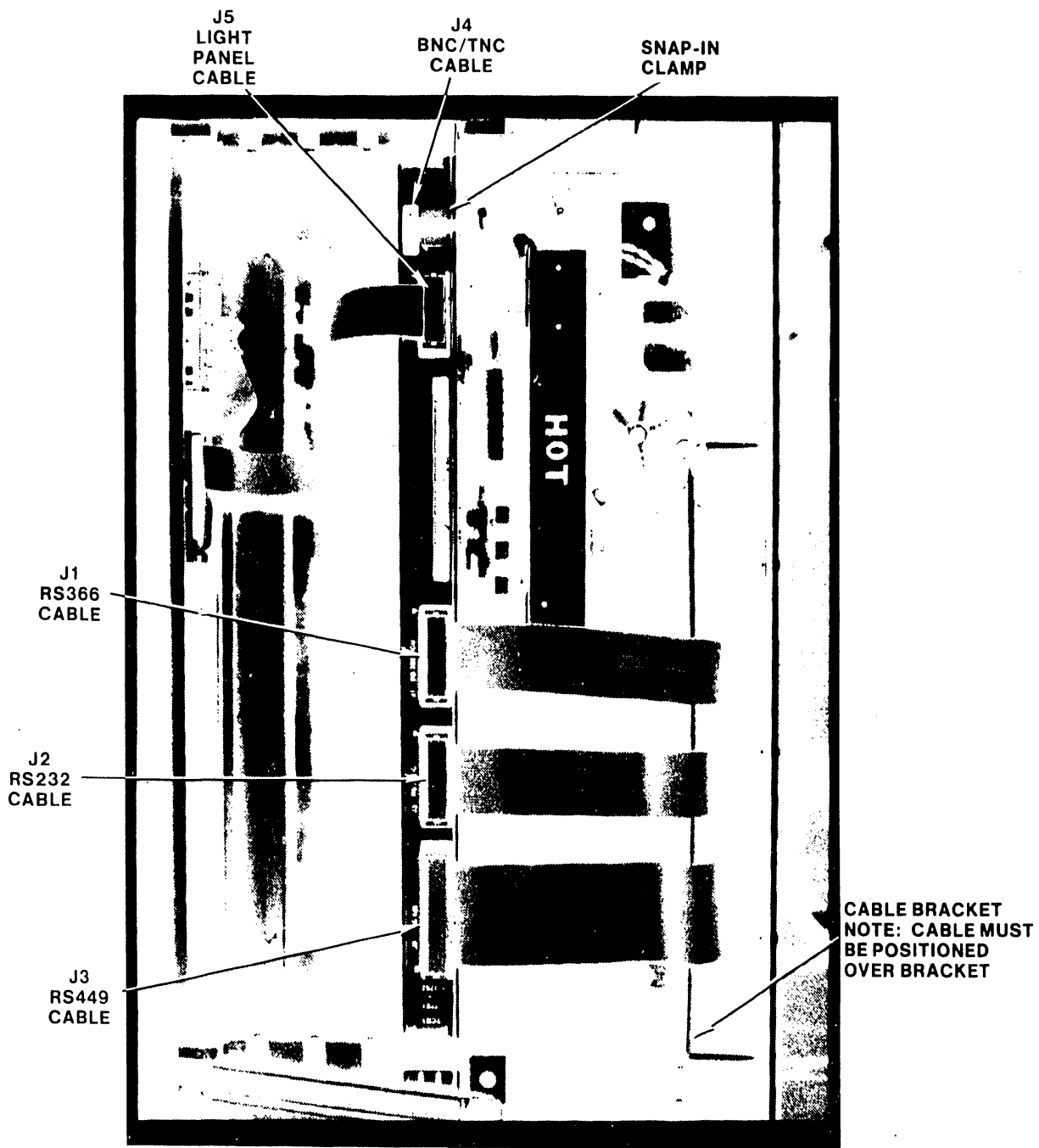


FIGURE 3-5 TCP (TOP VIEW TC-B1 INSTALLED)

- g. Set the 115V/230V Switch (see figure 3-4) to 115V for domestic use or 230V for international use.

### 3.4 REGULATOR PCB REMOVAL/REPLACEMENT

- a. Remove the four regulator mounting screws. The regulator mounting screws are located in each corner of the PCB (see figure 3-6).
- b. Remove Regulator PCB (210-7760) by carefully pulling upwards on the Regulator PCB removing it from it's connector.
- c. Replace the Regulator PCB by reversing steps a and b.

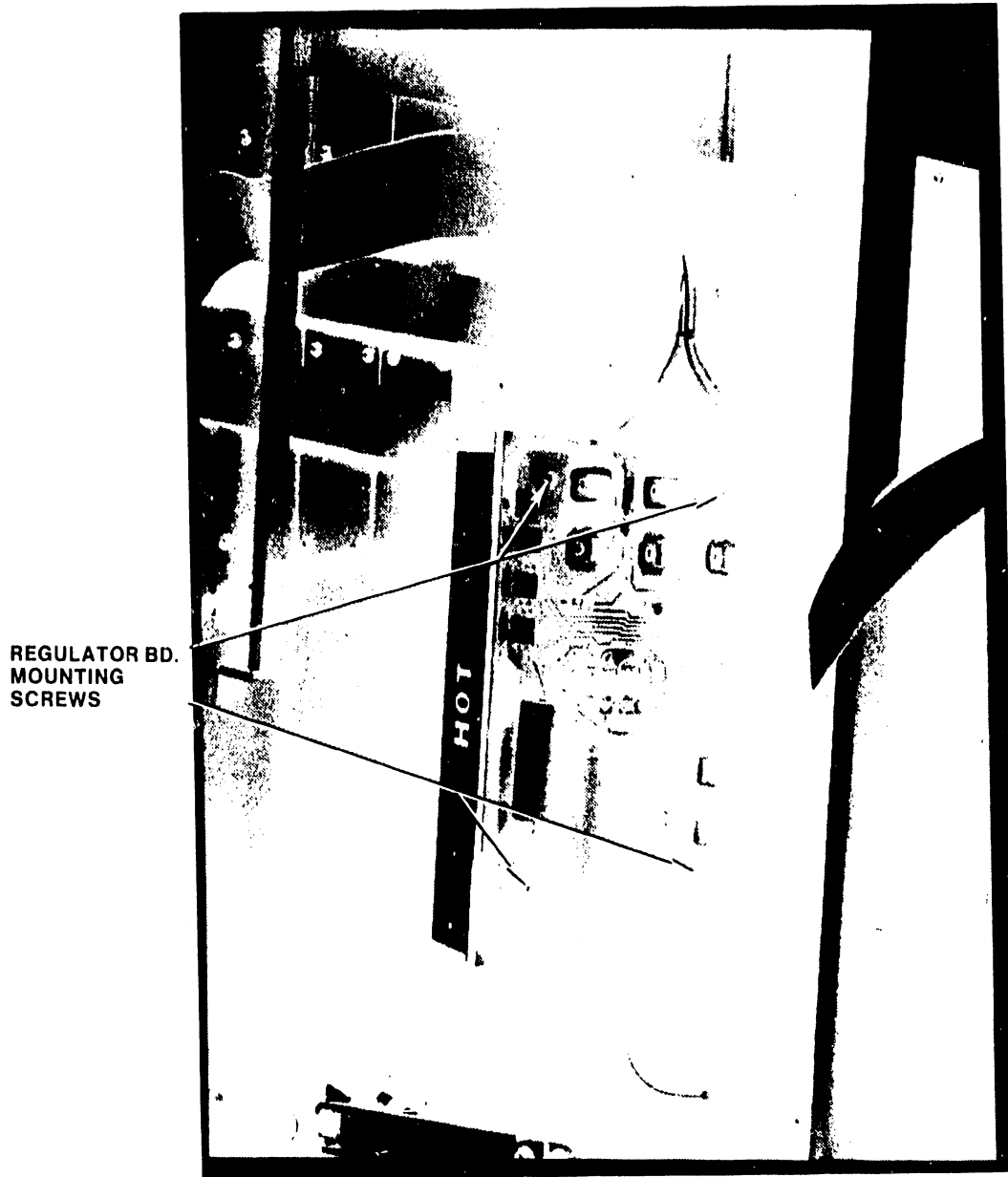
### 3.5 POWER SUPPLY ASSEMBLY REMOVAL/REPLACEMENT

- a. Remove the four power supply assembly mounting screws from the rear of the unit (see figure 3-1).
- b. Disconnect ac power cord from rear of unit (see figure 3-1).

#### CAUTION

Before disconnecting ac power cord from rear of unit,  
disconnect the power cord from ac power source.

- c. Remove the two power supply assembly mounting screws from inside of unit (see figure 3-7).
- d. Disconnect fan cable from fan (see figure 3-7).
- e. Disconnect cable J1 (see figure 3-7).
- f. Disconnect Motherboard cable (see figure 3-7).
- g. Lift power supply (270-0658) from unit.
- h. To install power supply assembly reverse the above steps.



REGULATOR BD.  
MOUNTING  
SCREWS

FIGURE 3-6 REGULATOR BOARD



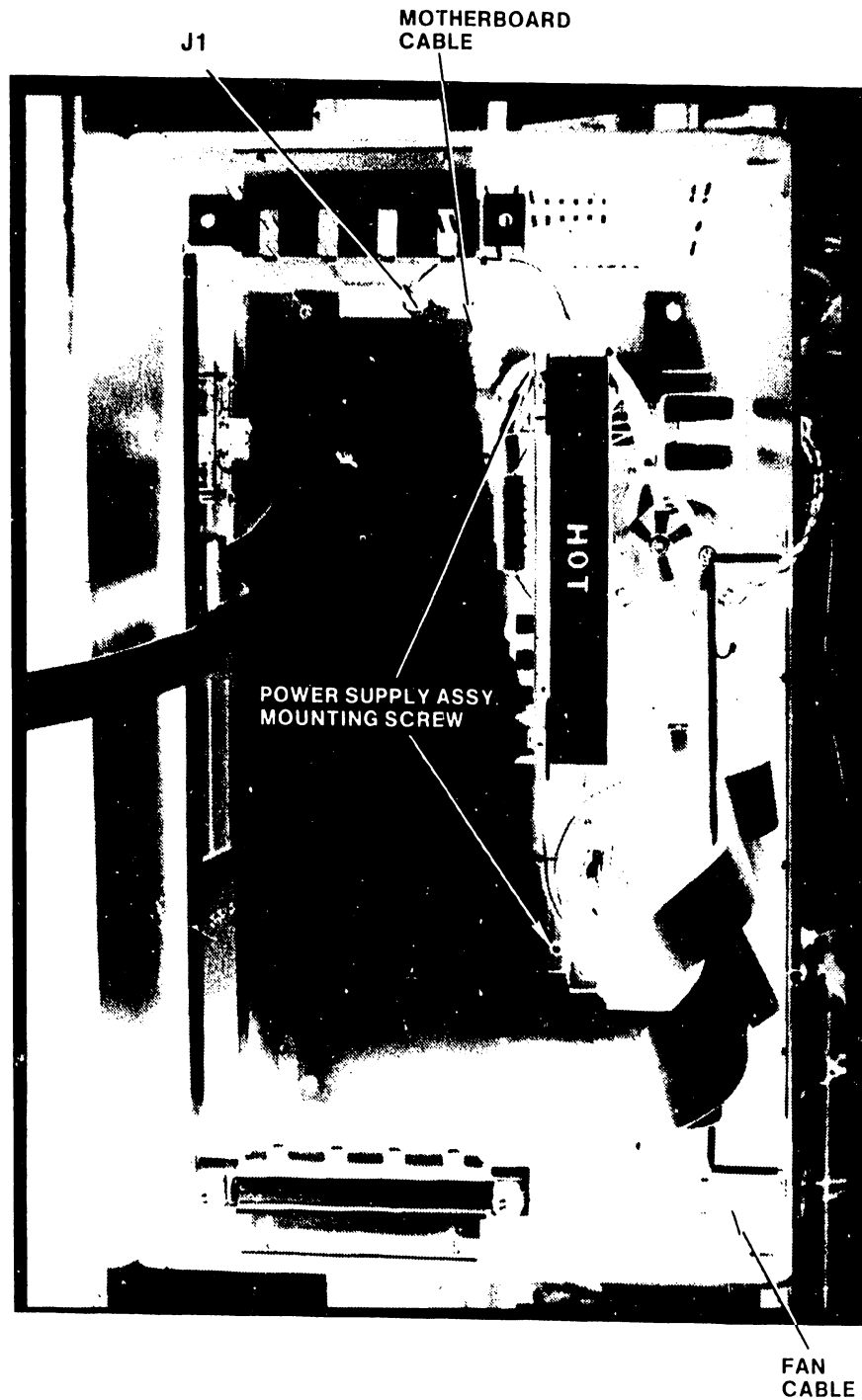


FIGURE 3-7 TCP (MOTHERBOARD REMOVED)

### 3.6 MOTHERBOARD REMOVAL/REPLACEMENT

- a. Remove the six machine screws (see figure 3-4) which secure the Motherboard to the main chassis. The motherboard mounting screws are easily identified because each one has a washer.
- b. Remove Motherboard.
- c. Replace Motherboard by reversing step a and b.

### 3.7 REAR PANEL REMOVAL/REPLACEMENT

- a. Remove top cover see paragraph 3.2.
- b. Disconnect RS 449, RS 232-C, RS 366-ACU, Light Panel, and BNC/TNC cables (see figure 3-5).
- c. Unscrew the six Phillips-head screws that secure the CH #1 Rear Panel to the rear of the unit (see figure 3-1).
- d. The Rear Panel can now be removed from inside the unit.
- e. To install or replace a Rear Panel reverse the above procedure.
- f. All Rear Panel (Ch #1--CH #4) are removed or replaced in the same manor.

### 3.8 LIGHT BOARD REMOVAL/REPLACEMENT

- a. Remove top cover see paragraph 3.2.
- b. Disconnect the Light Panel cable from J5 (see figure 3-5).
- c. Unsrew the four phillips-head screws that secure the Light Board to the front of the unit (see figure 3-8).
- d. The Light Board can now be removed.
- e. To install or replace a Light Board reverse the above procedure.

### 3.9 FUSE REMOVAL/REPLACEMENT

- a. Turn Fuse Holder (see figure 3-1) counter-clockwise.
- b. Pull Fuse Holder with fuse away from unit.
- c. Replace blown fuse with a 3-amp fuse.
- d. Replace fuse and holder and turn clockwise (see figure 3-1).

LIGHT BOARD  
MOUNTING  
SCREWS

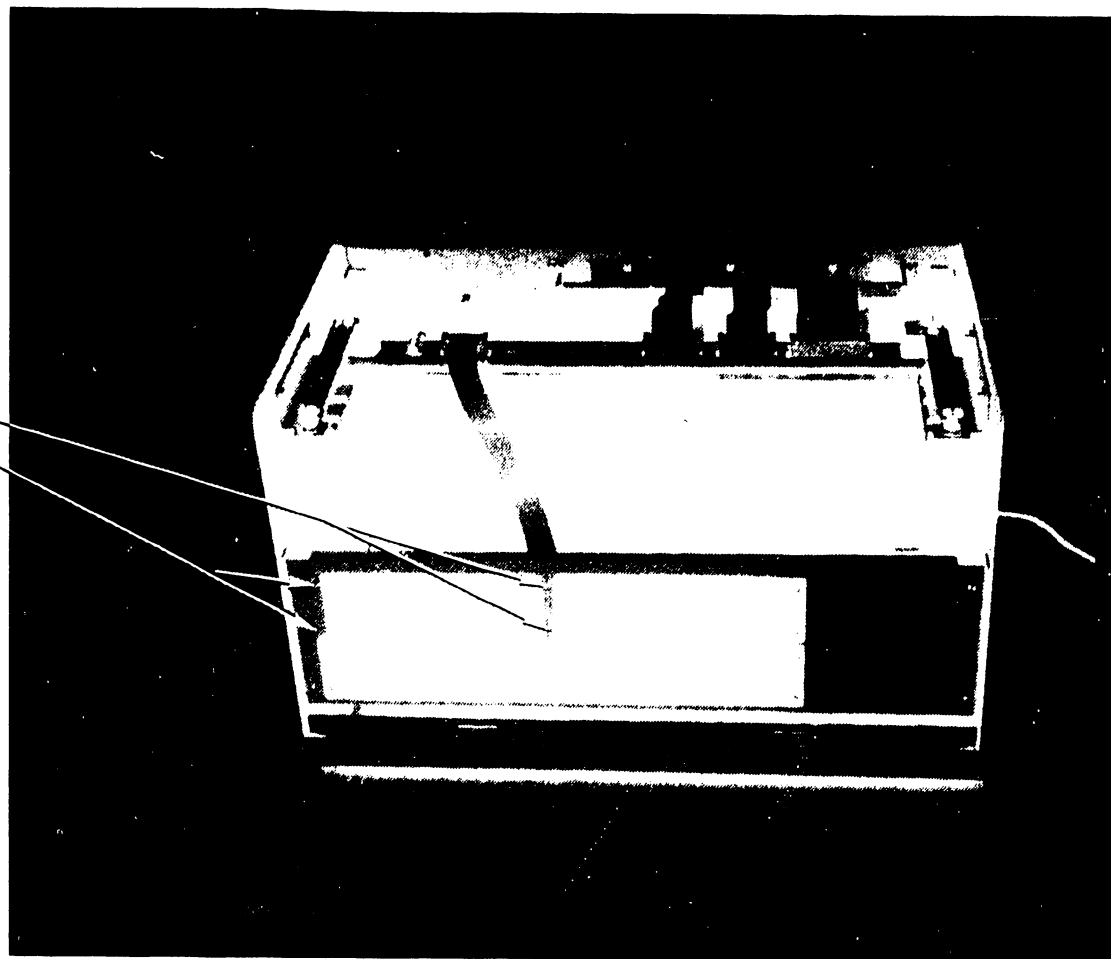


FIGURE 3-8 TCP (FRONT VIEW, COVER REMOVED)

3.10 124K CAPACITOR REMOVAL/REPLACEMENT

- a. For this procedure refer to figure 3-9.
- b. Loosen clamp screw.
- c. Remove the two phillips screws which secure leads to top of capacitor.
- d. Remove capacitor.
- e. To replace capacitor reverse steps b through d.

PHILLIPS  
SCREWS



CLAMP  
SCREW

FIGURE 3-9 124K CAPACITOR

**SECTION**

**4**

**REMOTE WANGNET**

**HARDWARE**

**CONFIGURATION**

SECTION 4  
REMOTE WANGNET HARDWARE CONFIGURATION

4.1 PRODUCT OVERVIEW

a. General Description

The Telecommunications Processor (TCP) resides externally to the VS CPU cabinet. Up to four TC-B1 controllers can reside in the TCP unit:

1. The TC-B1 is a Z80 microprocessor based Telecommunications controller. Besides having an RS-232C interface, the TC-B1 will also provide an RS-449 interface via a 37-pin mode connector. This interface will be multiplexed along with RS-232C interface. With RS-449 interface, longer cable lengths and faster baud rates are significantly increased over RS-232C connections. Depending upon the data modulation rate, a maximum of 4000 feet of cable length between the data-terminal equipment and the data communications equipment can be achieved. Additional interface to the RS-366 automatic calling unit (ACU) will be available, which permits any terminal or host to call any telephone number in the switched telephone network and transfer the circuit to the associated modem for the automatic transfer of data.
2. The memory organization consists of 4K PROM, for power-up diagnostics, and 60K of RAM.
3. The TCP will be used to interface between the VS and OIS and communicate between both sites in HDLC mode. This environment will be known as the remote WangNet.
4. The remote WangNet allows OIS systems to communicate interactively or in a batch mode with a VS system.

4.2 HARDWARE

4.2.1 VS HARDWARE

- a. The 22V17 or 22V27 used will support all serial workstations, including the VS Archiving Workstation, and all serial printers. These differ from the existing serial IOP's in one way only, they contain the necessary internal microcode to support the new Telecommunications Processors (TCP's). Engineering Change Orders (E.C.O.'s) which must be implemented on either the 22V17 and/or 22V27 are identified in Appendix I.
- b. The connection between the serial IOP and the TCP is coax.
- c. Full Duplex modems with switched carrier at the remote sites (leased lines only), or 2228N null modem must be used.

<u>VS</u>	<u>Serial IOP</u>	<u>Used On</u>
22V17-1	8 port	VS 80
22V17-2	16 port	VS 80
22V27-1	8 port	VS 100
22V27-2	16 port	VS 100
	<u>TCP Telecommunications Controllers</u>	
6554-1	Contains 1 TC-B1	
6554-2	2	
6554-3	3	
6554-4	4	

4.2.2 OIS HARDWARE

NOTE

The TCB-1 TC controller is mounted internally.

- a. OIS must have 8Mb of disk storage. The 5556C workstations are used for interactive communications with the VS. Any



64K Z80 based workstation must be dedicated to run the batch file program (any workstation may access the queues set up by this workstation).

b. VS software is modified OS 5

c. OIS uses 6.3 starter and must have external file source.

### 4.3 COMMUNICATION INTERFACE

The protocol used between the systems is HDLC and communications uses a modified subset of X.25. This does not imply the RCF will run on X.25 networks. Using this protocol each TC-B1 on the VS can support 24 virtual circuits and each OIS TC-B1 can support six virtual circuits. When File Transfer Manager is brought up on the VS, it will take one circuit leaving only 23. As each interactive terminal on the OIS or OIS's is activated, it will take one virtual circuit. If File Transfer Manager is activated on an OIS, it will take one virtual circuit leaving only five available on that OIS for interactive terminals. If multiple OIS's are running on one line, (six OIS's maximum) and they all have FTM activated only one virtual circuit will be used on the VS leaving 23, but each OIS will have five left on each.

The configurations are illustrated in figures 4-1 through 4-4.

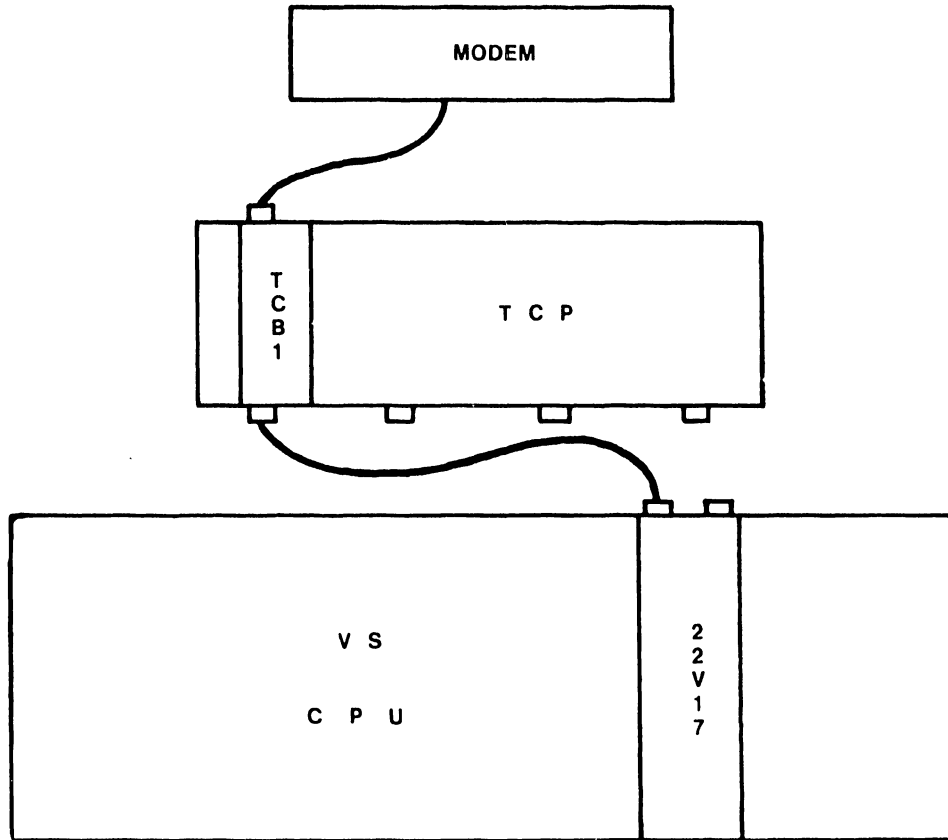


FIGURE 4-1 VS CONFIGURATION

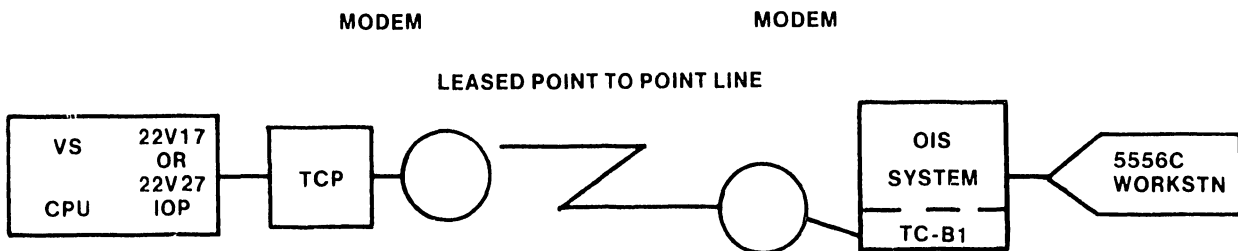


FIGURE 4-2 MINIMUM CONFIGURATION

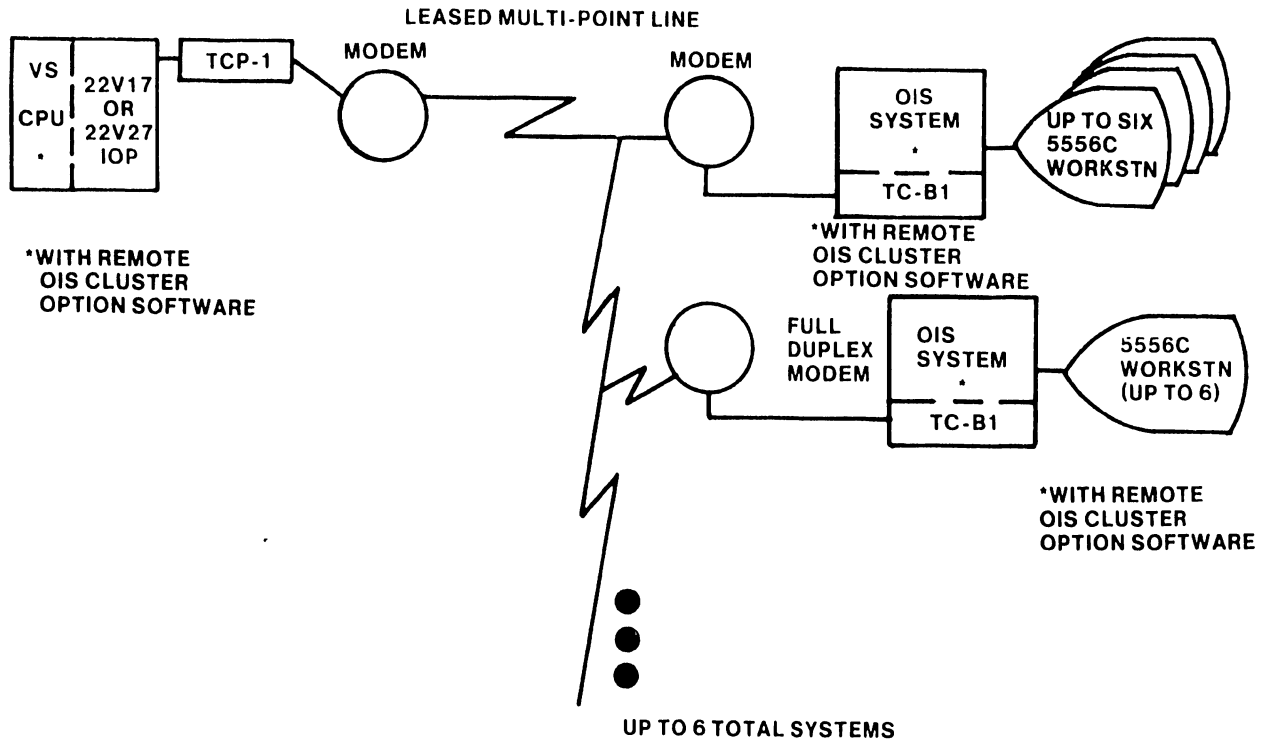


FIGURE 4-3 MAXIMUM REMOTE CONFIGURATION

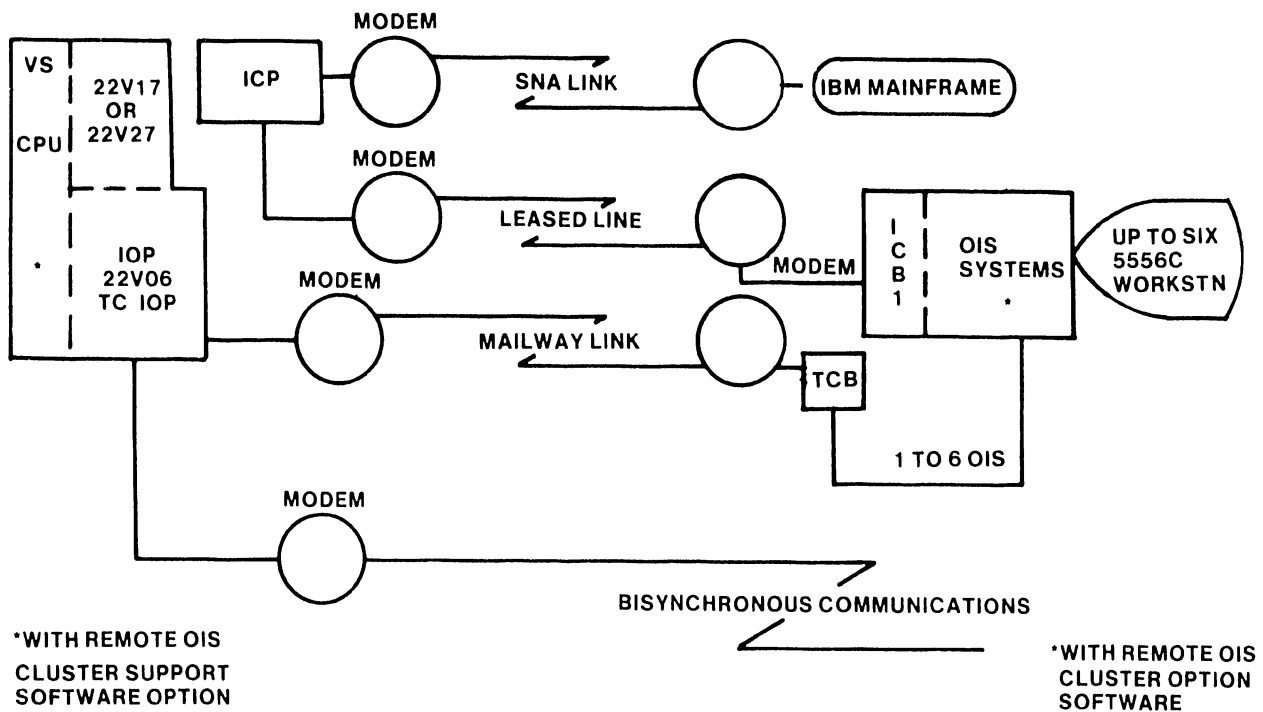


FIGURE 4-4 COMPLEX VS CONFIGURATION

**SECTION**

**5**

**TROUBLE-  
SHOOTING**

## SECTION 5 TROUBLESHOOTING

### 5.1 INTRODUCTION

Troubleshooting the Telecommunications Processor (TCP) can be a complex task. There are many components involved, such as telephone lines, modems, host computers, and remote facilities. Any one of these can cause a problem. This section provides tests and diagnostics for troubleshooting the components. When a problem is encountered in the telecommunications system during installation, refer to the Troubleshooting Checklist (Paragraph 5.2). This checklist is designed to assist the Customer Engineer in locating and repairing faults in the telecommunications system.

### 5.2 TROUBLESHOOTING CHECKLIST

The first thing any service representative should do is to check the installation items as follows:

- a. Check the entire TCP unit by running the power-up diagnostics defined in paragraph 5.6 and check all voltages. The voltage measurement test points are located on the mounting bracket of the TC-B1 board (See Figure 5-1).

-----CAUTION-----  
Avoid touching bare leads and causing a short circuit:  
very little clearance is provided for these measurements.  
-----

- b. Use a DVM (Digital Voltmeter) for all voltage measurements.
- c. Position the system power switch to ON.
- d. Measure the dc voltages at the test point on the TC-B1 board, using GND as reference. The dc Voltage Measurements are:

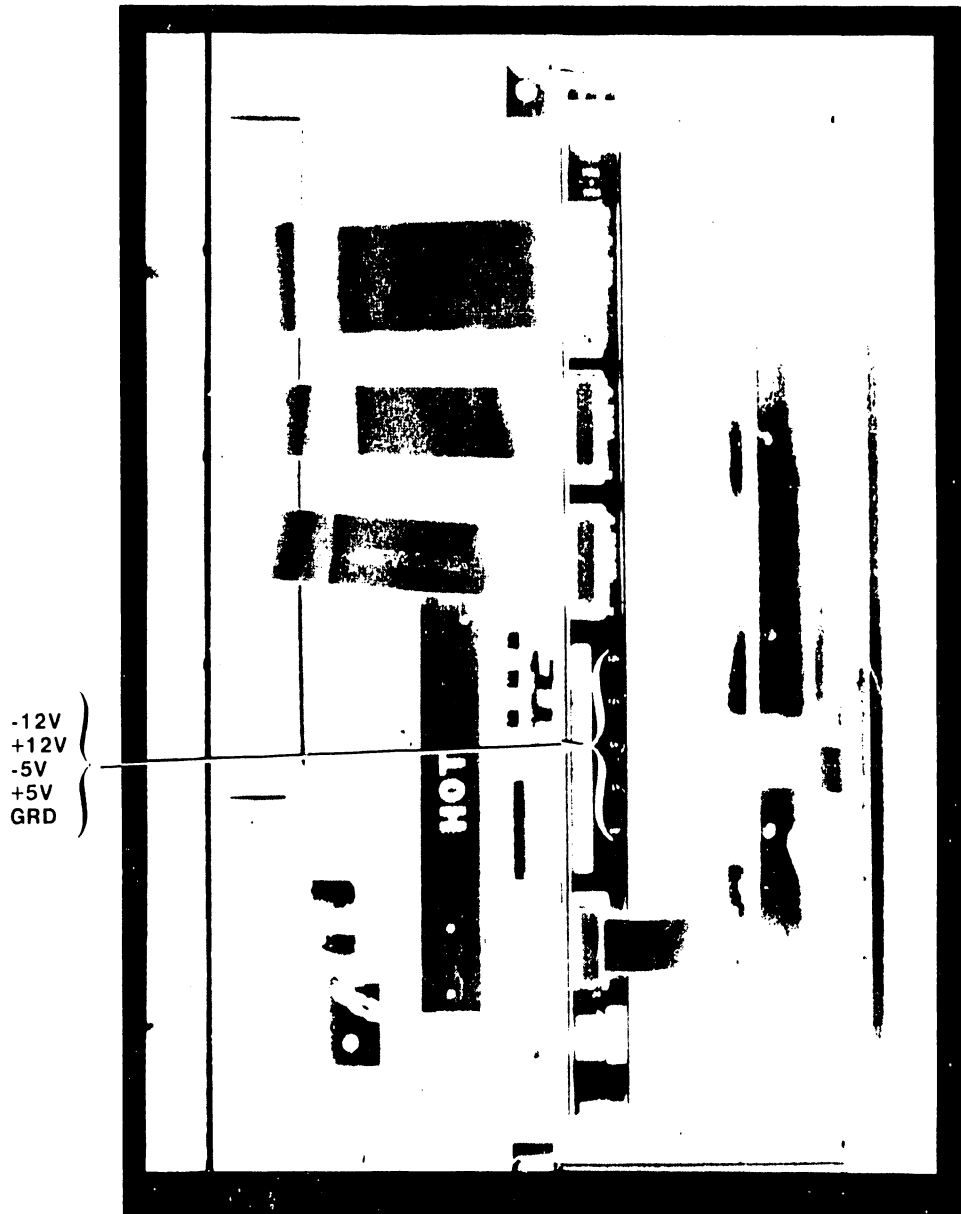


FIGURE 5-1 VOLTAGE TEST POINTS

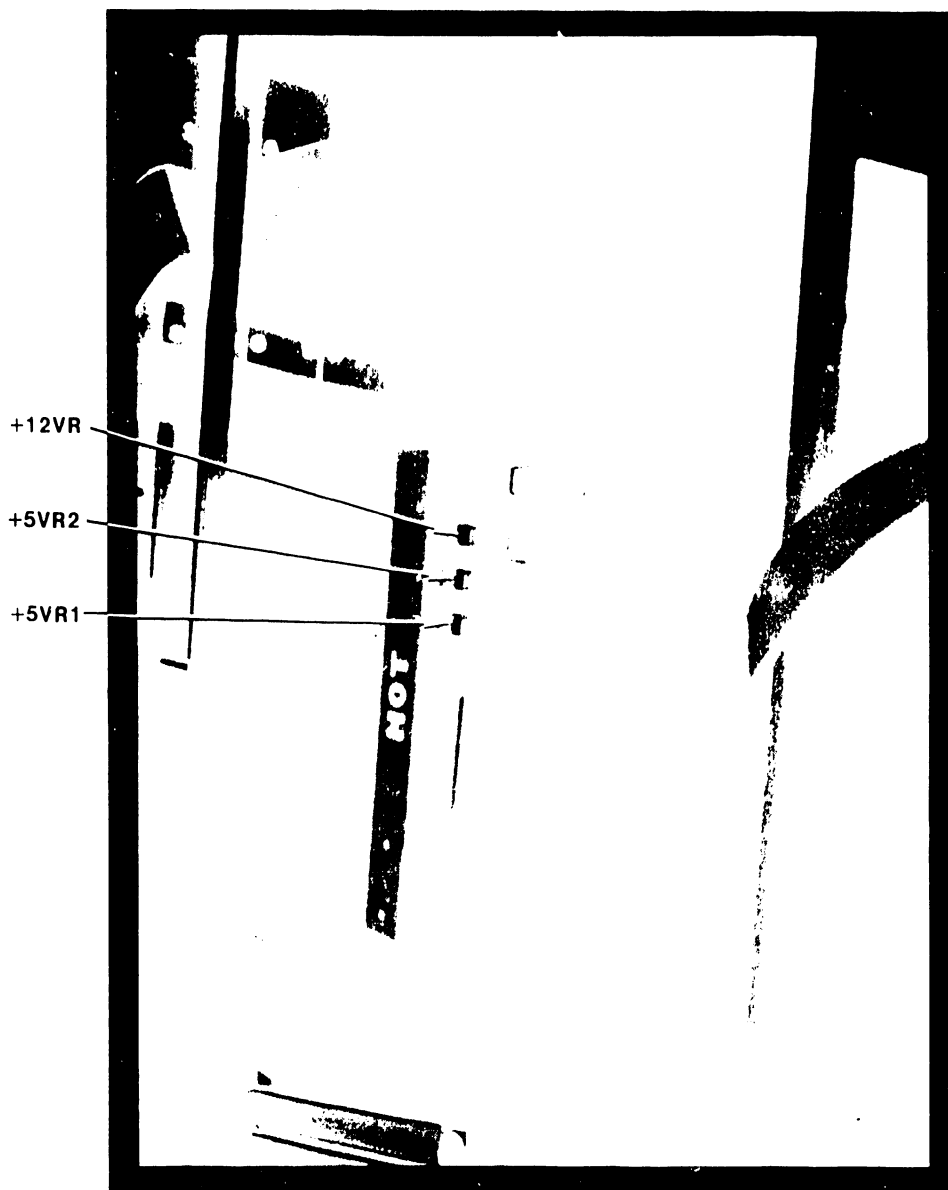


FIGURE 5-2 VOLTAGE ADJUSTMENT POTS

<u>TEST POINTS</u>	<u>LIMITS</u>
-12V	-11.8V to -12.2V
+12V	+11.8V to +12.2V
-5V	-4.9V to -5.1V
+5V	+4.9V to +5.1V

- e. Adjust positive voltages to within limits using the three adjustment pots located on the TCP Regulator Board (see figure 5-2):
- +5VR1 - adjust +5 volts for boards in Channels 1 and 2.
  - +5VR2 - adjust +5 volts for boards in Channels 3 and 4.
  - +12VR - adjust +12 volts for boards in Channels 1, 2, 3, and 4.
- f. Check the TC-B1 for correct switch setting, assuring switches SW 1 and SW 2 (located on the TC-B1 motherboard, WLI # 210-7763-A) are set as shown in figure 3-3. Power down unit and visually inspect the board for any broken components, short etches, etc. Make sure the board is seated properly into its connectors.
- g. Check the T.C. cable for any bad contacts. Do a continuity check on the cable from one end to another end and make sure all the required signal wires are connected on both ends of the cable. Power-up unit.
- h. Call the Telephone Data Service Center and have the modem checked. If possible be present when the modem service representative arrives and show him the problem.
- i. Get in touch with data processing personnel at the host computer and discuss the sign-on procedure and explain the problem. Almost all of the sign-on type problems can be resolved this way. If you know anyone else using the same host computer or similar system, find out how he is using it.
- j. Most important of all, try to get help from your area office, program analyst, home office, or anyone you know who has a telecommunications background.



### 5.3 ITS-1 EIA INTERFACE TEST SET

The model ITS-1 EIA Interface Test Set is a self-contained pocket size test set that can be inserted between the Data Communication Equipment (DCE) or modem and Data Terminal Equipment (DTE). It permits the user to monitor the EIA RS-232 signals and isolate and identify sources of trouble.

The EIA Interface Test Set contains nine indicators which continuously monitor the level of the following interface signals: transmitted data, received data, request-to-send, clear-to-send, data-set-ready, received-carrier-detect, data-terminal-ready, signal-quality-detect and ring indicator. Two indicators monitor the transmit and receive clock signals. Unlike the nine level indicators, the two indicators will not respond when only a dc level is present. The clock interface signal indicators will only turn on when there is an active clock signal present. Two additional uncommitted indicators are available for monitoring either positive or negative levels on any of the interface lines.

The Interface Test Set contains 24 switches which allow any of the interface signals except line one, (Frame Ground) to be interrupted. These switches are physically located in the center of the front panel and functionally divide the Test Set into two halves. The upper half contains a cable and connector for connecting the Test set to the DCE (data communications equipment) or modem. The indicators which monitor signals originating from the modem are also located on the upper half of the front panel. Likewise, the lower half of the Test Set contains a connector to which the DTE (Terminal or CPU) can be connected. The indicators which monitor signals originating from the DTE are also located on the lower half of the test set. Furthermore, the positive and negative test indicators are also located on the lower half of the Test Set. All indicators are labeled with both the standard EIA designation and the commonly used abbreviations.

Twenty five pins are located both above and below the switches. These pins permit monitoring of any of the interface lines with either or both the positive and negative test indicators with jumpers supplied or probing with an external meter or oscilloscope. Both sets of pins are arranged in the same configuration and order as the pins in a standard EIA RS-232 female connector.

The Interface Test Set is housed in a sturdy plastic case with aluminum extrusions and hinge. A positive latch is provided on the cover to keep the Test Set closed securely when not in use. The front panel is photographically etched and overcoated to prevent the lettering from being scratched or marred during use. The Test Set is self-contained and is powered by two penlite batteries which will provide over 100 hours of continuous operation. No power is consumed by the Test Set when not in use.

EIA INTERFACE TEST SET SPECIFICATIONS

LEVEL INDICATORS	ACTIVITY INDICATORS .....	Transmit Clock
Transmitted Data		Receive Clock
Received Data	INDICATOR THRESHOLD .....	$\pm 3$ volts
Request-to-Send		
Clear-to-Send	INDICATOR INPUT IMPENDANCE.....	30,000 ohms
Data-Set-Ready		
Received-Carrier-	POWER .....	Two 1.5 volts
Detect		AA Batteries
Data-Terminal-Ready		
Signal-Quality-Detect	DIMENSIONS .....	4.5"L x 3.6"W
		1.6"H
Ring Indicator		
Positive Test		
Negative Test	WEIGHT .....	12 oz.

5.4 MODEM CONTROL SIGNALS CHECKOUT

If the modem is suspected of causing trouble, the following control signals can be checked using an oscilloscope or an EIA Interface Test Set which provides test points and LED's that indicate signal activity. The modem must be in the data mode when checking the control signals.

- a. Position the TC-B1 so that you have access to the signals used by the EIA Interface Test Set connector (25-pin Cannon connector) or use an EIA Interface Test Set. Signal pin numbers given below are in reference to 25-pin Cannon connector (refer to Appendix H).

b. Pins 1 and 7 are chassis and reference ground. Check for any noise on ground circuit.

c. Pin 2 TRANSMITTED DATA (TO data set).

Signals on this circuit are generated by data terminal equipment. Check to see if terminal is transmitting data when in transmit mode. The data terminal will not transmit data unless Clear-To-Send signal is ON (+3V to +25v) at pin 5, Data-Terminal-Ready signal is ON (+3v to +25v) at pin 20 and Data-Set-Ready signal is ON (+3V to +25v) at pin 6.

d. Pin 3 RECEIVED DATA (FROM data set).

Signals on this circuit are generated by receiving data set in response to data signals received from a remote data set. This circuit is always held in the MARK state (-3v to -25v) when the Received Line Signal Detector (pin 8) is OFF (-3v to -25v).

e. Pin 4 REQUEST-TO-SEND (TO data set).

Data terminal presents ON signal (+3v to +25v) to this circuit when data terminal intends to transmit data. After turning this signal ON, data terminal must wait for ON condition of Clear-To-Send (pin 5) circuit before starting data transmission.

f. Pin 5 CLEAR-TO-SEND (FROM data set).

Signal on this circuit is generated by data set to indicate whether or not data set is ready to transmit data. This circuit is turned ON (+3v to +25v) in response to ON signal at pin 4 (Clear-To-Send) delayed approximately 50 to 200 ms depending on type of modem and customer options selected.

- g. Pin 6 DATA SET READY (FROM data set).

The ON condition (+3v to +25v) of this circuit indicates that data set is in DATA mode, and is capable of receiving and transmitting data. The Data-Terminal-Ready signal at pin 20 must be ON (+3v to +25v) during DATA mode. The OFF condition (-3v to -25v) indicates that data set is in Talk, Test, or On-Hook mode.

- h. Pin 8 RECEIVED LINE SIGNAL DETECTOR (carrier) (FROM data set).

The ON condition (+3v to +25v) of this circuit indicates that the data carrier signal is above the receiver threshold for at least 47 +3 milliseconds. This circuit is ON during the receive mode and will turn OFF (-3v to -25v) and disable the receiver when the data terminal is in the transmit mode or when Request-To-Send signal is turned ON.

- i. Pin 15 TRANSMITTER SIGNAL ELEMENT TIMING (FROM data set).

The square wave signals on this circuit at 2000 HZ (for 2000 baud modem) or 2400 HZ (for 2400 baud modem) or 4800 HZ (for 4800 baud modem) are used to provide the data terminal equipment with signal element timing information for the transmitted data circuit. A timing signal will be present on this circuit in most cases when power is on in the data set.

- j. Pin 17 RECEIVER SIGNAL ELEMENT TIMING (FROM data set).

The square wave signal on this circuit at 2000 HZ (2000 baud modem) or 2400 HZ (2400 baud modem) or 4800 HZ (4800 baud modem) rate is used to provide the data terminal equipment with receiver signal element timing information. The transition from ON-to-OFF normally indicates the center of each signal element on the received data circuit. A timing signal will be present on this circuit when CARRIER (pin 8) is ON for data sets 201A and 201C.

- k. Pin 20 DATA TERMINAL READY (TO data set).

The data terminal must apply an ON condition (+3v to +25v) to this circuit at all times to go into the DATA mode. An OFF signal on this line will not allow the data set to go in the data mode. An OFF signal on this line during data transmission/reception will make data set drop the communication line.

## 5.5 MODEM SELF TESTS

Several manufacturers including Bell Telephone have the self loopback test along with other tests built into their modem. Before calling the Telephone company or manufacturer, please use these self tests. Test procedures are always given in the modem operating manual. The Bell 201C and 208B data sets which have self tests and instructions to run them are given below.

### 5.5.1 DATA SET 201C SELF TESTS

#### 5.5.1.1 BUTTONS ON THE DATA SET

Five buttons are located on the front panel of the data set. The functions of the buttons are as follows:

- a. RO (Receive Only) - Used when testing the data set to condition it locally as a receiver.
- b. AL (Analog Loopback) - Connects the output of the local transmitter to the input of the local receiver.
- c. ST (Self Test) - When depressed this button causes the data set transmitter to turn on and transmit a fixed pattern.
- d. RT (Remote Test) - When depressed, this button conditions the data set to be tested remotely from a Telephone Company Data Test Center.

- e. DL (Digital Loopback) - This button allows for digital loopback test on a 4-wire data set.

#### 5.5.1.2 STATUS LAMPS ON THE DATA SET

The data set is provided with eight status lamps. Each lamp lights a portion of the front panel which shows the name of the control lead being monitored. The lamps and their functions are as follows:

- a. ON Lamp - This lights when the power cord is plugged into a 105- to 130-Vac source.
- b. TR (Terminal Ready) - This lamp monitors the status of the data terminal ready signal on the customer interface. When the lamp is lighted, the signal is in the on condition and tells the data set that the terminal is ready for data communication.
- c. MR (Modem Ready) - This lamp monitors the status of the data set ready signal on the customer interface. When the lamp is lighted, the signal is in the on condition and the data set is ready for data communication.
- d. RS (Request-to-Send) - This lamp indicates the status of the request-to-send signal on the customer interface or from the internal circuits which check the data set. When the lamp is lighted, the request-to-send signal is in the on condition and tells the data set to be conditioned to transmit data. In normal operation, when the CO lamp is on, the RS lamp will be off regardless of the status of the RS signal at the customer interface.
- e. CS (Clear-to-Send) - This lamp monitors the status of the carrier on signal on the customer interface during both normal and test modes of operation. The lamp comes on when a signal is being received by the data set.

- f. CO (Carrier On) - This lamp monitors the status of the carrier-on signal on the customer interface during both normal and test modes of operation. The lamp comes on when a signal is being received by the data set.
- g. MC (Modem Check) - The MC lamp indicates the absence of the receiver signal timing (pin 17) signal at the customer interface. In normal operation, the lamp will be ON when the CO lamp is OFF. It will be OFF when the CO lamp and interface signal CF (pin 8) are ON. When using the self-test feature, the MC lamp is ON whenever CO is OFF. However, when CO is ON during self-test, the MC flashes ON whenever an error occurs on the received data lead.
- h. TM (Test Mode) - This lamp will light when the data set is placed in the test mode by use of the AL, ST, RT or DL test switches.

#### 5.5.1.3 DATA SET TESTING

Perform an analog loop-back self-test with a data set at each end. If either set fails, replace it with one known to be operating properly. If both data sets pass the analog loop-back self-test, perform the end-to-end self-test (2-wire sets).

#### 5.5.1.4 ANALOG LOOP-BACK SELF TEST (2-WIRE OR 4-WIRE DATA SETS)

- a. Depress the AL and ST switches.

Requirement: All lamps except MC are lighted during a 30-second testing interval. If the MC lamp blinks or remains steadily ON, or if any of the other lamps are extinguished, the data set is defective and should be replaced.

- b. Depress the RO switch.

Requirement: RS and CS lamps extinguish. MC lamp lights. CO lamp extinguishes if data set optioned for switched carrier operation (option XA, XD, or XE).

- c. Return the data set to normal operation by depressing the RO, ST and AL switches.

Requirement: Switches return to the out position and TM lamp extinguishes.

#### 5.5.1.5 END-TO-END SELF-TEST (2-WIRE DATA SET)

- a. Depress ST switch at both ends.

Requirement: TM lamp lights.

- b. Depress RO switch at receive ends.

- c. Establish line connection.

Requirement: At transmit end, all lamps are lighted except CO lamp. At receive end, all lamps are lighted except RS, CS, and MC lamps. If MC lamp blinks an average or more than twice per minute or remains steadily ON, the data set or telephone facility is the source of trouble.

- d. Repeat the test in the opposite direction by releasing the RO switch at one end and depressing the RO switch at the other end.
- e. Return to pretest mode by releasing the ST switches at both ends and releasing the RO switch at the receive end.

Requirement: TM lamp extinguishes.

#### 5.5.2 DATA SET 208B SELF TESTS

##### 5.5.2.1 BUTTONS ON THE DATA SET

Six buttons are located on the front panel of the data set. All of these except the LP button are push-to-operate, push-to-release type. The functions of the buttons are as follows:



- a. LP (Lamp Test) - When depressed, this button causes all lamps to light except the ON lamp (The ON lamp is normally lighted when power is applied). This button is used to determine if all the status lamps are functional. Its use does not affect other data set operations.
- b. AL (Analog Loopback) - Connects the output of the local transmitter to the input of the local receiver. Depressing the AL button prevents the data set from entering the data mode from the talk mode or upon automatic answer. While the talk mode is not inhibited and calls can be made with the telephone set, any attempt to transfer to the data mode will result in the line being disconnected if the AL button is depressed.
- c. ST (Self Test) - When depressed, this button causes the data set transmitter to turn on and transmit a fixed pattern. The receiver is conditioned to look for this pattern and generate a signal which causes the ER lamp to flash if an error is detected.
- d. RO (Receive Only) - Used when testing the data set to condition it locally as a receiver. When depressed, the switch internally conditions the request-to-send signal to off regardless of the state of the request-to-send signal from the terminal equipment or from other test buttons.
- e. RT (Remote Test) - When depressed, this button conditions the data set to be tested remotely from a Telephone Company Data Test Center (DTC).
- f. 50 Button - When depressed, this button provides a request-to-send/-clear-to-send interval of 50 millisecond (ms). When the button is released, the request-to-send/clear-to-send interval is 150-ms. In almost all cases, the 50-ms request-to-send/clear-to-send interval can be used (button depressed). The 150-ms request-to-send/clear-to-send interval (button released) is provided to assure terminal compatibility and for applications where the channel delay exceeds the length of the transmitted signal. If the terminal equipment experiences frequency time-outs, the 150-ms request-to send/clear-to send interval might correct the condition.

5.5.2.2 STATUS LAMPS ON THE DATA SET

The data set is provided with seven status lamps. Each lamp lights a portion of the front panel which shows the name of the control lead being monitored. The lamps and their functions are as follows:

- a. ON Lamp - This lights when the power cord is plugged into a 105- to 130-volt ac source.
- b. TR (Terminal Ready) - This lamp monitors the status of the data terminal ready signal on the customer interface. When the lamp is lighted, the signal is in the ON condition and tells the data set that the terminal is ready for data communication.
- c. MR (Modem Ready) - This lamp monitors the status of the data set ready signal on the customer interface. When the lamp is lighted, the signal is in the ON condition and the data set is ready for data communication.
- d. RS (Request-to-Send) - This lamp indicates the status of the request-to-send on the customer interface or from the internal circuits which check the data set. When the lamp is lighted, the request-to-send signal is in the on condition and tells the data set to be conditioned to transmit data. In normal operation, when the CO lamp is on, the RS lamp will be off regardless of the status of the RS signal at the customer interface.
- e. CS (Clear-to-Send) - This lamp monitors the status of the clear-to-send signal on the customer interface during both the normal and test modes of operation. When the lamp is lighted, the signal is in the on condition and the data set is ready to transmit data.

- f. CO (Carrier ON) - This lamp monitors the status of the carrier on signal on the customer interface during both normal and test modes of operation. The lamp comes on when a signal is being received by the data set.
  
- g. ER (Equalizer Retrain) - This lamp monitors the status of the automatic retrain mode. If the CO lamp is lighted and the ER indicator is blinking, it indicates that invalid data has been received and that the automatic equalizer is now retraining. Continuous blinking, while the CO lamp is on, is an indication of marginal performance. When the data set is in the ST mode, the ER lamp blinks when an error is detected in received data. For normal operation, when the CO lamp is off, the ER lamp should be lighted and, when the CO lamp is lighted, the ER lamp should be off. Thus, CO and ER lamps light alternately in normal operation. A lighted ER lamp indicates an abnormal condition only when the CO lamp is also lighted.

#### 5.5.2.3 DATAPHONE TESTING

In cases of suspected trouble, the attendant should perform the Lamp Check, the Analog Loopback Test, test the data terminal equipment, and perform and End-to-End Self Test before calling the Telephone Company to report trouble. Only if these checks indicate trouble in Telephone Company provided equipment should the problem be reported to the Telephone Company.

In addition to the following tests, the Telephone Company Test Center personnel may request further assistance in trouble isolation by use of built-in features.

#### 5.5.2.4 LAMP TEST

Depress the LP nonlocking button. All the lamps on the data set should be lighted. The LP can be depressed at any time since it does not affect normal data set operation.

5.5.2.5 ANALOG LOOPBACK SELF TEST

The Analog Loopback Self Test is performed to analyze the data set without using external equipment. The test is performed as follows:

- a. Check that the data set is idle and that power is applied.
- b. Depress AL button.
- c. Depress ST button.
- d. Check that the ON, RS, CS and CO lamps are on and that ER and MR lamps are off. Disregard the status of the TR lamp. If the lamps are not as indicated, the data set has failed the Analog Loopback Self Test.
- e. Observe the ER lamp for 30 seconds. If the ER lamp is on or blinks, this indicates that the data set has failed the Analog Loopback Self Test.
- f. At the end of the test, depress the AL and ST buttons to return the data set to the normal operating condition.

NOTE

The data set power supply is equipped with an over-voltage protection circuit which limits the output voltage as it rises excessively. If this occurs, the data set will fail the Analog Loopback Self Test. To reset the power supply, the power cord must be unplugged and replugged into the ac outlet. If the data set still fails the Analog Loopback Self Test, notify the Telephone Company Repair Service for correction of the problem.

5.5.2.6      **END-TO-END SELF TEST**

The End-to-End Self Test is performed to test both far-end and near-end data sets and the telephone channel between the two sets. The test is performed as follows:

- a. Place a call to the far end and arrange to perform the End-to-End Self Test. Discuss the duration of the test (at least 5 minutes) and when to return to the talk mode.
- b. Request the far end to check the following lamps after the far-end data set has been transferred to the data mode. (ON, RS, CS, and ER lamps are on; MR and CO lamps are off; disregard status of TR lamp.) If the lamps are not as indicated, the system has failed the End-to-End Self Test.
- c. Request the far end to depress the ST button on the data set and the DATA button on the telephone set. The far-end data set is now transferred to the data mode.
- d. Depress the ST and RO buttons on your data set and then depress the DATA button on the telephone set. Your data is now transferred to the data mode and it is possible to receive data.
- e. Check that the ON and CO lamps are on at your data set and that the RS, CS, MR, and ER lamps are off. Disregard status of the TR lamp. If the lamps are not as indicated after transferring to the data mode, the system has failed the End-to-End Self Test.
- f. Observe the ER lamp for a 5-minute period. The ER lamp should be off and should not blink more than an average of three times in any 1-minute period.
- g. After the prearranged time, return to the talk mode and discuss the results of the test.

- h. Repeat the test in the opposite direction by releasing the RO button on your data set. Request the far end to depress the RO button on that set.
- i. Request the far end to check the following lamps after both data sets have been transferred to the data mode. (ON and CO lamps are on; RS, CS, MR, and ER lamps are off; disregard status on TR lamp.) If the lamps are not as indicated, the system has failed the End-to-End Self Test.
- j. Return both data sets to data mode by depressing DATA buttons on the telephone sets at both locations.
- k. Check that the ON, RS, CS, and ER lamps are on at your data set and that the MR and CO lamps are off. Disregard status of TR lamp. After transferring to the data mode, if the lamps are not as indicated, the system has failed the End-to-End Self Test.
- l. Repeat the 5-minute check for this direction of transmission; then return to talk mode.
- m. After the 5-minute check has been performed and the results have been discussed, return the data sets to normal operation by releasing the ST button at your data set.
- n. Return the far-end data set to normal operation by releasing the ST and RO buttons.

**NOTE**

If tests fail, make another attempt before reporting trouble by establishing a new connection.

## 5.6 POWER-UP DIAGNOSTICS

Upon powering-up, the TC-B1 microprocessor will run the TC-B1 power-up diagnostics. This will take 12 seconds, after this time the LED's located on the TC-B1 front panel will give an ON, OFF or BLINKING indication.

The TC-B1 front panel has 8 LEDs, numbered 1 through 8. Number 8 is a power indicator which is either blinking or ON. The others are either ON or OFF. Use of the LED's provides the Service Representative with maximum information and remains as consistent as possible with the front panel convention of the OIS System.

The following procedure is to be used as an example in locating TC-B1 faults. The LED indications in Figure 5-3 are to be used in conjunction with the following sample procedure, this procedure should help in understanding how Charts 1, 2, and 3 are used.

- a. Refer to Chart 1 to find the Condition of the TC-B1. Figure 5-3 shows LED 1 ON and 8 BLINKING, this condition indicates a Memory Chip Error (as indicated in Chart 1).
- b. Locate the bank which has the defective memory chip. Figure 5-3 shows LED 2 OFF and LED 3 ON, therefore Bank 1 has the defective memory chip (as indicated in Chart 2).
- c. Locate the defective chip. Figure 5-3 shows LED 4, 5, and 7 OFF and LED 6 ON, therefore Chip 2 is the defective chip (as indicated in Chart 3).

This is the description of LED usage for the preliminary release of the power-up prompts.

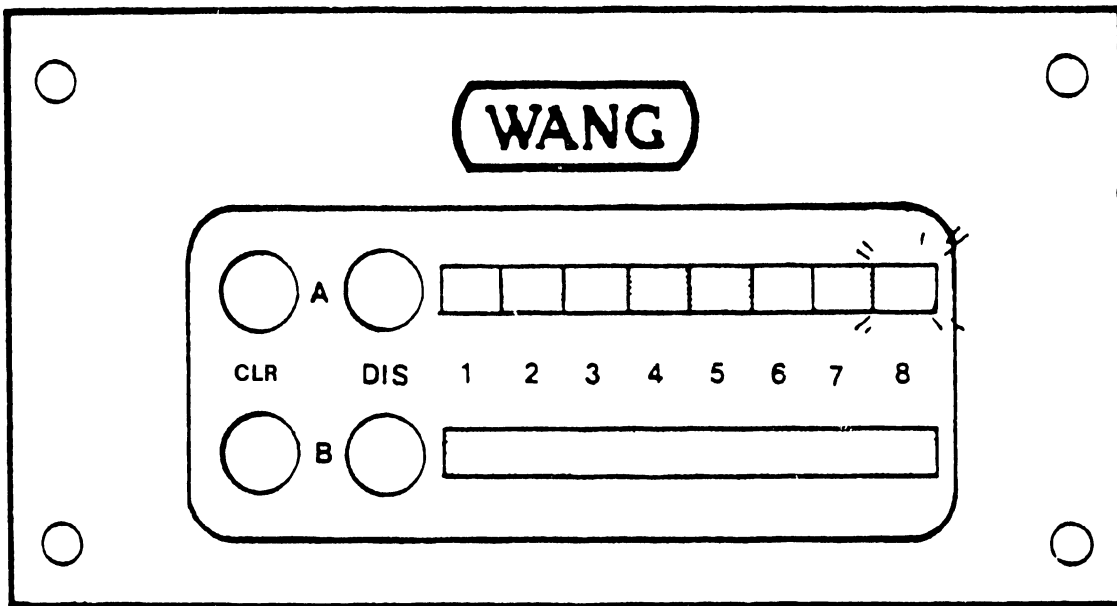


FIGURE 5-3 TC-B1 FRONT PANEL



Condition	Indication
Initial power-on or system reset	1-7 ON, 8 Blinking
Power-up Diagnostic Running, no error	1-7 OFF, 8 Blinking
Memory chip error Detected	1 ON, 8 Blinking
Memory Error, not repairable by replacing RAM chip	1 OFF, 2 ON, 3-7 OFF, 8 BLINKING
Fault on Motherboard	1-2 OFF, 3 ON, 8 BLINKING
Waiting for IPL	1-6 OFF, 7 ON, 8 BLINKING
Operation System Running	1-7 N.A., 8 ON

CHART 1 - Error Indication

LED	2	3	
	0	0	BANK 0
	0	1	BANK 1
	1	0	BANK 2
	1	1	BANK 3

CHART 2 - Bank Identification

LED	4	5	6	7	
	0	0	0	1	CHIP 1
	0	0	1	0	CHIP 2
	0	0	1	1	CHIP 3
	0	1	0	0	CHIP 4
	0	1	0	1	CHIP 5
	0	1	1	0	CHIP 6
	0	1	1	1	CHIP 7
	1	0	0	0	CHIP 8
	1	0	0	1	CHIP 9

See Figure 5-4 for chip location.

CHART 3 - Chip Identification

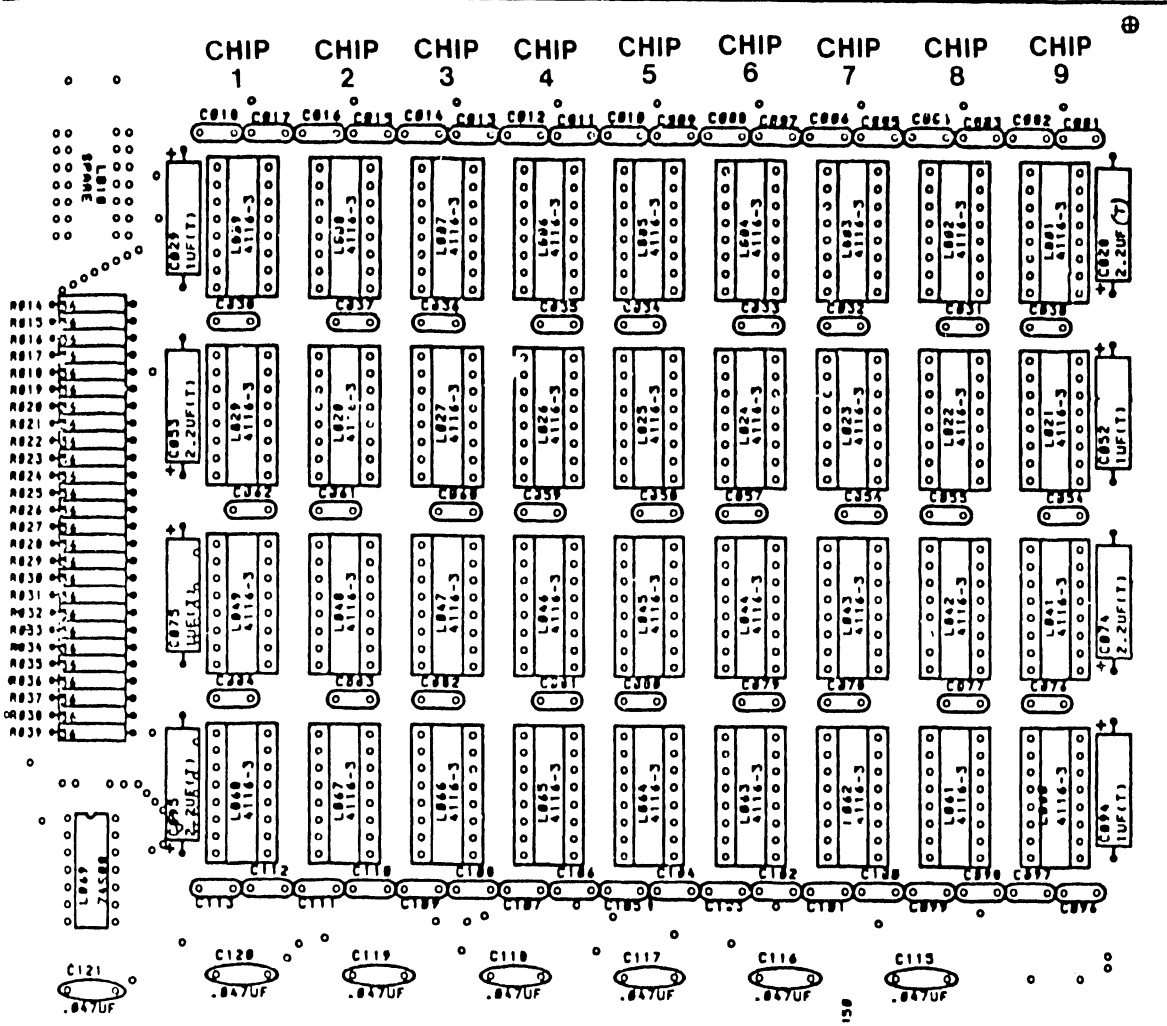


FIGURE 5-4 MEMORY CHIP LAYOUT

### 5.6.1 DIAGNOSTICS SWITCH SETTINGS

SW Bank 1 located on the CPU Motherboard (see Figure 3-3) is also used to select RS232/RS449 external loopback options. Also selectable is a loop on power-up option.

SW 7      ON - RS232 External Loopback and ACU Loopback  
 SW 6      ON - RS449 External Loopback is to be Tested  
 SW 8      ON - Loop On Power-up

### 5.6.2 RS232 EXTERNAL LOOPBACK AND ACU (RS366) LOOPBACK

- a. Set Switch 1      Switch Bank 1 located on the CPU Motherboard (see Figure 3-3) is used to select the RS232 External Loopback and ACU Loopback test. This test is performed during unit troubleshooting; therefore; select this test by positioning Slide SW 7 and 5 ON, and Slide SW 1,2,3,4,6, and 8 OFF.
- b. Install Loopback Plug      The RS232/RS336 Loopback connector plugs into the corresponding RS232/RS336 connector on the rear panel.
- c. Perform Loopback Test      To perform the Loopback Test simply turn the CPU ac power switch ON, the test will run automatically. Once the test is completed the LEDs on the front panel will indicate the condition of the board.

### 5.6.3 RS449 EXTERNAL LOOPBACK TEST

- a. Set Switch 1                      Switch Bank 1 located on the CPU Motherboard (see Figure 3-3) is used to select the RS449 External Loopback Test. This test is performed during unit troubleshooting; therefore; select this test by positioning Slide SW 5 and 6 ON, and Slide SW 1,2,3,4,7, and 8 OFF.
  
- b. Install Loopback Plug              The RS449 Loopback connector plugs into the corresponding RS449 connector on the rear panel.
  
- c. Perform Loopback Test              To perform the Loopback Test simply turn the CPU ac power switch ON, the test will run automatically. Once the test is completed the LEDs on the front panel will indicate the condition of the board.

### 5.6.4 LOOP ON POWER-UP

- a. Switch Setting                      Switch Bank 1 located on the CPU Motherboard (see Figure 3-3) is used to select the Loop On Power-Up Test. This test is performed during unit troubleshooting; therefore; select this test by positioning Slide SW 5 and 8 ON, and Slide SW 1,2,3,4,6, and 7 OFF.
  
- b. Perform Loopback Test              To perform the Loopback Test simply turn the CPU ac power switch ON, the test will run automatically, continuously looping on the power-up diagnostic. The LEDs on the front panel will indicate the condition of the board.

### 5.6.5 "DIS" and "CLR" SWITCH

The display panel provides two momentary contact switches: "DIS" signals the communication interface to inactivate the Data Terminal Ready signal, and "CLR" generates a Power-On Reset state.

### 5.6.6 VS DIAGNOSTIC MONITOR PACKAGE

The VS Diagnostic Monitor Package consists, primarily, of a monitor program and a set of diagnostic microcode programs. The diagnostic microcode programs run in and test serial devices. The Monitor runs under the control of the VS operating system and acts as the user/program interface. It allows the user to select the device he wishes to test, and then to select and download one or more diagnostic microcode programs to that device. When a diagnostic microcode program has been downloaded, the monitor program allows the user to control and observe the diagnostic microcode program's progress. The diagnostic monitor tests the TC-B1 as follows:

- a. Upper RAM Diagnostics, Rev. 1194  
(Tests RAM from 8K to the end of memory)
- b. Z-80 CPU Instruction Test, Rev. 1110  
(Tests all instructions of the Z-80 within controller)
- c. TC-B1 Diagnostics, Rev. 1170  
(Runs under the control of VS Diagnostic monitor and test CTC, DMA, SIO, internally and externally, Vector RAM and Character Monitor circuitry)

### 5.6.7 FRONT PANEL "LEDS"

The lights (LEDS) on the front panel of the TCP or on the OIS Master now are used to display some information on how the TC-B1 is operating. The use of these lights are defined below in terms of the number stenciled TC-B1 operating panel. Light "1" will represent the left most light and light "8" will represent the right most light. The light definitions are:

a. LED 1 System Activity

When the TC-B1 is operating normally, the system activity light should be blinking at a couple times per second. This indicates that the TC-B1's have been successfully loaded and in the absence of other lights, waiting for a line to come up. If the light is running more slowly it is because a lot of message traffic requiring compression is being processed. The light will also run more slowly at 64000 baud.

b. LED 2 Receive Data

This light indicates that a frame was received, without CRC errors. This light inverts each time a message is received, thus the first message that is received will turn the light on, the second will turn the light off, etc. It is, therefore, not unusual for this light to remain on or to remain off for short periods of time during operation.

c. LED 3 Transmit Data

When this light is on the transmitter is currently in the process of transmitting a frame on the line. Unlike the receive light, this light is only on when the transmitter is actually active, hence, when the light is off, that means the transmitter is not active.

d. LED 4 Data Carrier Detect

This light indicates that the signal DCD has been detected by the receiver. This light has a different meaning on the OIS system than on the VS. On the VS system, DCD is only active when the secondary is actually transmitting due to the multi/multi point nature of the data lines. Hence, on the VS system, this light should be used as another indication that secondaries are responding to polls. Note that this light, in conjunction with the receive data light, can be used to detect whether the secondaries are responding to polls AND the primary is understanding the response.

On the OIS system, this light means that the local modem is operating and that the primary's modem is also operating, if modems are in use. If modems are not in use, then it indicates that the VS Primary software is actually operating.

e. LED 5     Virtual Circuit Active

If this light is lit, it means that at least one virtual circuit has been established. It could mean, for example, that a user has logged on or attempted to log onto the VS, or that a batch file manager is active. This light can be used to tell if any workstations are using the TC-B1 prior to it being IPLd as part of the control functions menu as described below.

f. LED 6     Host Traffic Active

When this light is lit, the TC-B1 is in the process of talking to the local host either the OIS or the VS. This light is the best indication that actual user messages are flowing through the system as opposed to the transmit and receive lights which in most cases, merely indicate the polls are happening. On the VS it is not unusual for this light to remain on for long periods of time.

g. LED 7     TC-B1 Refusing New Traffic

When this light is lit, TC-B1 has more traffic than it is willing to handle at that particular time and additional user messages are being temporarily refused. This is not a fatal condition since the software is built with extensive logic to prevent traffic from increasing to a point where it would be fatal. However, it should be noted that if this light is frequently lit, user performance is suffering and the user should consider more communications hardware or operating at a faster line speed.

h. LED 8 Diagnostic Mode

This light should be on and NOT blinking during an operation. This indicates that the TC-B1 is in normal user operation.

i. Idle TC-B1

When a single light is rotating on the TC-B1 from left to right, this indicates that the TC-B1 is idle and may be loaded by the control menu and initialized.



**APPENDIX**

**A**

**SCHEMA-**

**TIC**

**DRAW-**

**INGS**

THE SCHEMATICS, WHEN AVAILABLE, ARE ON THE LAST FICHE IN THIS SET.

**APPENDIX**

**B**

**BILL**

**OF**

**MATER-**

**IALS**

APPENDIX B  
BILL OF MATERIALS

VS-TCP Mother Board	210-7i61
TCP Regulator	210-7760
TC-B1 Light Board	210-7865
TC-B1 CPU Motherboard	210-7763
TC-B1 Data Link & Memory PCB	210-7762

MBO080-A SINGLE-LEVEL BILL OF MATERIAL AS OF

RUN DATE- 12/19/81

PAGE 1

ASSEMBLY PART NUMBER 210-7761- - -

LEGEND

ASSEMBLY DESCRIPTION PCA VS-TCP MOTHER BOARD

1- P-PHANTOM- 2- ITEM MASTER DELY CODE- 3- \*-TAGGED OUT OF KIT-PROD STR-

POSITION IN STRUCTURE	LEGEND			COMPONENT PART NUMBER	DESCRIPTION	E C N	QUANTITY PER ASSY	U/M	L/T
	1	2	3						
1	IN			000-0001- - -	LABOR CIRCUIT SYSTEMS		.1500		00000
1	IN			000-0011- - -	LABOR QUALITY CONTROL		.0300		00000
1	IN			220-1711- - -	MOTHER BD CBL 806482-0865 20235D		1.0000	EACH	00010
1	IN			350-0021- - -	225-22221-110 SOL TYPE		8.0000	EACH	
1	IN			510-7761- - -	PCB VS-TCP MOTHER BUARD		1.0000	EACH	
1	IN			654-1193- - -	3 POS P.C.HEADER ASSY AMP 350210-1 20235D		1.0000	EACH	

ASSEMBLY PART NUMBER 210-7760- - -

LEGEND

ASSEMBLY DESCRIPTION PCA TCP REGULATOR BOARD

1- P-PHANTOM- 2- ITEM MASTER DELY CODE- 3- \*-TAGGED OUT OF KIT-PRDD SIR-

POSITION IN STRUCTURE	LEGEND			COMPONENT PART NUMBER	DESCRIPTION	E C N	QUANTITY PER ASSY	U/M	L/T
	1	2	3						
1	IN			300-1926- - -	CAP .22 UF 20% 100 V CERAMIC MONU...	19908D	4.0000	EACH	
1	IN			300-1931- - -	1 UF CERAMIC CAPACITOR-HIGH FREQ-	19908D	6.0000	EACH	
1	FS			300-1966- - -	CAP .047 UF 50V+80-20% CERAMIC MLD		4.0000	EACH	
1	IN			300-3010- - -	CAP 50 UF 50V -10+75% ELECT AXIAL	19433D	1.0000	EACH	
1	IN			300-3078- - -	8.2K UF 25V ELECTROLYTIC CAP-AXIAL-	19908D	2.0000	EACH	
1	IN			300-3080- - -	4K UF 30V ELECT CAP-AXIAL LEAD-		1.0000	EACH	
1	FS			300-4000- - -	CAP 1.0 UF 35 V 10% TANT AXIAL		1.0000	EACH	00001
1	FS			300-4002- - -	CAP .1 UF 35 V 10% TANT AXIAL	20454D	1.0000	EACH	00001
1	FS			300-4005- - -	CAP .18 UF 35 V 10% TANT AXIAL	19908D	2.0000	EACH	00001
1	FS			300-4008- - -	CAP .33 UF 35 V 10% TANT AXIAL		3.0000	EACH	00001
1	IN			300-4027- - -	CAP 2.2 UF 35 V 5% TANT AXIAL		2.0000	EACH	
1	FS			330-2011- - -	RES 100 OHM 1/4w 5% FIXED COMP	21586D	2.0000	EACH	
1	IN			330-3011- - -	RES 1K OHM 1/4w 5% FIXED COMP		1.0000	EACH	
1	FS			330-3023- - -	RES 2.2K OHM 1/4w 5% FIXED COMP	19908D	2.0000	EACH	
1	FS			330-3048- - -	RES 4.7K OHM 1/4w 5% FIXED COMP	20454D	3.0000	EACH	
1	FS			330-3056- - -	RES 5.6K OHM 1/4w 10% FIXED COMP	19433D	1.0000	EACH	
1	FS			330-4010- - -	RES 10K OHM 1/4w 10% FIXED COMP	19433D	5.0000	EACH	
1	FS			330-4022- - -	RES 22K OHM 1/4w 10% FIXED FILM	19433D	1.0000	EACH	
1	FS			330-5013- - -	120K OHM 1/4w 5% FIXED COMP		3.0000	EACH	
1	IN			332-2027- - -	RES 270 OHM 1w 10% FIXED COMP	19433D	1.0000	EACH	
1	IN			332-3010- - -	RES 1K OHM 1w 10% FIXED COMP	19908D	2.0000	EACH	
1	IN			336-1022- - -	RES 2K OHM VAR TRIM SIDE ADJ SQ		3.0000	EACH	
1	IN			337-2047- - -	RES 470 OHM 2w 10% FIXED COMP	20454D	1.0000	EACH	
1	IN			350-0222- - -	CON PN HJK 90 JLG 2 PUS PCB INT RED	19834D	1.0000	EACH	
1	IN			374-0002- - -	IC REG UA 7905 -5V TO-220		1.0000	EACH	
1	IN			374-0003- - -	IC REG UA 7912 -12V TO-220		1.0000	EACH	
1	IN			374-0024- - -	IC REG UA78GUIC PGS ADJ TO-202		3.0000	EACH	
1	IN			375-1027- - -	ISTR 2N3725 0.8W 80V SH NPN S	19908D	3.0000	EACH	
1	IN			375-1051- - -	TRANSISTOR 2N6292 -PLASTIC-		2.0000	EACH	
1	IN			375-9010- - -	HEAT SINK BIRTCHTER 3AL635-2K	20454D	3.0000	EACH	
1	IN			375-9018- - -	722 HEATSINK THERMALLOY 6107	20454D	4.0000	EACH	
1	IN			376-0240- - -	IC LM339 4 COMPARTOR		1.0000	EACH	
1	FS			380-1001- - -	D035 SIL DIODE 30V 100 MA AT IV T&R		5.0000	EACH	
1	IN			380-3008- - -	A15A RECTIFIER		2.0000	EACH	
1	IN			380-3015- - -	SRS605 50 PIV 6 AMP RECTIFIER		2.0000	EACH	
1	IN			510-7760- - -	PCB TCP REGULATOR BOARD		1.0000	EACH	
1	FS			650-3137- - -	SCR 6-32 3/8 PAN HEAD SLOT NYLON	20443D	7.0000	EACH	
1	FS			652-3002- - -	NUT 6-32UNC HEX REG PAT NYLON	20454D	7.0000	EACH	

ASSEMBLY PART NUMBER 210-7865- - -

LEGEND

ASSEMBLY DESCRIPTION PCA TCB-1 LIGHT BD

1: PHANTOM; 2: ITEM MASTER DELY CODE; 3: \* = TAGGED OUT OF KIT (PROD STR)

POSITION	IN	LEGEND			COMPONENT	DESCRIPTION	E C N	QUANTITY	U/M	L/T
		1	2	3						
1	IN				279-0300- - -	MICRO SWITCH ASSY.C6060-203		2.0000	EACH	00010
1	IN				325-9034- - -	PUSH BUTTON RED ALCO#C12	19695D	2.0000	EACH	
1	FS				330-2015- - -	RES 150 OHM 1/4W 10% FIXED COMP		8.0000	EACH	
1	IN				376-9905- - -	IC 16 PIN SOCKET CAMBION		1.0000	EACH	
1	IN				376-9008- - -	IC 16 PIN TEKNA #4330	19369D	1.0000	EACH	
1	IN				465-1742- - -	SPRING D.30 M.018 D.23 B10039-5027	19369D	2.0000	EACH	
1	IN				510-7865- - -	PCB TCB-1 LIGHT RC		1.0000	EACH	
1	IN				600-3104- - -	WIRE 26 AWG STRAND,YEL TEFLON INS	20434D	.3200	FEET	
1	FS				652-0012- - -	ALCO 1/4-40 X 5/16 HEX NUT	19369C	4.0000	EACH	
1	FS				653-0029- - -	ALCO LOCKWASHER	19369D	2.0000	EACH	
1	FS				653-6009- - -	WASH 1/4 .267ID .478OD INT T	ST 19369D	2.0000	EACH	

ASSEMBLY PART NUMBER 210-7763-A - -

LEGEND

ASSEMBLY DESCRIPTION PCA TCB-1 CFL MOTHER BD

1: F-PHANTOM; 2: ITEM MASTER (FLY CODE); 3: \*-TAGGED KIT OF KIT (FFCD STR)

POSITION IN STRUCTURE	L GENC			COMPONENT PART NUMBER	DESCRIPTION	E C N	QUANTITY PER ASSY	U/M	L/T
	1	2	3						
1		IN		000-0001- - -	LABCR CIRCLIT SYSTEMS		3.5000		CCCCC
1		IN		000-0011- - -	LAECR QUALITY CONTRCL		.7000		CCCCC
1	F	IN		209-7763- - -	PCA TCB-1 CPU MOTHER BD		1.0000	EACH	
1		IN		377-0341-L - -	2114L 1KX4 STATIC RAM 450NS L PWR		2.0000	EACH	
1		IN		377-0368- - -	IC 280A CPU 40 PIN	20642	1.0000	EACH	
1		IN		377-0371- - -	IC 280 CTCA 28 PIN	20642	1.0000	EACH	
1		IN		377-0388- - -	IC AM9517A1FC DIRECT MEMORY ACCESS	20642	1.0000	EACH	
1		IN		377-0393- - -	Z80A-SIO/2 SERIAL I/O 40 PIN 4MHZ	PA1REL	1.0000	EACH	
1		FS		378-6004- - -	TCB-1 POWER UP DIAGNOSTIC L95	20398D	1.0000	EACH	C0003
1		IN		615-1594- - -	TRIM STRIP TCE1 UPPER C10021-5029	20216D	1.0000	EACH	
1		IN		615-1595- - -	TRIM STRIP TCE1 LOWER C10021-5029	20216C	1.0000	EACH	
1		IN		615-1659- - -	TRIM STRIP TCE1 MIDDLE C10021-5029	20216C	1.0000	EACH	



ASSEMBLY PART NUMBER 209-7763- - - \*\*\* PHANTOM \*\*\* LEGEND

ASSEMBLY DESCRIPTION PCA PCB-1 CPU MOTHER BD

1- P-PHANTOM- 2- ITEM MASTER DELY CODE- 3- \*-TAGGED OUT OF KIT-PROD STR-

POSITION IN STRUCTURE	LEGEND 1 2 3	COMPONENT PART NUMBER	DESCRIPTION	E C N	QUANTITY PER ASSY	U/M	L/T
1	IN	220-3170-	14 PIN FLAT CABLE ASSY C06482-0014	18586D	1.0000	EACH	00010
1	IN	300-1270-	CAP 270 PF 10% 500 V CERAMIC DISC	19116D	3.0000	EACH	
1	IN	300-1920-	CAP 820 PF 10% 500 V CERAMIC DISC		1.0000	EACH	
1	IN	300-1903-	CAP .01 UF +80-20% 25 V CERAMIC D	19116D	1.0000	EACH	
1	IN	300-1906-	CAP .001 UF 10% 500 V CERAMIC DISC	20843D	1.0000	EACH	
1	IN	300-1907-	CAP .0015 UF 20% 500 V CERAMIC DISC	19116D	1.0000	EACH	
1	IN	300-1930-	.1 UF 50V +80-20% CERAMIC CAP-HIFRQ	19116D	6.0000	EACH	
1	FS	300-1966-	CAP .047 UF 50V+80-20% CERAMIC MLJ	20843D	76.0000	EACH	
1	IN	300-2210-	CAP .1 UF 10% 100 V MYLAR		1.0000	EACH	
1	IN	300-4020-	CAP 47.0 UF 15 V 10% TANT AXIAL	19116D	1.0000	EACH	
1	FS	300-4022-	CAP 15.0 UF 20 V 10% TANT AXIAL	19116D	6.0000	EACH	00001
1	IN	325-1501-	SWITCH SLIDE SPST 5 POS DIL	19116D	1.0000	EACH	
1	IN	325-1503-	SWITCH SLIDE SPST 8 POS DIL	19116D	1.0000	EACH	
1	FS	330-1011-	RES 10 OHM 1/4W 5% FIXED COMP	21506D	1.0000	EACH	
1	FS	330-1057-	RES 56 OHM 1/4W 5% FIXED COMP	20843D	1.0000	EACH	
1	FS	330-1069-	RES 68 OHM 1/4W 5% FIXED COMP	20843D	3.0000	EACH	
1	FS	330-2011-	RES 100 OHM 1/4W 5% FIXED COMP		6.0000	EACH	
1	FS	330-3023-	RES 2.2K OHM 1/4W 5% FIXED COMP	21623D	21.0000	EACH	
1	FS	330-3033-	RES 3.3K OHM 1/4W 10% FIXED COMP		1.0000	EACH	
1	FS	330-3047-	RES 4.7K OHM 1/4W 10% FIXED COMP	19116D	13.0000	EACH	
1	FS	330-3048-	RES 4.7K OHM 1/4W 5% FIXED COMP	19116D	1.0000	EACH	
1	FS	330-3068-	RES 6.8K OHM 1/4W 10% FIXED COMP		1.0000	EACH	
1	FS	330-4010-	RES 10K OHM 1/4W 10% FIXED COMP	19116D	10.0000	EACH	
1	FS	330-4021-	RES 20K OHM 1/4W 5% FIXED COMP	19116D	8.0000	EACH	
1	FS	330-4047-	RES 47K OHM 1/4W 10% FIXED COMP	19116D	4.0000	EACH	
1	FS	330-4052-	RES 51K OHM 1/4W 5% FIXED COMP	20843D	1.0000	EACH	
1	FS	330-6033-	RES 3.3M OHM 1/4W 10% FIXED COMP		1.0000	EACH	
1	FS	330-6056-	RES 5.6M OHM 1/4W 10% FIXED COMP		1.0000	EACH	
1	FS	331-2012-	RES 120 OHM 1/2W 10% FIXED COMP		2.0000	EACH	00001
1	IN	337-1047-	RES 47 OHM 2W 10% FIXED COMP		2.0000	EACH	
1	IN	350-0009-	225-21521-10500 PC CONN SOLDER TYPE	19116D	4.0000	EACH	
1	IN	350-4506-	CONN 2 POS. SHUNT .100 CTR 22360E	19116D	1.0000	EACH	
1	IN	375-1012-	MPS 6512 SILICON TRANSISTOR	19116D	1.0000	EACH	
1	IN	375-1014-	MPS 6518 SILICON TRANSISTOR	19116D	1.0000	EACH	
1	IN	376-0076-	IC 75150P 2 LINE DRIVER	19116D	6.0000	EACH	
1	IN	376-0077-	IC 75154 4 LINE REC	19116D	3.0000	EACH	
1	IN	376-0080-	IC 74123 RETRIGGER MONOSTABLE MVB	19116D	2.0000	EACH	
1	IN	376-0126-	IC 555 TIMER		1.0000	EACH	
1	IN	376-0139-	IC 7414 HEX SCHMITT TRIGGER		1.0000	EACH	
1	IN	376-0148-	IC 74LS266 4 2 IN EXCL NOR GATE		2.0000	EACH	
1	IN	376-0153-	IC 74LS08 4 2 IN POS AND GATE	19116D	5.0000	EACH	
1	IN	376-0155-	IC 74LS74 2 D TYPE EDGE TRIG FF	19116D	11.0000	EACH	
1	IN	376-0159-	IC 74LS174 HEX D TYPE FLIP FLUP	19116D	1.0000	EACH	
1	IN	376-0160-	IC 74LS175 4 D TYPE EDGE TRIG F/F		1.0000	EACH	
1	IN	376-0180-	IC 74LS04 HEX INVERTER	19116D	3.0000	EACH	
1	IN	376-0192-	IC 74LS367 HEX BUS DRIVER 3 STATE	19116D	1.0000	EACH	
1	IN	376-0202-	IC 74S74 2 D TYPE F F W PRESET CLR	19116D	1.0000	EACH	
1	IN	376-0206-	IC 74S260 2 5 IN POS NOR GATE	18586D	1.0000	EACH	
1	IN	376-0207-	IC 74LS00 4 2 IN POS NAND GATE	19116D	2.0000	EACH	
1	IN	376-0208-	IC 74LS02 4 2 IN POS NOR GATE		3.0000	EACH	
1	IN	376-0209-	IC 74LS10 3 3 IN POS NAND GATE		1.0000	EACH	
1	IN	376-0210-	IC 74LS20 2 4 IN POS NAND GATE	19116D	2.0000	EACH	

ASSEMBLY PART NUMBER 209-7763- - - \*\*\* PHANTOM \*\*\* LEGEND

ASSEMBLY DESCRIPTION PCA TCB-1 CPU MOTHER BD

1- P-PHANTOM- 2- ITEM MASTER DELY CODE- 3- \*-TAGGED OUT OF KIT-PROD STR-

POSITION IN STRUCTURE	LEGEND			COMPONENT PART NUMBER	DESCRIPTION	L C N	QUANTITY PER ASSY	U/M	L/T
	1	2	3						
1	IN			376-0211- - -	IC 74LS32 4 2 IN POS OR GATE	19116D	8.0000	EACH	
1	IN			376-0213- - -	IC 74LS51 2 2 w 2 IN AND OR INV GT		1.0000	EACH	
1	IN			376-0216- - -	IC 74LS157 4 2-1 LINE DATA SELC MX		1.0000	EACH	
1	IN			376-0226- - -	IC 74LS139 2 2-4 LINE DECODE	19116D	2.0000	EACH	
1	IN			376-0228- - -	IC 74S00 4 2 IN POS NAND GATE		1.0000	EACH	
1	IN			376-0231- - -	IC 74LS86 4 2 IN EXCLUSIVE OR GATE		1.0000	EACH	
1	IN			376-0242- - -	IC 74LS280 9 BIT ODD EVEN PARITY GN		1.0000	EACH	
1	IN			376-0245- - -	IC 74LS27 3 3 IN POS NOR GATE		2.0000	EACH	
1	IN			376-0285- - -	IC 74LS245 8 BUS TRANS w/TR ST OUTP	19116D	2.0000	EACH	
1	IN			376-0286-1 - -	IC 74LS374 11/SIG/MMI ONLY	19116D	1.0000	EACH	
1	IN			376-0283- - -	IC 74LS244 OCTAL BUF/LINE DR 3 OUT	19116D	1.0000	EACH	
1	IN			376-0293- - -	IC 74LS158 4 2-1 LINE DATA SELC/MPX	19116D	3.0000	EACH	
1	IN			376-0294- - -	IC 74LS133 3-8 LINE DECODER/MPX		2.0000	EACH	
1	IN			376-0297- - -	IC 74LS240 OCTAL BUF/LINE DR/LN REC	19116D	3.0000	EACH	
1	IN			376-0302- - -	IC 74LS273 OCTAL D-TYPE F/F w/CLEAR		3.0000	EACH	
1	IN			376-0304- - -	IC 74LS73 DUAL J-K MASTER SLAVE F/F	19116D	2.0000	EACH	
1	IN			376-0310- - -	IC 74LS373 OCTAL D-TYP LATCHES SCITT		1.0000	EACH	
1	IN			376-0323- - -	IC 74S225 16 X 5 BI POLAR FIFO	19116D	2.0000	EACH	
1	IN			376-0324- - -	IC 74125 DUAL BUSBUFF w/TRI STATE	19116D	1.0000	EACH	
1	IN			376-0470- - -	IC 26LS31 QUAD HIGH SPEED DIF LINE		1.0000	EACH	
1	IN			376-0471- - -	IC 26LS32 QUAD HIGH SPEED DIF LINE		2.0000	EACH	
1	IN			376-9003- - -	IC 24 PIN SOCKET BURNDY	20387D	1.0000	EACH	
1	IN			376-9011- - -	IC 40 PIN SOCKET BURNDY # DILBZ40P1	19116D	3.0000	EACH	
1	IN			376-9012- - -	IC 14 PIN SOCKET CAMBION	19116D	2.0000	EACH	
1	IN			376-9014- - -	IC 18 PIN SOCKET		2.0000	EACH	
1	IN			376-9015- - -	IC 28 PIN SOCKET BURNDY	19116D	1.0000	EACH	
1	FS			380-1001- - -	D035 SIL JUDGE 30V 100 MA AT LV T&R	19116D	2.0000	EACH	
1	IN			449-0247- - -	HANDLE,FACEPLATE B6815-123	19116D	2.0000	EACH	
1	IN			452-2095-45- -	FACE PLT -7762 & 7763- J06877-0586	19116D	1.0000	EACH	
1	IN			452-2095- - -	STIFFENER CARD C06877-0706	20104D	1.0000	EACH	
1	IN			462-0410- - -	SPCR .115 ID .250 OD .437L FIBRE	20985	3.0000	EACH	
1	IN			510-7763- - -	PCB TCB-1 CPU MOTHER BD		1.0000	EACH	
1	FS			650-2120- - -	4-40 X 3/8 PAN HD PHL MS SS SEMS	19116D	3.0000	EACH	
1	FS			650-2160- - -	4-40 X 1/2 PAN HD PHL MS SS SEMS	19116D	8.0000	EACH	
1	FS			650-2240- - -	4-40 X 3/4 PAN HD PHL MS SS SEMS	19116D	3.0000	EACH	
1	FS			651-0016- - -	SCR,#4X1/2 SELF THR SL RND HD T-25	19116D	4.0000	EACH	
1	FS			653-0003- - -	WASHER, NO.4 NYLON 1/8 ID X 3/8 OD	19116D	5.0000	EACH	
1	IN			654-0104- - -	CONN HEADER. 3 .100 ROW STR PIN	19116D	1.0000	EACH	
1	IN			654-1192- - -	TERMINAL, SINGLE NECK PMP 103-w/O-77	19116D	9.0000	EACH	
1	IN			654-1329- - -	CLIP COMPONENT B10073-5000	19592D	1.0000	EACH	

MB0080-A SINGLE-LEVEL BILL OF MATERIAL AS OF

RUN DATE: 10/29/80

PAGE 1

ASSEMBLY PART NUMBER 210-7762-A - -

LEGEND

ASSEMBLY DESCRIPTION PCA TCB-1 DATA LINK & MEMORY BD

1: P=PHANTOM; 2: ITEM MASTER DELY CODE; 3: \*=TAGGED OUT OF KIT(PROD STR)

POSITION	IN	LEGEND	COMPONENT	DESCRIPTION	E C N	QUANTITY	U/M	L/T
STRUCTURE		1 2 3	PART NUMBER			PER ASSY		
1		IN	209-7762- - -	PCA TCB-1 DATA LINK & MEMORY BD		1.0000	EACH	00010
1		IN	377-0345-M - -	MK4116-N3 16K-1 BIT DYNM RAM MOSTEK		36.0000	EACH	

ASSEMBLY PART NUMBER 209-7762- - - \*\*\* PHANTOM \*\*\* LEGEND  
 ASSEMBLY DESCRIPTION PCA PCB-1 DATA LINK & MEMORY BD 1- P-PHANTOM- 2- ITEM MASTER DELY CODE- 3- \*-TAGGED OUT OF KIT-PROD STR-

POSITION	IN	LEGEND	COMPONENT	DESCRIPTION	E C N	QUANTITY	U/M	L/T
STRUCTURE	1	2	3	PART NUMBER		PER ASSY		
1		IN	300-1022-	22 PF CERAMIC CAP		1.0000	EACH	
1		IN	300-1220-	CAP 220 PF 10% 500 V CERAMIC DISC		1.0000	EACH	
1		IN	300-1270-	CAP 270 PF 10% 500 V CERAMIC DISC		3.0000	EACH	
1		IN	300-1390-	CAP 390 PF 10% 500 V CERAMIC DISC	19193D	2.0000	EACH	
1		IN	300-1930-	.1 UF 50V +80-20% CERAMIC CAP-HIFRQ	PATREL	63.0000	EACH	
1		IN	300-1944-	CAP 100PF 20% 100V CERAMIC DISC	19193D	1.0000	EACH	
1		FS	300-1966-	CAP .047 UF 50V+80-20% CERAMIC MLD	19193D	67.0000	EACH	
1		FS	300-4000-	CAP 1.0 UF 35 V 10% TANT AXIAL	PATREL	4.0000	EACH	00001
1		FS	300-4002-	CAP .1 UF 35 V 10% TANT AXIAL		1.0000	EACH	00001
1		FS	300-4022-	CAP 15.0 UF 20 V 10% TANT AXIAL	PATREL	4.0000	EACH	00001
1		IN	300-4027-	CAP 2.2 UF 35 V 5% TANT AXIAL	PATREL	4.0000	EACH	
1		IN	300-5012-	CAP .0022UF 5% 500 V MICA DIPPED		1.0000	EACH	
1		IN	321-0044-	CRYSTAL 31.9488MHZ .005% 3RD OVERTN		1.0000	EACH	
1		FS	330-1057-	RES 56 OHM 1/4W 5% FIXED COMP	21586D	26.0000	EACH	
1		FS	330-1069-	RES 68 OHM 1/4W 5% FIXED COMP	PATREL	3.0000	EACH	
1		FS	330-1092-	RES 91 OHM 1/4W 5% FIXED COMP		2.0000	EACH	
1		FS	330-2011-	RES 100 OHM 1/4W 5% FIXED COMP	PATREL	3.0000	EACH	
1		FS	330-2015-	RES 150 OHM 1/4W 10% FIXED COMP		1.0000	EACH	
1		FS	330-2028-	RES 270 OHM 1/4W 5% FIXED COMP		1.0000	EACH	
1		FS	330-2040-	RES 390 OHM 1/4W 5% FIXED COMP	19556D	3.0000	EACH	
1		IN	330-3011-	RES 1K OHM 1/4W 5% FIXED COMP	21622D	3.0000	EACH	
1		FS	330-3023-	RES 2.2K OHM 1/4W 5% FIXED COMP	21623D	22.0000	EACH	
1		FS	330-3048-	RES 4.7K OHM 1/4W 5% FIXED COMP	21714D	2.0000	EACH	
1		FS	330-4010-	RES 10K OHM 1/4W 10% FIXED COMP		2.0000	EACH	
1		FS	330-4033-	RES 33K OHM 1/4W 10% FIXED COMP		1.0000	EACH	
1		IN	375-1003-	TSTR 2N3640 0.2W SH PNP S		1.0000	EACH	
1		IN	376-0073-	IC 7490 DECADE COUNTER		1.0000	EACH	
1		IN	376-0092-	IC 7425 2 4 IN NOR GATE /SIROBE		1.0000	EACH	
1		IN	376-0104-	IC 9602 2 RETRIG RESET MONOSTBL MVB	PATREL	1.0000	EACH	
1		IN	376-0146-	IC 75107 2 LINE RECEIVER		1.0000	EACH	
1		IN	376-0153-	IC 74LS08 4 2 IN POS AND GATE		2.0000	EACH	
1		IN	376-0155-	IC 74LS74 2 D TYPE EDGE TRIG FF	PATREL	8.0000	EACH	
1		IN	376-0159-	IC 74LS174 HEX D TYPE FLIP FLOP		1.0000	EACH	
1		IN	376-0180-	IC 74LS04 HEX INVERTER		2.0000	EACH	
1		IN	376-0197-	IC 74S04 HEX INVERTER		1.0000	EACH	
1		IN	376-0199-	IC 74S02 4 2 IN POS NOR GATE		2.0000	EACH	
1		IN	376-0200-	IC 74S08 4 2 IN POS AND GATE		1.0000	EACH	
1		IN	376-0202-	IC 74S74 2 D TYPE F F W PRESET CLR	PATREL	6.0000	EACH	
1		IN	376-0205-	IC 74S32 4 2 IN POS OR GATE		1.0000	EACH	
1		IN	376-0207-	IC 74LS00 4 2 IN POS NAND GATE	PATREL	2.0000	EACH	
1		IN	376-0208-	IC 74LS02 4 2 IN POS NOR GATE		1.0000	EACH	
1		IN	376-0209-	IC 74LS10 3 3 IN POS NAND GATE	PATREL	1.0000	EACH	
1		IN	376-0211-	IC 74LS32 4 2 IN POS OR GATE	19193D	4.0000	EACH	
1		IN	376-0213-	IC 74LS51 2 2 W 2 IN AND OR INV GT		1.0000	EACH	
1		IN	376-0216-	IC 74LS157 4 2-1 LINE DATA SELC MX	PATREL	2.0000	EACH	
1		IN	376-0228-	IC 74S00 4 2 IN POS NAND GATE	19193D	1.0000	EACH	
1		IN	376-0233-	IC 74LS161 SYN CTR DIRECT CLEAR		5.0000	EACH	
1		IN	376-0235-	IC 74S163 SYN 4 BIT COUNTER		1.0000	EACH	
1		IN	376-0237-	IC 74S11 3 3 IN POS AND GATE		1.0000	EACH	
1		IN	376-0238-	IC 74S10 3 3 IN POS NAND GATE	PATREL	1.0000	EACH	
1		IN	376-0246-	IC 74S289 9 BIT ODD EVEN PARITY GEN		1.0000	EACH	
1		IN	376-0248-	IC 74LS175 4 BIT PAR ACCES SHIFT		1.0000	EACH	

ASSEMBLY PART NUMBER 209-7762- - - \*\*\* PHANTOM \*\*\* LEGEND  
 ASSEMBLY DESCRIPTION PCA TCB-1 DATA LINK & MEMORY BD 1- P-PHANTOM- 2- ITEM MASTER DELY CODE- 3- \*-TAGGED OUT OF KIT-PROD STR-

POSITION IN STRUCTURE	IN LEGEND			COMPONENT PART NUMBER	DESCRIPTION	E C N	QUANTITY PER ASSY	U/M	L/T
	1	2	3						
1		IN		376-0256- - -	IC 75113 2 DIF LINE REC 3 STATE OUT		1.0000	EACH	
1		IN		376-0270- - -	IC 74S175 4 D-TYPE F/F		1.0000	EACH	
1		IN		376-0278- - -	IC 74S161 4 BIT BINARY SYNC/CNTRS		1.0000	EACH	
1		IN		376-0285- - -	IC 74LS245 8 BUS TRANS W/TR ST OUTP		1.0000	EACH	
1		IN		376-0286- - -	IC 74LS374 8 LATCHES W/TR ST OUTP		2.0000	EACH	
1		IN		376-0293- - -	IC 74LS158 4 2-1 LINE DATA SELC/MPX		5.0000	EACH	
1		IN		376-0298- - -	IC 74S138 3 TO 8 LINE DECODLR/MPX		1.0000	EACH	
1		IN		376-0303- - -	IC 74LS299 SCHOTTKY 8 BIT UNIV RES	191930	1.0000	EACH	
1		IN		376-0310- - -	IC 74LS373 OCTL D-TYP LATCHES SCHTT		1.0000	EACH	
1		IN		376-0324- - -	IC 74125 QUAD BUSBUFF W/TRI STATE		2.0000	EACH	
1		IN		376-0334- - -	IC 74S240 OCTAL BUF/LINE DR/LN REC	PATREL	3.0000	EACH	
1		IN		376-0336- - -	IC 74S151 DATA SEL/MUX	PATREL	1.0000	EACH	
1		IN		375-9002- - -	IC 16 PIN SOCKET BURNDY		36.0000	EACH	
1		IN		380-2129- - -	DIO ZEN IN4372A 3.0V 400MA S J0-7		1.0000	EACH	
1		IN		510-7762- - -	PCB TCB-1 DATA LINK & MEMORY BD		1.0000	EACH	
1		IN		654-1192- - -	TERMINAL,SINGLE NECK PMP 103-W/G-77	191930	11.0000	EACH	
1		IN		654-1197- - -	CONN HEADER. 5 .125 1ROW 90D PIN	185840	1.0000	EACH	
1		IN		655-0254- - -	BUMPER,.640 OJ X.340 THK BLK AD-UK	201670	2.0000	EACH	

**APPENDIX**

**C**

**RS232/RS366**

**LOOPBACK**

**CONNECTOR**

**WIRING DIAGRAM**

APPENDIX C

RS232/RS366 LOOPBACK CONNECTOR WIRING DIAGRAM

ACU RS-366

pin		pin
3 -----		14
5-----		15
6-----		16
13-----		17
22-----		2
		4-----!

!  
!  
!  
!  
!  
!  
!

RS-232

pin		pin	!
2-----		3	!
4-----		5	!
5-----		8	!
6-----		20	!
11-----		15	!
15-----		17	!
		22-----!	

RS232/RS366 LOOP BACK CONNECTOR (WLI# 420-1041)

**APPENDIX**

**D**

**RS449 LOOPBACK**

**CONNECTOR**

**WIRING DIAGRAM**





**APPENDIX**

**E**

**RS232-C**

**CONNECTOR PIN**

**ASSIGNMENT**

APPENDIX E  
RS-232-C CONNECTOR PIN ASSIGNMENT

<u>PIN</u>	<u>EIA</u>	<u>CCITT</u>	<u>SIGNAL DESCRIPTION</u>	<u>SOURCE</u>
1	AA	101	Protective Ground	
2	BA	103	Transmitted Data	TC-B1
3	BB	104	Received Data	Modem
4	CA	105	Request to Send	TC-B1
5	CB	106	Clear to Send	Modem
6	CC	107	Data Set Ready	Modem
7	AB	102	Signal Ground	
8	CF	109	Received Line Signal Detector	Modem
9				
10				
11	SCA	120	Secondary Request to Send	TC-B1
12	SCF	122	Secondary Rec'd Line Sig. Det.	Modem
13	SCB	121	Secondary Clear to Send	Modem
14	SBA	118	Secondary Transmitted Data	TC-B1
15	DB	115	Receiver Signal Element Timing	Modem
16	SBB	119	Secondary Received Data	Modem
17	DD	115	Receiver Signal Element Timing	Modem
18		124	Select Frequency Groups	TC-B1
19	SCA	120	Secondary Request to Send	TC-B1
20	CD	108.2	Data Terminal Ready	TC-B1
21	CG	110	Signal Quality Detector	Modem
22	CE	125	Ring Indicator	Modem
23	CH/CI	111/112	Data Signaling Rate Selector	TC-B1/Modem
24	DA	113	Trans. Signal Element Timing	TC-B1
25			Unassigned	

**APPENDIX**

**F**

**RS449-C**

**CONNECTOR PIN**

**ASSIGNMENT**

## APPENDIX F

## RS-449-C CONNECTOR PIN ASSIGNMENT

<u>PIN</u>	<u>SIGNAL DESCRIPTION</u>	<u>MNEM.</u>	<u>SOURCE</u>
1		Shield	
2	Signal Rate Indicator	SI	Modem
3	Terminal Timing	TT	TC-B1
4	Send Data	SD	TC-B1
5	Send Timing	ST	Modem
6	Receive Data	RD	Modem
7	Request to Sent	RS	TC-B1
8	Receive Timing	RT	Modem
9	Clear to Send	LS	Modem
10	Local Loopback	LL	
11	Data Mode	DM	Modem
12	Terminal Ready	TR	TC-B1
13	Receive Ready	RR	Modem
14	Remote Loopback	RL	
15	Incoming Call	IC	Modem
16	Select Freq./Signal Rate Select.	SF/SR	
17	Spare	TT	
18	Test Mode		
19	Signal Ground	SG	
20	Incoming Call	IC	Modem
21	Terminal Timing	TT	TC-B1
22	Send Data	SD	TC-B1
23	Send Timing	ST	Modem
24	Receive Data	RD	Modem
25	Request to Send	RS	TC-B1
26	Receive Timing	RT	Modem
27	Clear to Send	CS	Modem
28	Terminal in Service	IS	
29	Data Mode	DM	Modem
30	Terminal Ready	TR	TC-B1
31	Receive Ready	RR	Modem
32	Select Standby	SS	
33	Signal Quality	SQ	
34	New Signal	NS	
35	Spare	TT	
36	Standby Indicator		
37	Signal Ground	SG	

**APPENDIX**

**G**

**RS-366**

**CONNECTOR PIN**

**ASSIGNMENT**

## APPENDIX G

## RS-366 CONNECTOR PIN ASSIGNMENT

<u>PIN</u>	<u>EIA</u>	<u>CCITT</u>	<u>SIGNAL DESCRIPTION</u>	<u>SOURCE</u>
1			Frame Ground	
2	211		Digit Present	TC-B1
3	205		Abandon Call and Retry	ACU
4	202		Call Request	TC-B1
5	210		Present Next Digit	ACU
6	213		Power Indication	ACU
7	201		Signal Ground	
8				
9				
10				
11				
12				
13	204		Data Set Status	ACU
14	206		Digit Bit 0 (LSB)	TC-B1
15	207		Digit Bit 1	TC-B1
16	208		Digit Bit 2	TC-B1
17	209		Digit Bit 0 (MSB)	TC-B1
18				
19				
20				
21				
22	203		Data Line Occupied	ACU
23				
24				
25				

**APPENDIX**

**H**

**BELL**

**MODEMS**



APPENDIX H  
BELL MODEMS

TELECOMMUNICATIONS SUPPORT

BELL MODEM 201C

TYPE Synchronous, half-duplex  
 SPEED 2400 BPS PRIVATE LINE  
 NETWORK For medium speed point-to-point PRIVATE LINE  
 WANG SYSTEMS For Wang VS TC-B1 IOP.  
 For Wang VS Remote Workstations 2246R  
 For Wang Computers using the 2228B/OP62B, and 2228C/D  
 For Wang Word Processors using TC-3, TC-WS, TC-B2, TC-8, TC-B1

STANDARD MODEM DECISIONS

FOR COMPATIBILITY WITH

<u>DECISION</u>		<u>WANG SYSTEMS</u>	<u>COMMENTS</u>
A	1. EIA Interface 2. Contace Interface	A1	(Note 1)
B	3. Alternate Voice 4. W/O Alternate Voice	B3	Customers Choice
C	5. With New Sync 6. W/O New Sync	C5	
D	7. 2-Wire 8. 4-Wire	D7	(Note 2)
E	9. 4-Wire Private Line (Continuous Carrier) 10. 4-Wire Private Line (Carrier controlled by Request-to-Send or multiparty)	E9	

Note 1 EIA is always used on Private Line with the 201C data set.

Note 2 If Decision D7 - Decision E is not required

## BELL MODEM 208A

TYPE Synchronous, half-duplex  
 SPEED 2400 BPS  
 NETWORK For high speed PRIVATE line point-to-point or multi-point networks  
 WANG SYSTEMS For Wang VS TC-B1 IOP.  
 For Wang VS Remote Workstations 2246R  
 For Wang Computers using the 2228B/OP62B, and 2228C/D  
 (multipoint operation with Burroughs emulation)  
 For Wang Word Processors using TC-3, TC-WS, TC-B2, TC-B,  
 TC-B1 (point-to-point operation only)

<u>DECISION</u>	<u>STANDARD MODEM DECISIONS FOR COMPATIBILITY WITH WANG SYSTEMS</u>		<u>COMMENTS</u>
A	1. transmitter internally timed 2. transmitter externally timed	A1	
B	3. continuous carrier  4. switched carrier	B3	Normal option for point to point connection. Use B4 if multipoint.
C	5. switched request to send 6. continuous request to send	C5	If B4 was selected, C5 must be ***NOTE 1*** selected for proper operation
D	7. one second holdover used 8. one second holdover not used	D7	
E	9. new sync used 10. new sync not used	E10	
F	11. data set ready lead on in analog loopback test 12. data set ready lead off in analog loopback test	F11	

\*\*NOTE 1\*\* For 2246R the modem on the remote side must have option C5. The  
 modem on the CPU side must have option C6.

BELL MODEM 103J

TYPE Asynchronous, full-duplex  
 SPEED Up to 300 BPS  
 NETWORK For low speed, point-to-point SWITCHED networks  
 WANG SYSTEMS For Wang Computers using 2227B/OP62, 2228B/OP62B, or 2228C  
 For Wang Word Processors using TC-3, TC-WS.

<u>DECISION</u>	<u>STANDARD MODEM DECISIONS FOR COMPATIBILITY WITH WANG SYSTEMS</u>	<u>COMMENTS</u>
A	1. Send space disconnect 2. No Send space disconnect	A1
B	3. Receive Space Disconnect 4. No Receive Space Disconnect	B3
C	5. Loss of Carrier Disconnect 6. No Loss of Carrier Disconnect	C5
D	7. Fail Safe State of ON Circuit OFF 8. Fail Safe State of ON Circuit ON	D7
E	9. Automatic Answer IN 10. Automatic Answer OUT	E9
F	11. Factory Supplied EIA Interface 12. Customer Selected EIA Interface	F11

TYPE Asynchronous, half-duplex  
 SPEED Up to 1200 BPS  
 NETWORK For medium speed, point-to-point SWITCHED networks  
 WANG SYSTEMS For Wang Computers using 2227B/OP62, 2228B/OP62B, or 2228C  
 For Wang Word Processors using TC-3, TC-WS.

<u>DECISION</u>	<u>STANDARD MODEM DECISIONS FOR COMPATIBILITY WITH WANG SYSTEMS</u>		<u>COMMENTS</u>
A	1. Local copy on primary channel 2. No Local copy on primary channel	A2	
B	3. Local copy on reverse channel 4. No local copy on reverse channel	B4	
C	5. Telco engineered timing options 6. Customer engineered timing options	C5	
D	7. DSR lead on in analog loopback test 8. SDR lead off in analog loopback test	D7	
E	9. Automatic answer in 10. Automatic answer out	E9	
F	11. Signal and frame ground connected 12. Signal and frame ground not connected	F11	

BELL MODEM 202T

TYPE Asynchronous, half-duplex or full-duplex  
 SPEED Up to 1800 BPS  
 NETWORK For medium speed PRIVATE line, point-to-point or multi-point networks  
 WANG SYSTEMS For 2236 Remote Terminal connection to 2200MVP with 2236MXD  
 (for point-to-point connections only)  
 For Wang Computers using 2227B/OP62, 2228B/OP62B, or 2228C  
 (multi-point operation only with BURROUGHS emulator)  
 For Wang Word Processors using TC-3, TC-WS.

STANDARD MODEM DECISIONS  
FOR COMPATIBILITY WITH

<u>DECISION</u>		<u>WANG SYSTEMS</u>	<u>COMMENTS</u>
A	1. Local copy on primary channel 2. No Local copy on primary channel	A1	See NOTE 1
B	3. Local copy on reverse channel 4. No local copy on reverse channel	B4	
C	5. Telco engineered timing options 6. Customer engineered timing options	C5	
D	7. Telco engineered timing options 8. Customer engineered timing options	D7	See NOTE 2
E	9. Reverse Channel installed 10. Reverse Channel not installed	E10	See NOTE 3
F	11. Signal and frame ground connected 12. Signal and frame ground not connected	F11	

NOTE 1 Option A1 & A2 does not apply when 4-wire required.

NOTE 2 The following control options are provided by decision D7, and are recommended.

<u>Option</u>		<u>Designation</u>
Carrier Detector Reset	OUT	ZM
Continuous Carrier	IN	ZN
State of DSR in Analog Loopback	OFF	YA
Receive Data Clamp	IN	F

NOTE 3 Specify 4-wire for 2236 terminal. (This is a standard option)

## BELL MODEM 212A

TYPE Asynchronous, full-duplex  
 Synchronous, full-duplex  
 SPEED 300/1200 BPS dual mode - Asynchronous operation  
 1200 BPS - Synchronous/300 BPS Asynchronous operation  
 NETWORK For low or medium speed, point-to-point SWITCHED networks  
 WANG SYSTEMS For Wang VS TC-B1 IOP.  
 For Wang VS Remote Workstation 2246R  
 For Wang Computers using 2227B/OP62, 2228B/OP62B, or 2228C  
 For Wang Word Processors using TC-3, TC-WS, TC-B2, TC-B, TC-B1

<u>DECISION</u>	<u>STANDARD MODEM DECISIONS FOR COMPATIBILITY WITH</u>		<u>COMMENTS</u>
		<u>WANG SYSTEMS</u>	
A	1. Factory supplied Disconnect options	A1	See NOTE
	2. Customer selected Disconnect options		
B	3. Automatic answer - yes	B3	
	4. Automatic answer - no		
C	5. Factory supplied EIA Interface	C5	
	6. Customer selected EIA Interface		
D	7. Factory supplied dual	D7	This option will mode enable Dual 300/1200ASYNC Mode
	8. For 1200 BPS synchronous	Select D8 and the mode below listed sub-options for dual mode 1200 synchronous and 300 asynchronous operation.	
			D8a2
			D8c1
			D8d2
			D8e1
E	9. Interface controlled make Busy/analog loop-in	E10	
	10. Interface controlled make Busy/analog loop-out		

NOTE At 1200 BPS, the 212A is not compatible with Bell 202 type modems.

## BELL MODEM 201C

TYPE Synchronous, half-duplex  
 SPEED 2400 BPS  
 NETWORK For medium speed, point-to-point SWITCHED networks  
 WANG SYSTEMS For Wang VS TC-B1 IOP.  
 For Wang VS Remote Workstation 2246R  
 For Wang Computers using 2227B/OP62, 2228B/OP62B, or 2228C  
 For Wang Word Processors using TC-3, TC-WS, TC-B2, TC-B, TC-B1

<u>DECISION</u>	<u>STANDARD MODEM DECISIONS</u>		<u>COMMENTS</u>
	<u>FOR COMPATIBILITY WITH</u>		
	<u>WANG SYSTEMS</u>		
A	1. Transmitter Timing Internal 2. Transmitter Timing External	A1	
B	3. Automatic Answer not provided 4. Automatic Answer controlled by DTR only	B4	
C	5. Ring indicator on EIA interface pin 22 6. Ring indicator contact closure on pins 22 and 23	C5	
D	7. Continuous receiver bit clock-in 8. Continuous receiver bit	D8	Select D7 if direct distance-dialing oversatellite link, otherwise D8
E	9. EIA interface pin 18 includes local analog loopback 10. EIA interface pin 18 provides receive symbol clock	E10	
F	11. Signal and frame ground connected 12. Signal and frame ground not connected	F11	



## BELL MODEM 208B

TYPE Synchronous, half-duplex  
 SPEED 4800 BPS  
 NETWORK For high speed, point-to-point SWITCHED networks  
 WANG SYSTEMS For Wang VS TC-B1 IOP.  
                   For Wang VS Remote Workstation 2246R  
                   For Wang Computers using 2227B/OP62, 2228B/OP62B, or 2228C  
                   For Wang Word Processors using TC-3, TC-WS, TC-B2, TC-B, TC-B1

<u>DECISION</u>	<u>STANDARD MODEM DECISIONS</u>		<u>COMMENTS</u>
		<u>FOR COMPATIBILITY WITH</u> <u>WANG SYSTEMS</u>	
A	1. Transmitter Internally Timed 2. Transmitter Externally Timed	A1	
B	3. Without R01 Auto calling unit  4. With R01 Auto calling unit	B3	Select B4 if auto-calling is required.
C	5. CC off when AL pressed 6. CC on when AL pressed	C6	
D	7. Without Automatic Answer 8. With Automatic Answer	D8	
E	9. Desk mounting 10. Rack or cabinet mounting	E9	

BELL MODEM 209A

TYPE Synchronous, Binary Serial  
 SPEED(S) 9600bps  
 7200 - 2400bps !  
 4800 - 4800bps ! Mutliplex  
 4800 - 2400 - 2400bps ! Combinations  
 2400 - 2400 - 2400 - 2400bps !

NETWORK Point-to-Point 9600 Service  
 Point-to-Point 9600 Multiplex Service  
 Many Point Multiplexing Service  
 One - to - Many Mutiplexing Service  
 DDD Backup at a selectable speed of 9600 bps or 4800 bps

WANG SYSTEMS For Wang VS TC-B1 IOP.  
 For Wang VS Remote Workstation 2246R  
 For Wang Computers using 2227B/OP62, 2228B/OP62B, or 2228C  
 For Wang Word Processors using TC-3, TC-WS, TC-B2, TC-B, TC-B1

STANDARD MODEM DECISIONS  
FOR COMPATIBILITY WITH

<u>DECISION</u>		<u>WANG SYSTEMS</u>	<u>COMMENTS</u>
A	1. Transmitter Timing by Data Set 2. Transmitter Timing by Data Terminal	A1	
B	3. Data Set Read interface Load On in Analog Loopback Mode 4. Data Set Ready interface Lead OFF in Analog Loopback Mode	B3	
C	5. Transmit Timing Slaved to Receive Timing 6. Transmit Timing Not Slaved to Receive Timing	C5	
D	7. Elastic Stores IN 8. Elastic Stores OUT	D8	NOTE
E	9. Continuous Carrier 10. Switched Carrier	E9	(Decision F required) (Decision F not required)
F	11. Switched Request to Send 12. Continuous Request to Send	F11	

NOTE Elastic Stores should be IN for 209A (multiplexer) to Modem operation and OUT for 209A to Terminal operation.

## BELL MODEL 801A

## AUTOMATIC CALLING UNIT

DATA SET - PRIVATE LINE - SERIES 800

DECISION	OPTION	SELECT DECISION
A	1. EIA Voltage Interface	A1
	2. Contact Interface	
B	3. Call terminated through ACU after DSS on	B4
	4. Call terminated through data set after DSS on	
C	5. ACR timer stopped after DSS on	C5
	6. ACR timer not stopped after DSS on	
D	7. End-of-number signal from customer terminal	D7
	8. No end-of-number signal from customer terminal(**See Note**)	
E	9. ACR answer-tone detection (801A6 only)	
	10. Data set answer-tone detection without EON signal (R01A5 only)	

NOTE: If D7 decision, no E decision is required. If D8 decision E decision is made.

## BELL MODEL 801C

## AUTOMATIC CALLING UNIT

## DATA SET - PRIVATE LINE - SERIES 800

DECISION	OPTION	SELECT DECISION
A	1. 2-Wire	A1
	2. 4-Wire	
B	3. Call terminated ACU	B4
	4. Call terminated through data set after DSS on	
C	5. ACR timer stopped after DSS on	C5
	6. ACR timer not stopped after DSS on	
D	7. Line transfer controlled by end-of-number signal from customer terminal (see Note 2)	D7
	8. No end-of-number signal from customer terminal(see Note 2)	
E	9. Line transfer after ACU answer-tone detection (R01C4 only)	E10
	10. Data set answer-tone detection without EON	
F	11. Loop start (R01C4 only)	
	12. Ground Start	

NOTE 1: If Decision D7, ACU option B must be installed in R01C3 or 801C4 and Decision E is limited to 9.

NOTE 2: If Decision is D8, then the choice must be made in Decision E between an 801C4 with option B or option E in 801C3 or 801C4

## BELL MODEL 801C L1/2

## AUTOMATIC CALLING UNIT

DATA SET - PRIVATE LINE - SERIES 800

DECISION	OPTION	SELECT DECISION
A (See Note 1)	1. Signal ground connected to frame ground	A1
	2. Signal ground NOT connected to frame ground	
B	3. Call terminated through ACU	B4
	4. Call terminated through data set after DSS ON	
C	5. ACR timer stopped after DSS on	C5
	6. ACR timer NOT stopped after DSS ON	
D (see Note 2)	7. Longest ACR timing interval	
	8. ACR timing interval specified by customer	

Note 1: If second dial tone detection is required option A2 must be selected and TELCO option 12 (Loop start) must be selected. Grounding option of the data set and ACU must be the same.

Note 2: The longest ACR time available is 40 seconds or greater

The customer specified ACR times are:

1. 7 seconds
2. 14 to 15 seconds
3. 25 to 28 seconds

**APPENDIX**

**I**

**ENGINEERING**

**CHANGE ORDERS**

APPENDIX I  
ENGINEERING CHANGE ORDERS

<u>E.C.O. No.</u>	<u>Description</u>
19783*	Serial IOP 22V17/22V27 Hardware Upgrade
21705*	Serial IOP 22V17 PROMS Upgrade
21757*	Serial IOP 22V27 PROMS Upgrade
22104**	Data Link & Memory Board (210-7762)
22166***	TCP (6554) Regulator Board (210-7760 OIS Operating System Upgrade to 6.3

\*E.C.O. must be implemented to support Remote Wangnet

\*\*E.C.O. is implemented only if board is found defective and returned for repair

\*\*\*E.C.O. is implemented only if more than one TC-B1 is installed in the TCP

**APPENDIX**

**A**

**SCHEMA-**

**TIC**

**DRAW-**

**INGS**



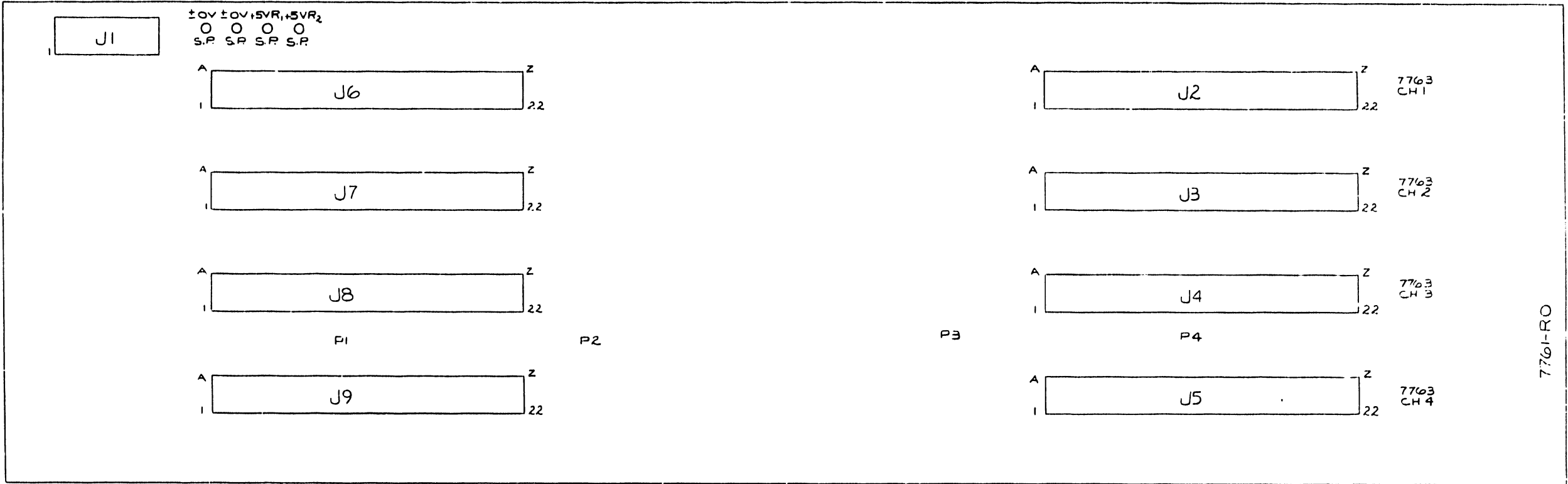
APPENDIX A  
SCHEMATIC DRAWINGS

VS-TCP Mother Board	210-7761
TCP Regulator	210-7760
TC-B1 Light Board	210-7865
TC-B1 CPU Motherboard	210-7763
TC-B1 Data Link & Memory PCB	210-7762



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DO NOT SCALE



COMPONENT	TYPE	W.L. PART NO
J1	3 PIN MOLEX	654-1193
J2-9	44 PIN CONN	350-0021

E-REV  
0

REV	DATE	BY	DESCRIPTION
1	11/11/66	W	ORIGINATED PER DWG # 7761
2	11/11/66	W	APP'D: W

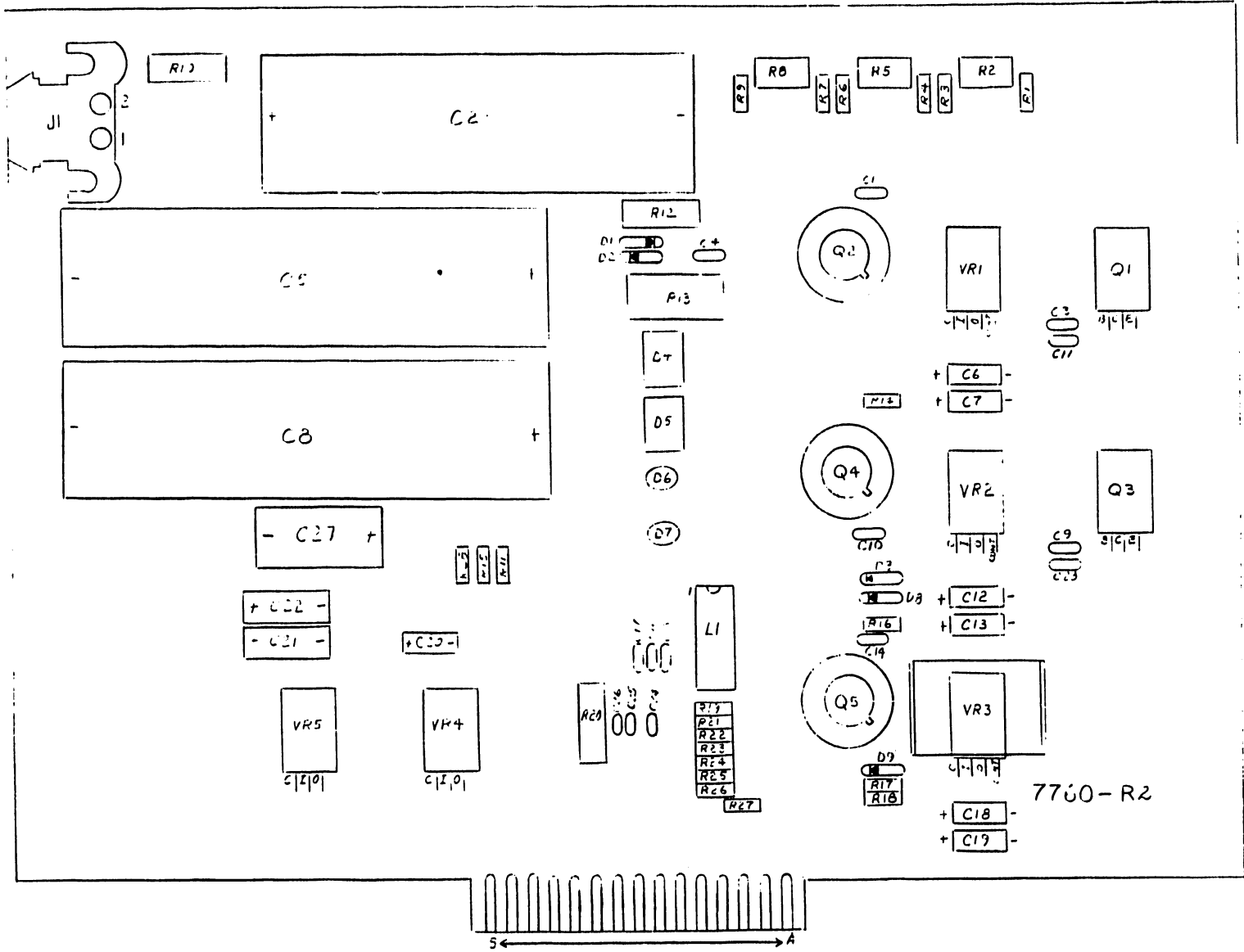
<b>WANG</b> LABORATORIES INC. LOWELL, MASS. U.S.A.		BY DWR	DATE 11/11/66	APPROVED BY E. L. FINE	DATE 11/11/66
MATERIAL PCB	MODEL NO. VS-TCP	TITLE VS-TCP MOTHER BOARD			
FINISH PCB		TOL. EX. AS NOTED		DRAWING NUMBER 7761	
SCALE 1/8" = 1"		PART NUMBER 210-7761		SIZE D	REV 0

22"  
17"  
11"  
8.5"  
8.5"  
11"  
17"  
22"

22"  
17"  
11"  
8.5"  
8.5"  
11"  
17"  
22"

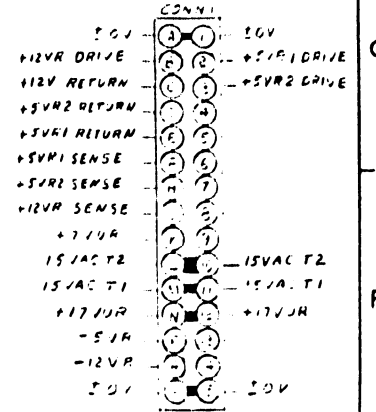
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DO NOT SCALE



LOCATION	TYPE	W.L. PART NO.
L1	LM 339	376-0290

COMPONENT	TYPE	W.L. PART NO.
R25	1K 1/4W 5%	330-3011
R22, 24, 26	120K 1/4W 5%	330-5013
R1, 9, 7	4.7K 1/4W 5%	330-3048
R2, 5, 8	2K 1/4W 5%	330-1022
R3	56K 1/4W 10%	330-3056
R6, 9, 13, 11, 15	10K 1/4W 10%	330-4010
R10, 12	1K 1/2W 10%	330-3010
R28	22K 1/4W 10%	330-4022
R13	470Ω 2W 10%	330-2047
R14, 16, 17, 29	2.2K 1/4W 10%	330-3022
R19, 27	100Ω 1/4W 10%	330-3010
R21, 23	2.2K 1/4W 5%	330-3023
R20	270Ω 1/4W 10%	330-2027
C1, 4, 11, 14	.047μF 50V	300-1986
C2	4K 35V (E)	300-3050
C3, 19, 23	... 100V	300-1926
C5, 8	32K 25V (E)	300-3065
C6, 12, 18	.33μF 25V (T)	300-4008
C17	.1μF 35V (T)	300-4002
C20	1μF 35V (T)	300-4000
C21, 25	.1μF 35V (T)	300-4027
C15, 17, 24, 26	1μF (HF)	300-1931
VR1, 3, 3	LM733JIC	374-0024
VR4	7807	374-0022
VR5	7805	374-0022
C7, 12	15μF 35V (T)	300-4003
Q1, 3	2N392	375-1051
Q2, 4, 5	2N3705	375-1027
D1, 2, 3, 9	31L DIODE	350-1001
D4, 5	5P5605	330-3015
D6, 7	1A5A	330-3008
C27	50μF 50V (E)	300-3010
J1	2POS - EADER	350-0222

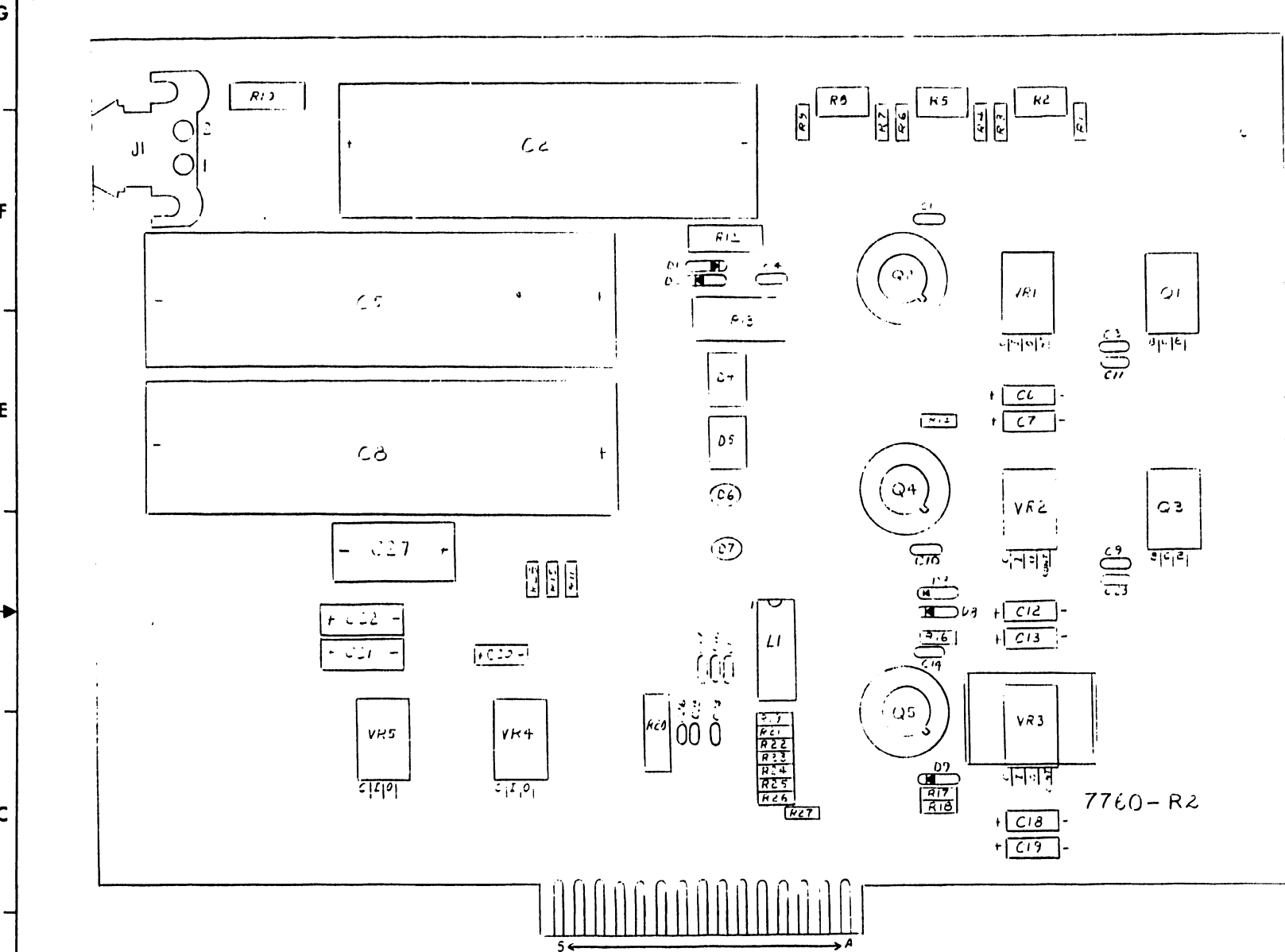


REV	DATE	BY	CHK	APP	DESCRIPTION
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2	...	...	...	...	...
3	...	...	...	...	...

<b>WANG</b> LABORATORIES, INC. LOWELL, MASS. U.S.A.		BY: DWN	DATE: 6-27-71	APPROVED BY: E ENGR	DATE: 6-27-71
MATERIAL: #	MODEL NO: TCP	CHK: HXR	TITLE: TCP REGULATOR		
FINISH: #	10L EX AS NOTED	300-7700		D	7700
SCALE: 1/8" = 1"		DRAWING NUMBER: 300-7700		SIZE: D	

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DO NOT SCALE

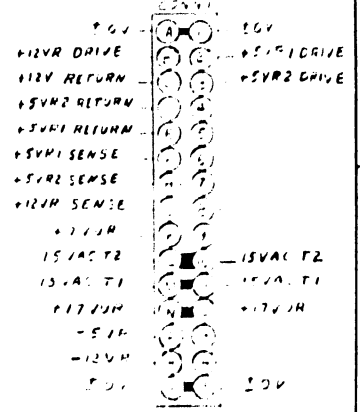


LOCATION	TYPE	W.L. PART NO.
L1	LM 334	376-0240

COMPONENT	TYPE	W.L. PART NO.
R25	1K 1/4W 5%	330-3011
R22, 24, 26	120K 1/4W 5%	330-5013
R19, 7	4.7K 1/4W 5%	330-3044
R2, 5, 6	20K 1/4W 5%	330-3045
R3	20K 1/4W 5%	330-3056

R4, 10, 11, 15	10K 1/4W 5%	330-3046
R16	10K 1/4W 5%	330-3047
R23	2.2K 1/4W 5%	330-4022
R17	4.7K 1/4W 5%	330-3044
R14, 18, 27	2.2K 1/4W 5%	330-3045
R12, 17	100Ω 1/4W 5%	330-3010
R1, 13	200Ω 1/4W 5%	330-3023
R20	270Ω 1/4W 5%	330-2027
C1, 10, 14	2.2μF 50V	300-1750
C2	4K 3.3μF	300-1080
C3, 17, 23	100μF 50V	300-1726
C5, 8	5.0μF 50V (T)	300-3065
C6, 12, 13	0.33μF 50V (T)	300-4008
C15	1μF 50V (T)	300-4002
C20	1μF 50V (T)	300-4000
C1	1μF (T)	300-4001
C15, 17, 24, 26	1μF (HF)	300-1731
D1, 2, 3	1N4148	300-0024
D4	1N4148	300-0022
D5	1N4148	300-0023
D6, 7	1N4148	300-4008
D12	1N4148	300-4008
D13	1N4148	300-4008
C12, 13	UNSPEC	300-1017

D1, 2, 3, 4	1N4148	300-0024
D4, 5	1N4148	300-3010
D6, 7	1N4148	300-3008
C27	500Ω 50V E	300-3010
J1	25POS HEADER	350-0222



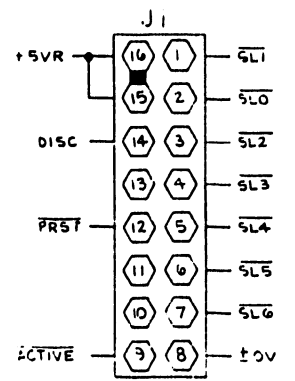
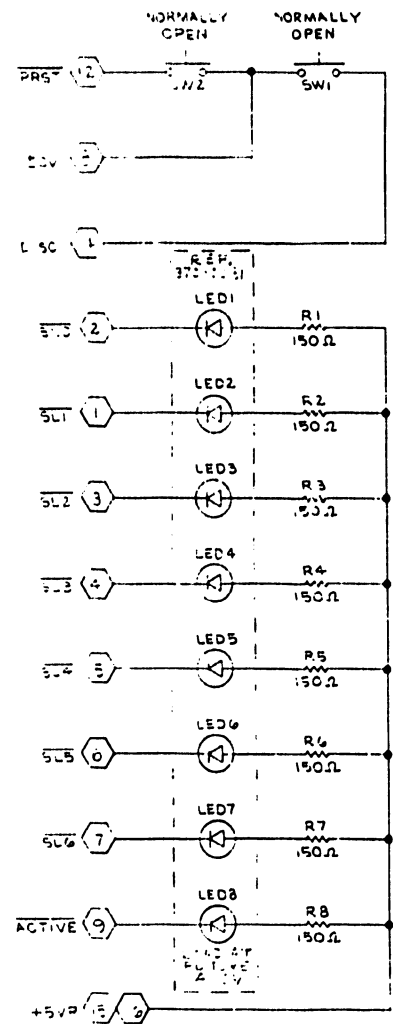
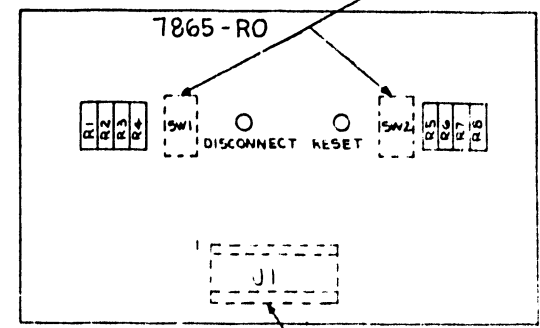
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28	11-11-71	DK	DK	DK
29	11-11-71	DK	DK	DK
30	11-11-71	DK	DK	DK

<b>WANG</b> LABORATORIES, INC. LOWELL, MASS. U.S.A.		BY DWN	DATE 6-1-72	APPROVED BY E ENGR	DATE 6-1-72
MATERIAL //		MODEL NO TCP	TITLE TCP REGULATOR		
FINISH //		SEE ENGR SPECIFICATIONS	MFG ENGR		
SCALE: 2		LOT 2 OF 2	WANG PART NUMBER 210-7760	SIZE D	DRAWING NUMBER 7760

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DO NOT SCALE

REF. N.L. # 279-0300  
MTD. EXT.



MNEMONICS	COORD
ACTIVE	1C11
DISC	1F11
PRST	1F11
SL0-5L6	1E11
±0V	1F11
+5VR	1C11

COMPONENT	TYPE	N.L. PART NO.
R1-8	150Ω 0% 1/4W	330-2015
J1	16PIN SOCKET	576-3005

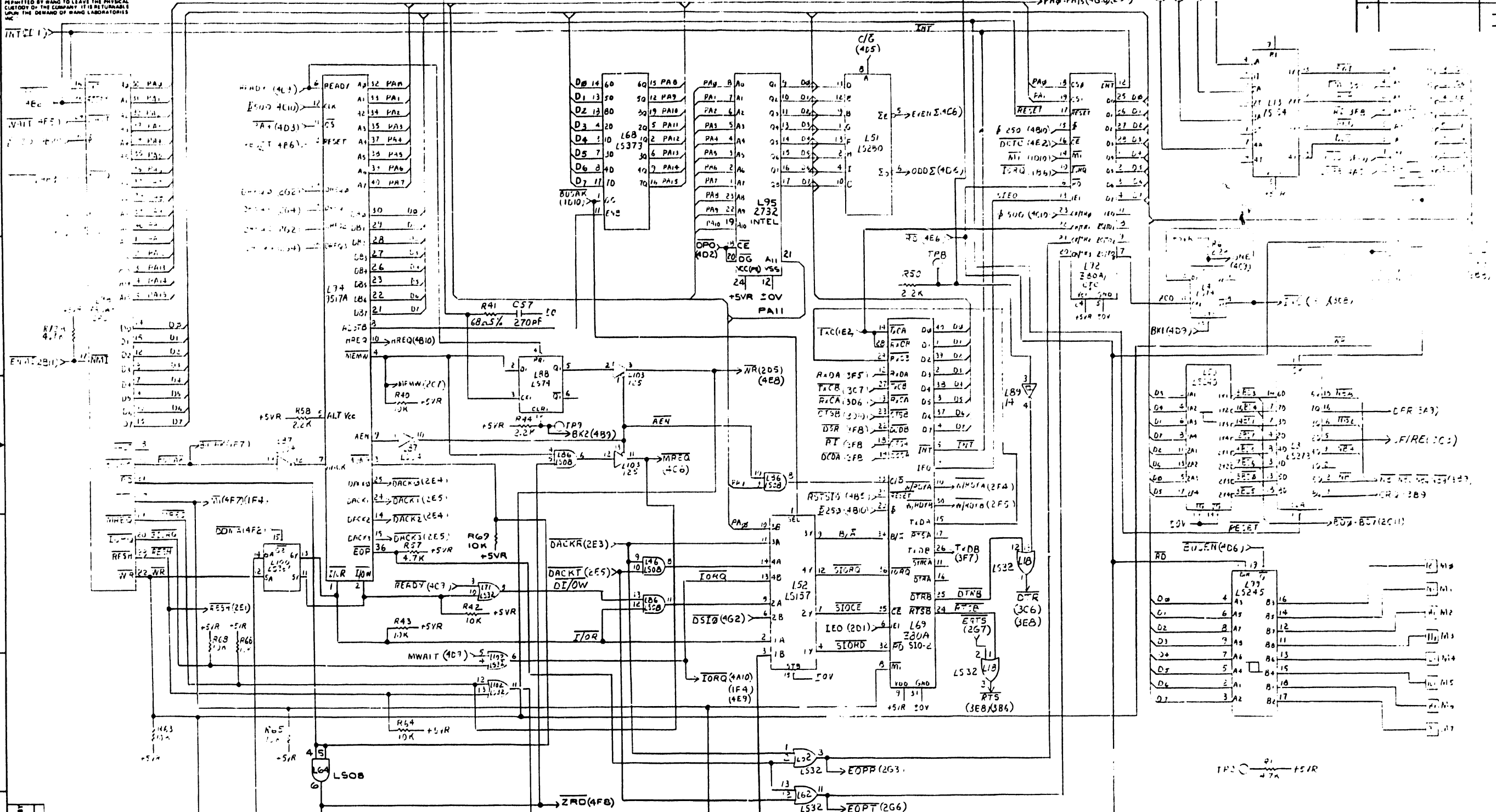
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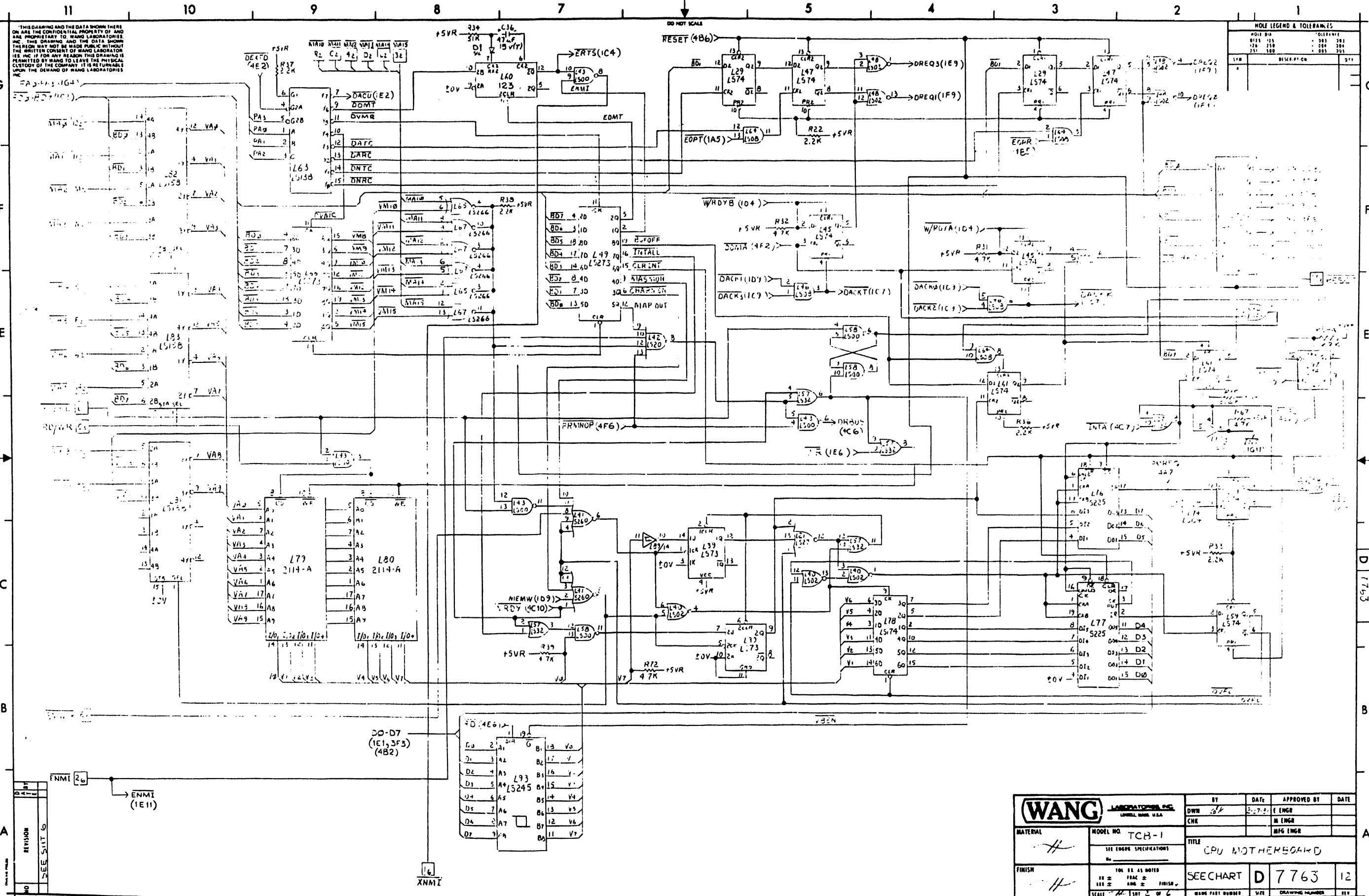
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2	...	...	...

WANG LABORATORIES, INC.		BY	DATE	APPROVED BY	DATE
LABORATORIES, INC. LITTLE ROCK, ARK., U.S.A.		DWN ...	1/15/60	E ENGR	...
MATERIAL		CHK ...	...	M ENGR	...
MODEL NO. TCB-1		TITLE			
SEE ENGR SPECIFICATIONS		LIGHT BOARD			
FINISH		210-7865		D	7865
SCALE		SHEET 1 OF 1		DRWG NUMBER	...

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HOLE LEGEND & TOLERANCES	
Ø	±0.005
Ø	±0.010
Ø	±0.015
Ø	±0.020
Ø	±0.025
Ø	±0.030
Ø	±0.035
Ø	±0.040
Ø	±0.045
Ø	±0.050
Ø	±0.055
Ø	±0.060
Ø	±0.065
Ø	±0.070
Ø	±0.075
Ø	±0.080
Ø	±0.085
Ø	±0.090
Ø	±0.095
Ø	±0.100
Ø	±0.105
Ø	±0.110
Ø	±0.115
Ø	±0.120
Ø	±0.125
Ø	±0.130
Ø	±0.135
Ø	±0.140
Ø	±0.145
Ø	±0.150
Ø	±0.155
Ø	±0.160
Ø	±0.165
Ø	±0.170
Ø	±0.175
Ø	±0.180
Ø	±0.185
Ø	±0.190
Ø	±0.195
Ø	±0.200
Ø	±0.205
Ø	±0.210
Ø	±0.215
Ø	±0.220
Ø	±0.225
Ø	±0.230
Ø	±0.235
Ø	±0.240
Ø	±0.245
Ø	±0.250
Ø	±0.255
Ø	±0.260
Ø	±0.265
Ø	±0.270
Ø	±0.275
Ø	±0.280
Ø	±0.285
Ø	±0.290
Ø	±0.295
Ø	±0.300
Ø	±0.305
Ø	±0.310
Ø	±0.315
Ø	±0.320
Ø	±0.325
Ø	±0.330
Ø	±0.335
Ø	±0.340
Ø	±0.345
Ø	±0.350
Ø	±0.355
Ø	±0.360
Ø	±0.365
Ø	±0.370
Ø	±0.375
Ø	±0.380
Ø	±0.385
Ø	±0.390
Ø	±0.395
Ø	±0.400
Ø	±0.405
Ø	±0.410
Ø	±0.415
Ø	±0.420
Ø	±0.425
Ø	±0.430
Ø	±0.435
Ø	±0.440
Ø	±0.445
Ø	±0.450
Ø	±0.455
Ø	±0.460
Ø	±0.465
Ø	±0.470
Ø	±0.475
Ø	±0.480
Ø	±0.485
Ø	±0.490
Ø	±0.495
Ø	±0.500
Ø	±0.505
Ø	±0.510
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Ø	±0.675
Ø	±0.680
Ø	±0.685
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Ø	±0.695
Ø	±0.700
Ø	±0.705
Ø	±0.710
Ø	±0.715
Ø	±0.720
Ø	±0.725
Ø	±0.730
Ø	±0.735
Ø	±0.740
Ø	±0.745
Ø	±0.750
Ø	±0.755
Ø	±0.760
Ø	±0.765
Ø	±0.770
Ø	±0.775
Ø	±0.780
Ø	±0.785
Ø	±0.790
Ø	±0.795
Ø	±0.800
Ø	±0.805
Ø	±0.810
Ø	±0.815
Ø	±0.820
Ø	±0.825
Ø	±0.830
Ø	±0.835
Ø	±0.840
Ø	±0.845
Ø	±0.850
Ø	±0.855
Ø	±0.860
Ø	±0.865
Ø	±0.870
Ø	±0.875
Ø	±0.880
Ø	±0.885
Ø	±0.890
Ø	±0.895
Ø	±0.900
Ø	±0.905
Ø	±0.910
Ø	±0.915
Ø	±0.920
Ø	±0.925
Ø	±0.930
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Ø	±0.940
Ø	±0.945
Ø	±0.950
Ø	±0.955
Ø	±0.960
Ø	±0.965
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Ø	±0.995
Ø	±1.000





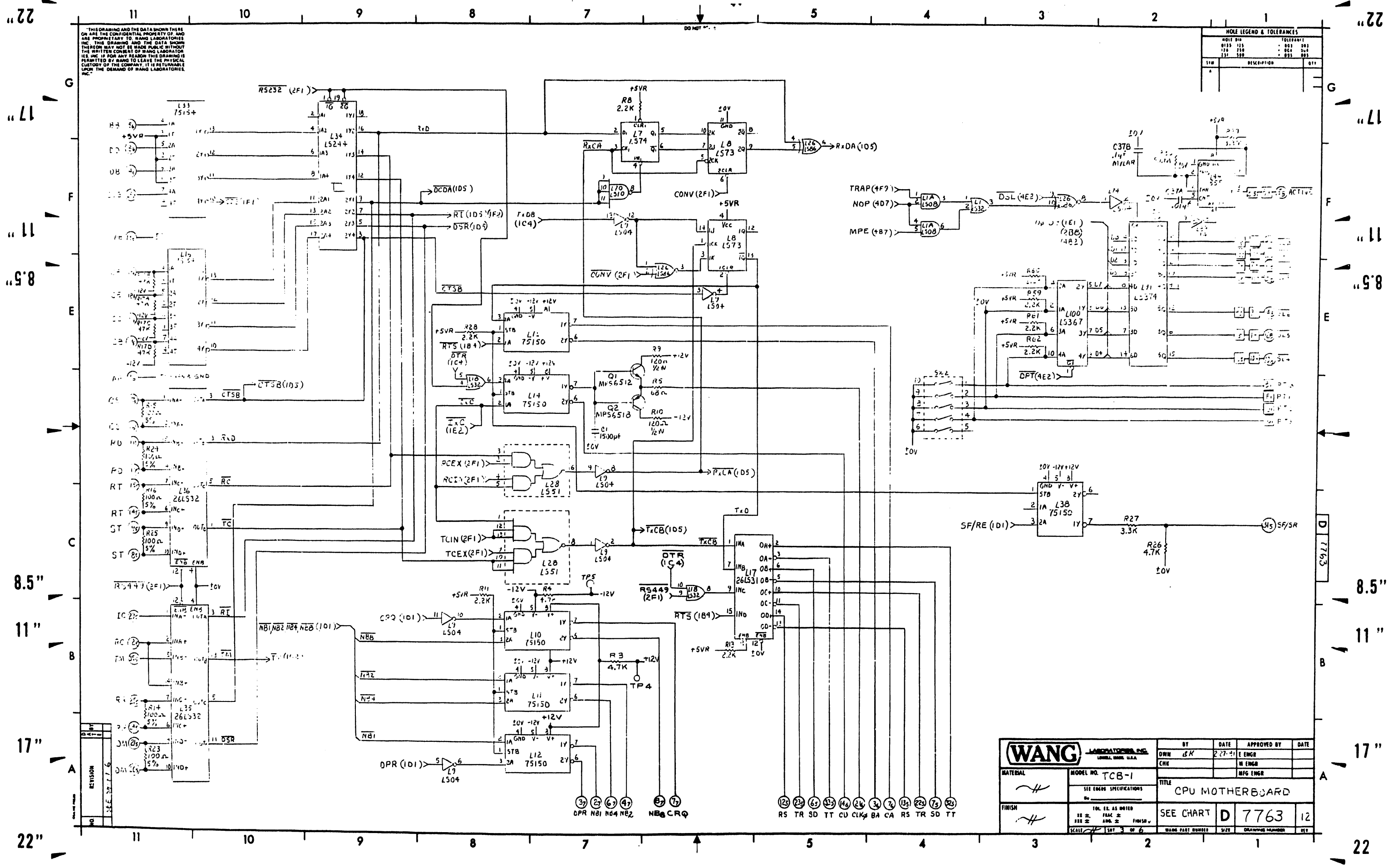
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HOLE LEGEND & TOLERANCES	
SIZE	DIAMETER
0.015	0.015
0.020	0.020
0.030	0.030
0.040	0.040
0.050	0.050
0.060	0.060
0.070	0.070
0.080	0.080
0.090	0.090
0.100	0.100
0.125	0.125
0.150	0.150
0.1875	0.1875
0.250	0.250
0.3125	0.3125
0.375	0.375
0.500	0.500
0.625	0.625
0.750	0.750
1.000	1.000
1.250	1.250
1.500	1.500
2.000	2.000
2.500	2.500
3.000	3.000
4.000	4.000
5.000	5.000
6.000	6.000
8.000	8.000
10.000	10.000
12.000	12.000
15.000	15.000
20.000	20.000
25.000	25.000
30.000	30.000
40.000	40.000
50.000	50.000
60.000	60.000
80.000	80.000
100.000	100.000

REV	DATE	BY	CHKD	APPROVED BY	DATE
1					
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20					

<b>WANG</b> LABORATORIES, INC. LOWELL, MASS. U.S.A.		BY	DATE	APPROVED BY	DATE
MATERIAL		DWN	2-7-77	E ENGR	
MODEL NO. TCH-1		CHK		M ENGR	
SEE ENGR SPECIFICATIONS		TITLE CPU MOTHERBOARD			
FINISH		FOR USE AS NOTED			
SCALE 1/8" = 1"		SEE CHART	D 7763	12	
SCALE 1/8" = 1"		WANG PART NUMBER	SIZE	DRAWING NUMBER	REV





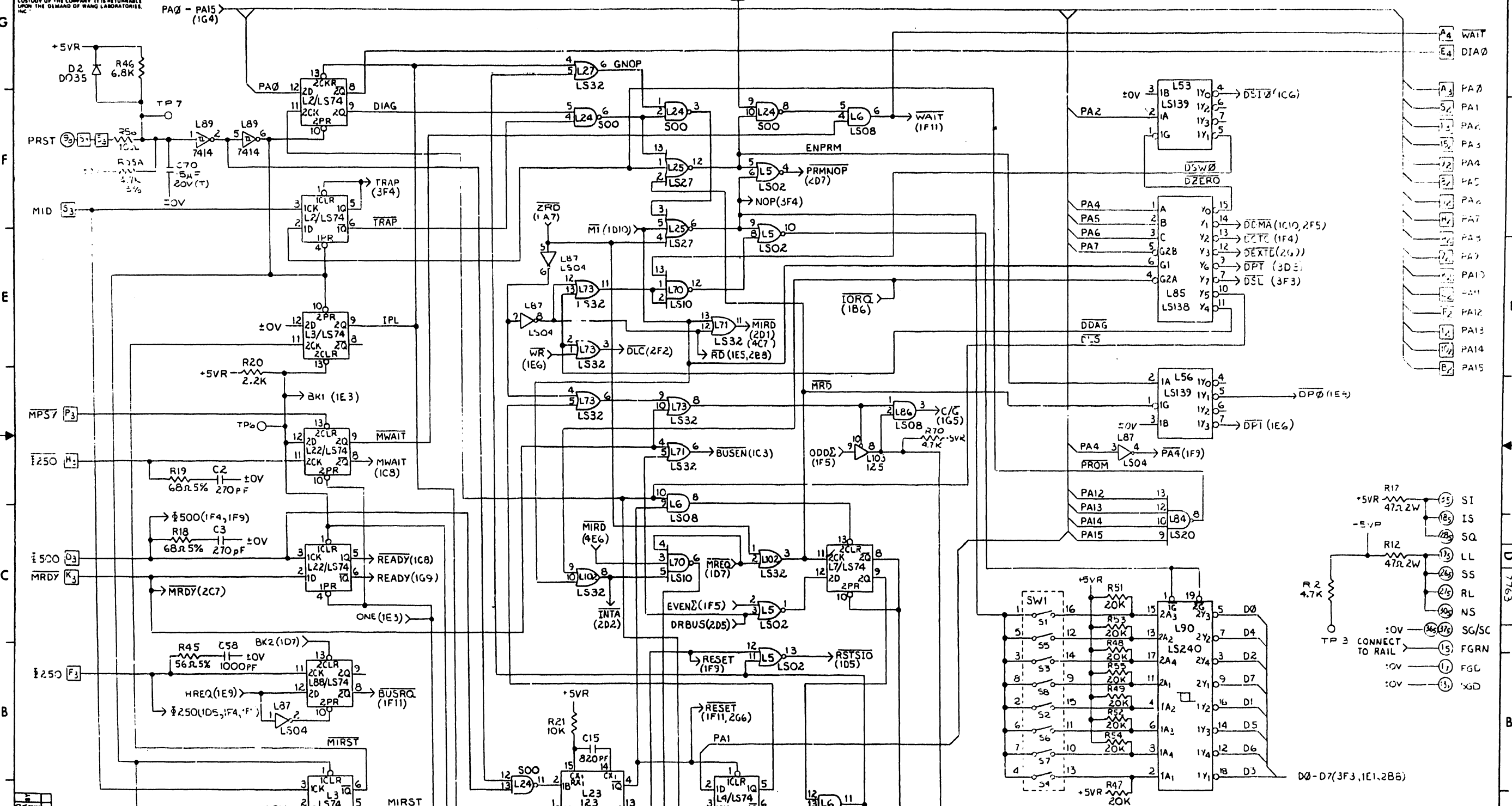
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HOLE LEGEND & TOLERANCES		
HOLE DIA	TOLERANCE	
0.125	+0.003	0.01
0.1875	+0.004	0.02
0.250	+0.005	0.03
0.3125	+0.006	0.04
0.375	+0.007	0.05
0.4375	+0.008	0.06
0.500	+0.009	0.07
0.5625	+0.010	0.08
0.625	+0.011	0.09
0.6875	+0.012	0.10
0.750	+0.013	0.11
0.8125	+0.014	0.12
0.875	+0.015	0.13
0.9375	+0.016	0.14
1.000	+0.017	0.15
1.0625	+0.018	0.16
1.125	+0.019	0.17
1.1875	+0.020	0.18
1.250	+0.021	0.19
1.3125	+0.022	0.20
1.375	+0.023	0.21
1.4375	+0.024	0.22
1.500	+0.025	0.23
1.5625	+0.026	0.24
1.625	+0.027	0.25
1.6875	+0.028	0.26
1.750	+0.029	0.27
1.8125	+0.030	0.28
1.875	+0.031	0.29
1.9375	+0.032	0.30
2.000	+0.033	0.31
2.0625	+0.034	0.32
2.125	+0.035	0.33
2.1875	+0.036	0.34
2.250	+0.037	0.35
2.3125	+0.038	0.36
2.375	+0.039	0.37
2.4375	+0.040	0.38
2.500	+0.041	0.39
2.5625	+0.042	0.40
2.625	+0.043	0.41
2.6875	+0.044	0.42
2.750	+0.045	0.43
2.8125	+0.046	0.44
2.875	+0.047	0.45
2.9375	+0.048	0.46
3.000	+0.049	0.47
3.0625	+0.050	0.48
3.125	+0.051	0.49
3.1875	+0.052	0.50
3.250	+0.053	0.51
3.3125	+0.054	0.52
3.375	+0.055	0.53
3.4375	+0.056	0.54
3.500	+0.057	0.55
3.5625	+0.058	0.56
3.625	+0.059	0.57
3.6875	+0.060	0.58
3.750	+0.061	0.59
3.8125	+0.062	0.60
3.875	+0.063	0.61
3.9375	+0.064	0.62
4.000	+0.065	0.63
4.0625	+0.066	0.64
4.125	+0.067	0.65
4.1875	+0.068	0.66
4.250	+0.069	0.67
4.3125	+0.070	0.68
4.375	+0.071	0.69
4.4375	+0.072	0.70
4.500	+0.073	0.71
4.5625	+0.074	0.72
4.625	+0.075	0.73
4.6875	+0.076	0.74
4.750	+0.077	0.75
4.8125	+0.078	0.76
4.875	+0.079	0.77
4.9375	+0.080	0.78
5.000	+0.081	0.79
5.0625	+0.082	0.80
5.125	+0.083	0.81
5.1875	+0.084	0.82
5.250	+0.085	0.83
5.3125	+0.086	0.84
5.375	+0.087	0.85
5.4375	+0.088	0.86
5.500	+0.089	0.87
5.5625	+0.090	0.88
5.625	+0.091	0.89
5.6875	+0.092	0.90
5.750	+0.093	0.91
5.8125	+0.094	0.92
5.875	+0.095	0.93
5.9375	+0.096	0.94
6.000	+0.097	0.95
6.0625	+0.098	0.96
6.125	+0.099	0.97
6.1875	+0.100	0.98
6.250	+0.101	0.99
6.3125	+0.102	1.00
6.375	+0.103	1.01
6.4375	+0.104	1.02
6.500	+0.105	1.03
6.5625	+0.106	1.04
6.625	+0.107	1.05
6.6875	+0.108	1.06
6.750	+0.109	1.07
6.8125	+0.110	1.08
6.875	+0.111	1.09
6.9375	+0.112	1.10
7.000	+0.113	1.11
7.0625	+0.114	1.12
7.125	+0.115	1.13
7.1875	+0.116	1.14
7.250	+0.117	1.15
7.3125	+0.118	1.16
7.375	+0.119	1.17
7.4375	+0.120	1.18
7.500	+0.121	1.19
7.5625	+0.122	1.20
7.625	+0.123	1.21
7.6875	+0.124	1.22
7.750	+0.125	1.23
7.8125	+0.126	1.24
7.875	+0.127	1.25
7.9375	+0.128	1.26
8.000	+0.129	1.27
8.0625	+0.130	1.28
8.125	+0.131	1.29
8.1875	+0.132	1.30
8.250	+0.133	1.31
8.3125	+0.134	1.32
8.375	+0.135	1.33
8.4375	+0.136	1.34
8.500	+0.137	1.35
8.5625	+0.138	1.36
8.625	+0.139	1.37
8.6875	+0.140	1.38
8.750	+0.141	1.39
8.8125	+0.142	1.40
8.875	+0.143	1.41
8.9375	+0.144	1.42
9.000	+0.145	1.43
9.0625	+0.146	1.44
9.125	+0.147	1.45
9.1875	+0.148	1.46
9.250	+0.149	1.47
9.3125	+0.150	1.48
9.375	+0.151	1.49
9.4375	+0.152	1.50
9.500	+0.153	1.51
9.5625	+0.154	1.52
9.625	+0.155	1.53
9.6875	+0.156	1.54
9.750	+0.157	1.55
9.8125	+0.158	1.56
9.875	+0.159	1.57
9.9375	+0.160	1.58
10.000	+0.161	1.59
10.0625	+0.162	1.60
10.125	+0.163	1.61
10.1875	+0.164	1.62
10.250	+0.165	1.63
10.3125	+0.166	1.64
10.375	+0.167	1.65
10.4375	+0.168	1.66
10.500	+0.169	1.67
10.5625	+0.170	1.68
10.625	+0.171	1.69
10.6875	+0.172	1.70
10.750	+0.173	1.71
10.8125	+0.174	1.72
10.875	+0.175	1.73
10.9375	+0.176	1.74
11.000	+0.177	1.75

<b>WANG</b> LABORATORIES, INC. LOWELL, MASS. U.S.A.		BY DWN	DATE 2-27-71	APPROVED BY E ENGR	DATE
MATERIAL	MODEL NO. TCB-1	CNK		MFG ENGR	
SEE ENDS SPECIFICATIONS		TITLE CPU MOTHERBOARD			
FINISH	100.00 AS NOTED	SEE CHART	D	7763	12
SCALE	1:1	DATE PART NUMBER	SIZE	DRAWING NUMBER	REV

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DO NOT SCALE

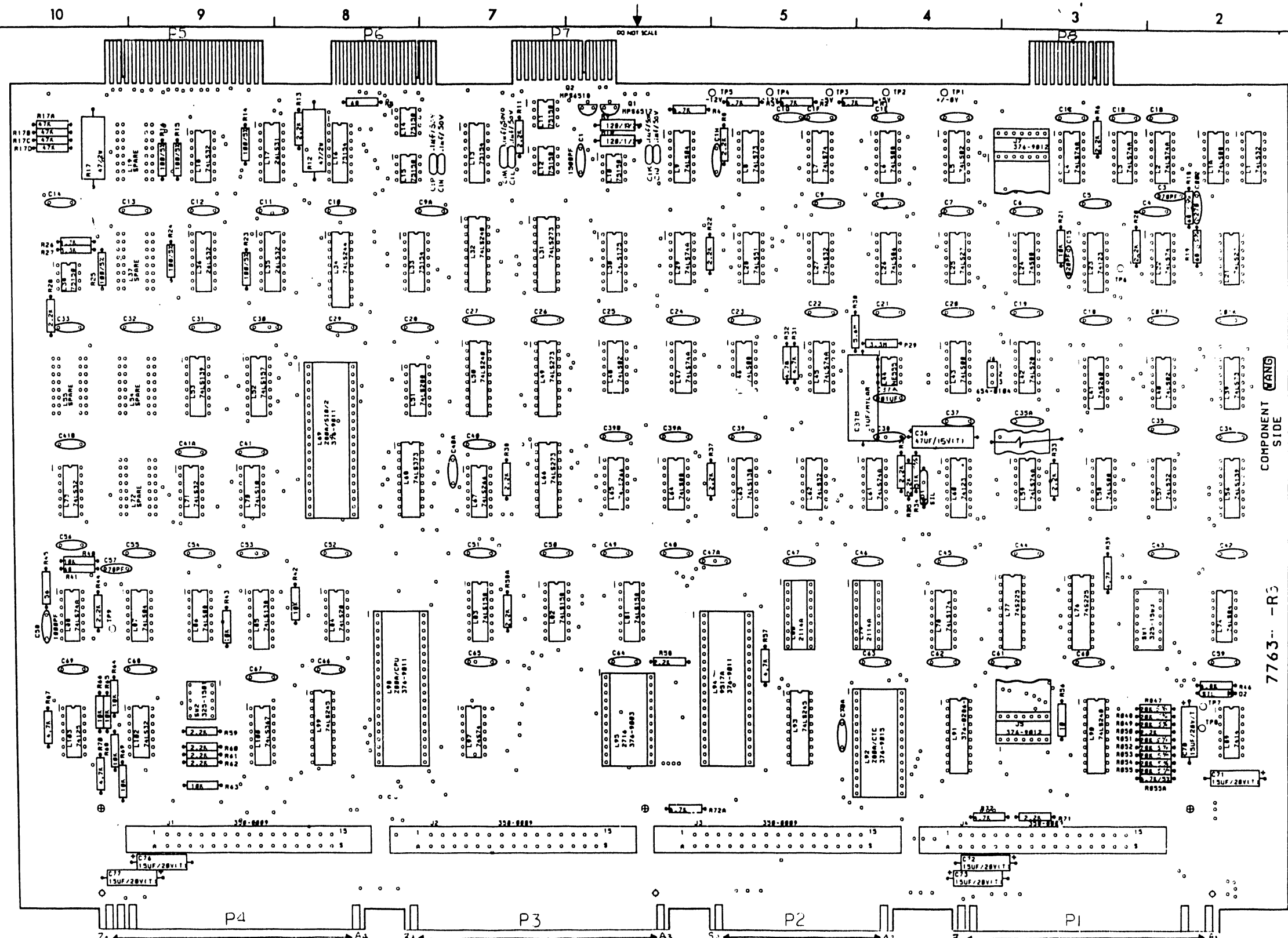


REV	DESCRIPTION
1	ISSUED
2	REVISED
3	REVISED
4	REVISED
5	REVISED
6	REVISED
7	REVISED
8	REVISED
9	REVISED
10	REVISED
11	REVISED

<b>WANG</b> LABORATORIES, INC. LOCAL MADE U.S.A.		BY OWN R. L. Olson	DATE 4-10-71	APPROVED BY E ENGR	DATE
MATERIAL		MODEL NO. TCB-1		TITLE CPU MOTHERBOARD	
FINISH		SEE ENGR SPECIFICATIONS		SEE CHART D 7763	
SCALE 1:1 = FRAC = FINISH		SHEET 4 OF 6		DRAWING NUMBER 12	

22" 11" 8.5" 17" 22" 11" 8.5" 17" 22"

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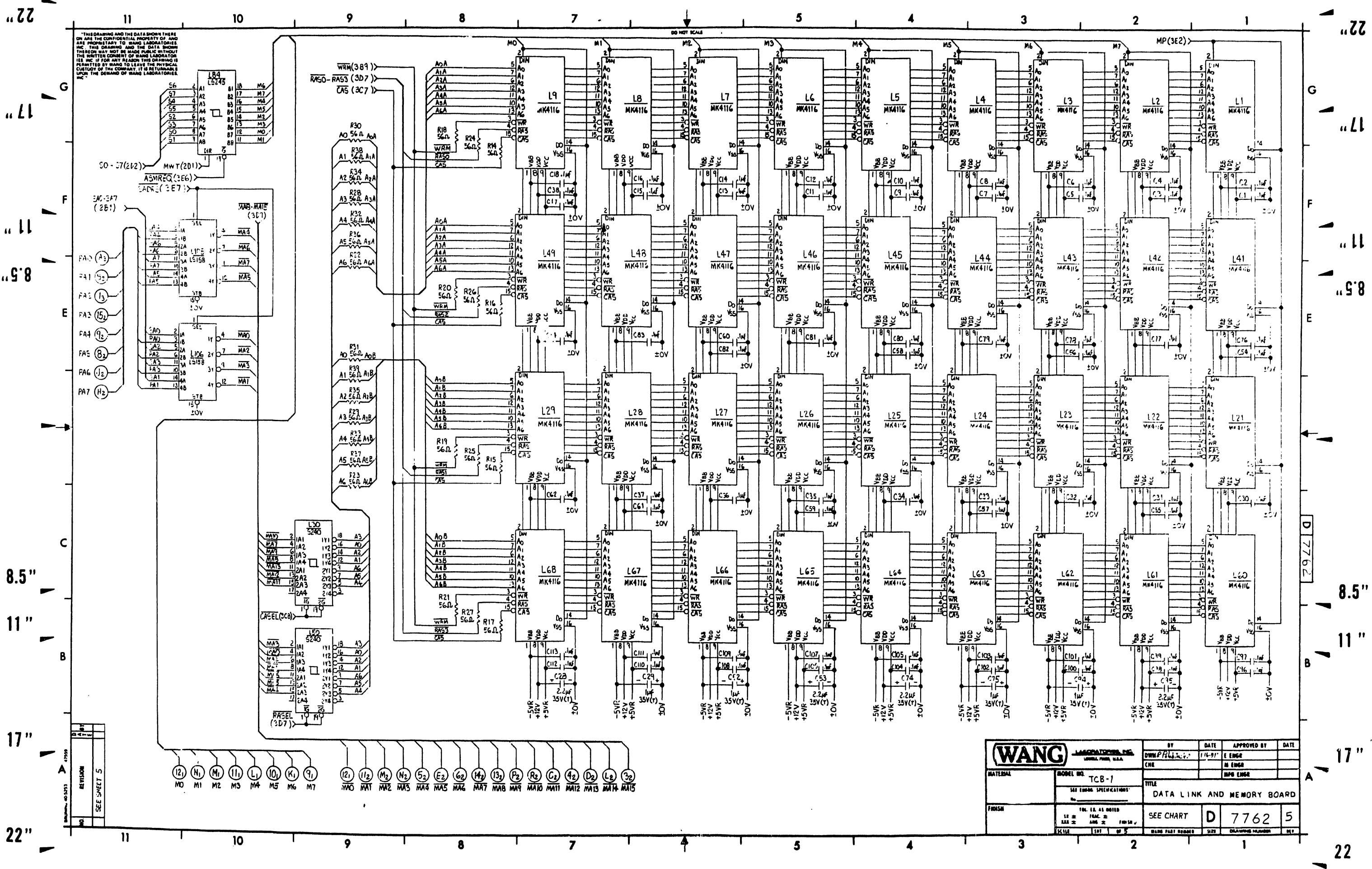
COMPONENT SIDE  
7763--R5

- NOTES:
1. ALL CAPACITORS ARE .047UF CER EXCEPT AS NOTED.
  2. L79 & L80 LOAD 18 PIN SOCKET 376-9814 (QTY 2).
  3. J1, J2, J3, & J4 ARE MOUNTED ON CIRCUIT SIDE.
  4. TP1 THRU TP9 LOAD TERMINAL POST 654-1192 (QTY 9).
  5. ALL RESISTORS ARE 1/4W 10% EXCEPT WHERE NOTED.

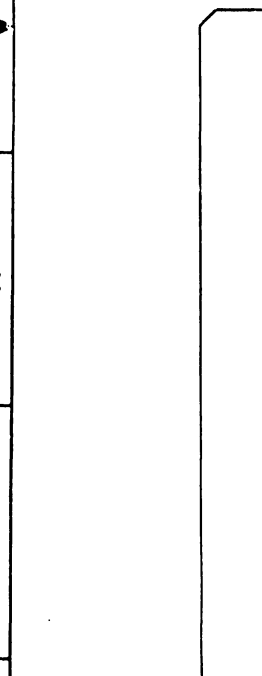
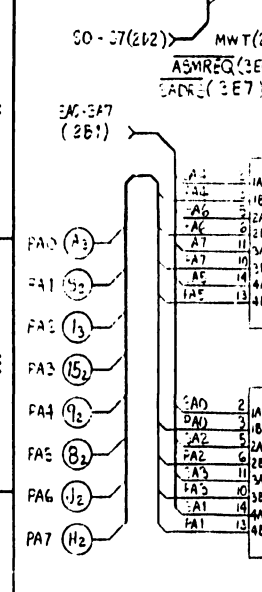
		BY	DATE	APPROVED BY	DATE
		DWN	4-21	E ENGR	
MODEL NO TCB-1 SEE ENGR SPECIFICATIONS		CHK		M ENGR	
				MFG ENGR	
FINISH		TITLE		DRAWING NUMBER	
100 IS AS NOTED 110 IS AS NOTED 120 IS AS NOTED 130 IS AS NOTED 140 IS AS NOTED 150 IS AS NOTED 160 IS AS NOTED 170 IS AS NOTED 180 IS AS NOTED 190 IS AS NOTED 200 IS AS NOTED 210 IS AS NOTED 220 IS AS NOTED 230 IS AS NOTED 240 IS AS NOTED 250 IS AS NOTED 260 IS AS NOTED 270 IS AS NOTED 280 IS AS NOTED 290 IS AS NOTED 300 IS AS NOTED 310 IS AS NOTED 320 IS AS NOTED 330 IS AS NOTED 340 IS AS NOTED 350 IS AS NOTED 360 IS AS NOTED 370 IS AS NOTED 380 IS AS NOTED 390 IS AS NOTED 400 IS AS NOTED 410 IS AS NOTED 420 IS AS NOTED 430 IS AS NOTED 440 IS AS NOTED 450 IS AS NOTED 460 IS AS NOTED 470 IS AS NOTED 480 IS AS NOTED 490 IS AS NOTED 500 IS AS NOTED 510 IS AS NOTED 520 IS AS NOTED 530 IS AS NOTED 540 IS AS NOTED 550 IS AS NOTED 560 IS AS NOTED 570 IS AS NOTED 580 IS AS NOTED 590 IS AS NOTED 600 IS AS NOTED 610 IS AS NOTED 620 IS AS NOTED 630 IS AS NOTED 640 IS AS NOTED 650 IS AS NOTED 660 IS AS NOTED 670 IS AS NOTED 680 IS AS NOTED 690 IS AS NOTED 700 IS AS NOTED 710 IS AS NOTED 720 IS AS NOTED 730 IS AS NOTED 740 IS AS NOTED 750 IS AS NOTED 760 IS AS NOTED 770 IS AS NOTED 780 IS AS NOTED 790 IS AS NOTED 800 IS AS NOTED 810 IS AS NOTED 820 IS AS NOTED 830 IS AS NOTED 840 IS AS NOTED 850 IS AS NOTED 860 IS AS NOTED 870 IS AS NOTED 880 IS AS NOTED 890 IS AS NOTED 900 IS AS NOTED 910 IS AS NOTED 920 IS AS NOTED 930 IS AS NOTED 940 IS AS NOTED 950 IS AS NOTED 960 IS AS NOTED 970 IS AS NOTED 980 IS AS NOTED 990 IS AS NOTED 1000 IS AS NOTED		SEECHART D 7763		12	
SCALE 1/8" = 1"		WANG PART NUMBER		SIZE	DWG NUMBER

REV	NO	DATE	BY	DESCRIPTION
	1			SEE SHEET 6





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REV	REVISION
5	SEE SHEET 5

<b>WANG</b> LABORATORIES, INC. WALTHAM, MASS.		BY DWN/PIL	DATE 1/4-91	APPROVED BY E ENGR	DATE
MATERIAL	MODEL NO. TCB-1	CHK	M ENGR	MFG ENGR	
SEE BOARD SPECIFICATIONS		TITLE DATA LINK AND MEMORY BOARD			
VOL. 11. 41 0010		SEE CHART		D 7762	5
11 22		PAGE 22		SIZE	DRAWING NUMBER
SCALE		LIST		OF 5	REV

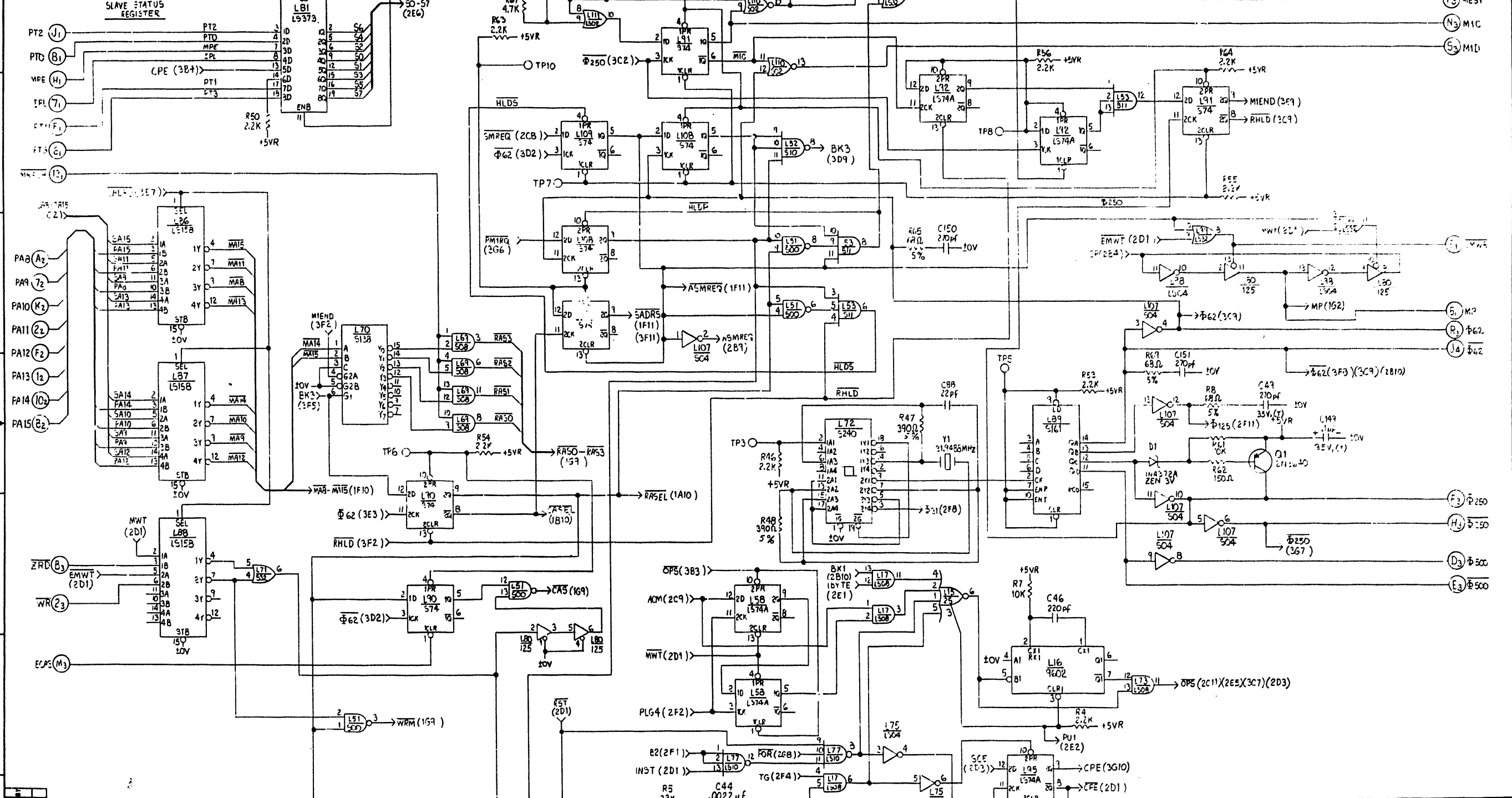
22  
17  
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17  
22





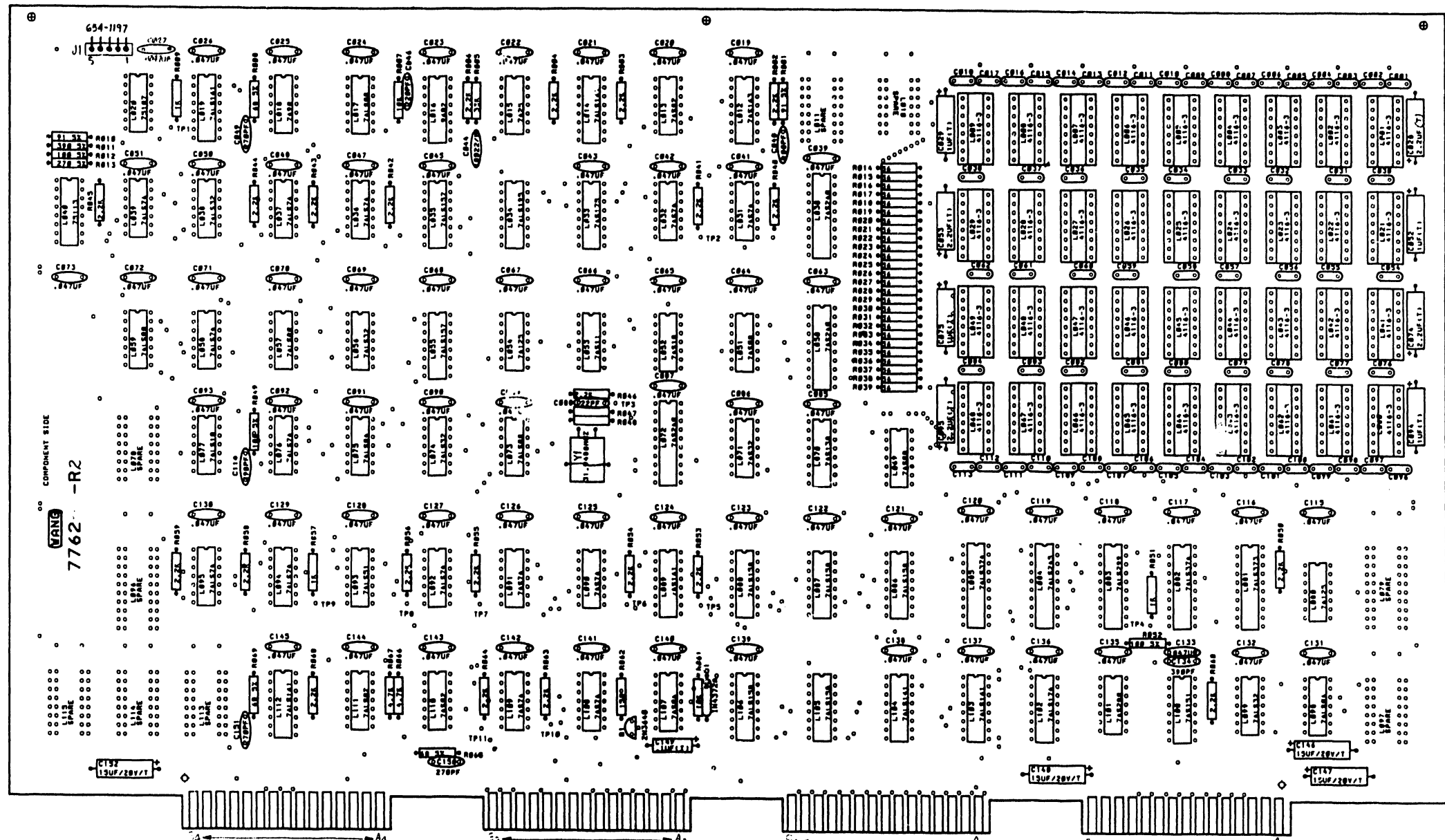
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REV	DESCRIPTION	DATE
1	ISSUE 1	11/15/68
2	ISSUE 2	11/15/68
3	ISSUE 3	11/15/68
4	ISSUE 4	11/15/68
5	ISSUE 5	11/15/68

<b>WANG</b> LABORATORIES INC. LOWELL, MASS. U.S.A.		BY DWN P. R. L. J. A.	DATE 2-2-69	APPROVED BY E ENGR	DATE
MATERIAL		CHKR		M ENGR	
MODEL NO. TCB-1		TITLE DATA LINK AND MEMORY BOARD			
SEE ENGR. SPECIFICATIONS					
FINISH	FOR IS AS NOTED	SEE CHART	D	7762	5
	SEE ENGR. SPECIFICATIONS				
SCALE	1:1	NAME PART NUMBER	SIZE	DRAWING NUMBER	REV

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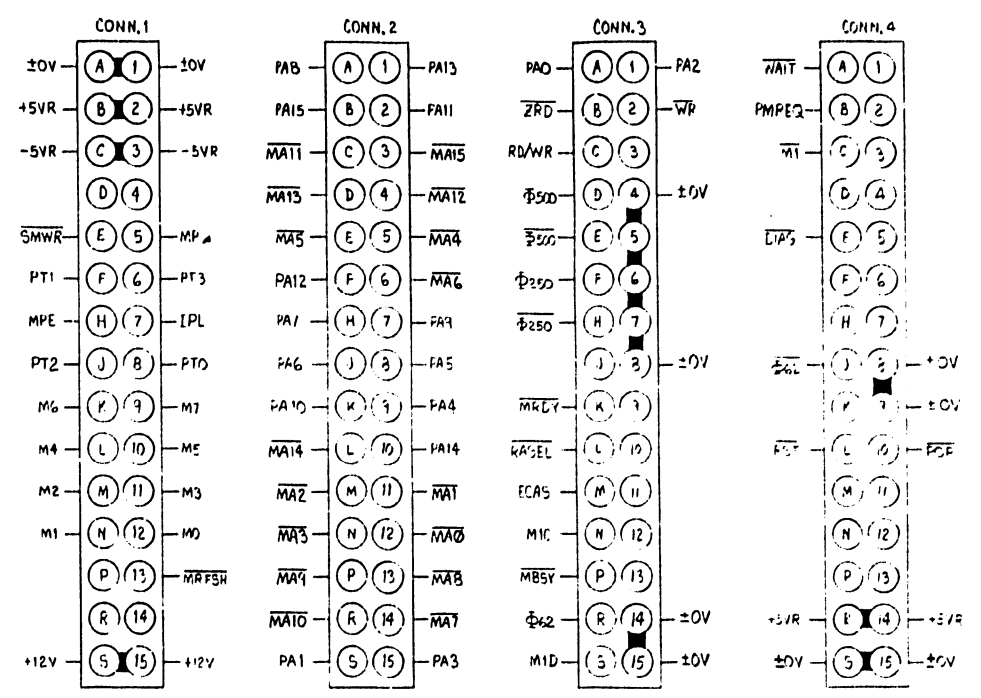
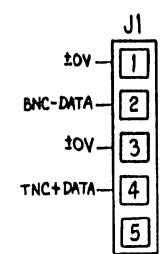
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I.C. LOCATION	TYPE	W.L. PART NO.
L1-9, 21-29, 41-49, 60-68	MK4116-N3	SEE CHART
L10, 11, 78, 79, 76, 97, 113-115	SPARES	
112	745163	376-0235
L13, 110	74502	376-0131
L14, 111, 103, 104, 112	745161	376-0233
L15	7425	376-0012
L16	11602	376-0104
L17, 73	74508	376-0153
118	1190A	376-0073
119	75107	376-0146
120, 50, 72	745240	376-0334
121, 122, 100, 11, 108, 109	74574	376-0222
123	745175	376-0270
124	MLS115A	376-0248
125, 25	745157	376-0216
L26, 37, 31, 58, 76, 12, 14, 15	74574A	376-0155
L38, 56, 74, 39	74532	376-0211
L40	75113	376-0256
141	74500	376-0228
L57, 59	74500	376-0207
L52	74510	376-0238
L53	74511	376-0237
L54, 30	74125	376-0324
159	74508	376-0200
160	74513B	376-0293
L71	74532	376-0202
L75, 18	74504	376-0180
177	74510	376-0201
181	745373	376-0310
L82, 25	745374	376-0286
L83	745299	376-0303
L84	745245	376-0285
L86-88, 105, 106	745158	376-0293
L89	745161	376-0278
L93	74551	376-0213
L100	745151	376-0336
L101	745280	376-0246
L102	745174	376-0159
L107	74504	376-0197
L111	74502	376-0208
L11-9, 21-29, 41-49, 60-68	SMT, 16 PIN	376-1002

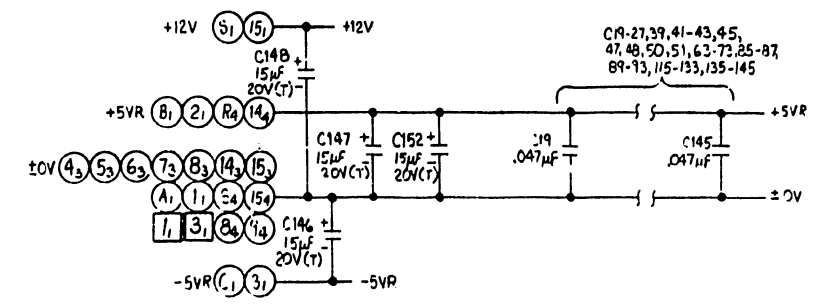
TYPE	I.C. LOCATION	SPARES
74502	L13	1
	L110	2
74504	L98	3
74532	L71	3
74532	L38	2
	L56	1
74551	L93	1
74125	L54	1

COMPONENT	TYPE	W.L. PART NO.
J1	CONN, 5 PIN	654-1197
D1	IN4372A, 3V	380-2129
R1, 10	91K, 1/4W, 5%	330-1092
R2-4, 6, 40-46, 50, 53-56, 58-60, 63, 64, 65	2.2K, 1/4W, 10%	330-3022
R5	33K, 1/4W, 10%	330-4033
R7, 61	10K, 1/4W, 10%	330-4010
R8, 65, 69	68K, 1/4W, 5%	330-1069
R9, 51, 57	1K, 1/4W, 10%	330-3010
R11, 47, 48	390K, 1/4W, 5%	330-2040
R62	150K, 1/4W, 10%	330-2015
R12, 49, 52	100K, 1/4W, 5%	332-2011
R13	270K, 1/4W, 5%	330-2028
R14-39	56K, 1/4W, 10%	330-1056
R66, 67	4.7K, 1/4W, 10%	330-3047
C1-10, 30-38, 54-62, 76-84, 116-113	.1uF, 50V	300-1930
C19-27, 39, 41-43, 45, 47, 48, 50, 51, 63-73, 85-87, 89-93, 115-133, 135-145	.047uF, 50V	300-1966
C29, 52, 75, 74	1uF, 35V, (T)	300-4070
C40	100uF, 100V	300-1744
C44	.0022uF, 500V, MICA	300-5012
C46	220uF, 500V	300-1820
C49, 150, 151	270uF, 500V	300-1270
C88	22uF	300-1022
C28, 53, 74, 95	2.2uF, 35V, (T)	300-4027
C114, 134	390uF, 500V	300-1310
C146-148, 152	15uF, 20V, (T)	300-4022
C141	.1uF, 35V, (T)	300-4002
Q1	2N2670	375-1003
T1	31.7+89MHZ	321-0044

MNEMONICS	COORD.
BNC-DATA	2G9
DIAG	2F11
ECAS	3B11
[PL	3F11
MA2-MA15	1A9
MBSY	3G1
M0-M7	1A10
MP	3E1
MPE	3F11
MI	3GB
MRDY	3AB
MRF5H	3F11
MIC	3G1
MID	3G1
PA0-PA7	1E11
PA8-PA15	3E11
PMREQ	3G7
FOR	2G9
PT0	3G11
PT1	11
PT2	51
PT3	41
KASEL	3A9
RD/WR	3AB
R5T	3A7
SMWR	3E1
TNC+DATA	2G9
WAIT	3G4
WR	3C11
ZRD	3C11
Φ62	3E1
Φ62	3E1
Φ250	3C1
Φ250	3C1
Φ500	3C1
Φ500	3C1



210=209+377 OR 378		
210	209	L1-9, 21-29, 41-49, 60-68
7762-A	7762	377-0345-M



NO.	REVISION	DATE	BY	APPROVED BY
1	ORIG. DES. DWG. 10/25	10-25-68	W. J. B.	W. J. B.
2	REVISED PER APP'D: 11/14/68	11-14-68	W. J. B.	W. J. B.
3	REVISED PER APP'D: 1/15/69	1-15-69	W. J. B.	W. J. B.
4	REVISED PER APP'D: 7-25-69	7-25-69	W. J. B.	W. J. B.
5	REVISED PER APP'D: 8/27/69	8-27-69	W. J. B.	W. J. B.

<b>(WANG)</b> LABORATORIES, INC. MODEL NO. TCB-1		BY: DWG. ENGR. [Signature]	DATE: 4/5/81
TITLE: DATA LINK AND MEMORY BOARD		APPROVED BY: [Signature]	DATE: 4/5/81
FINISH: 100% AT BUILT	SEE CHART	D 7762	5
SCALE: 1:1	WANG PART NUMBER	SIZE	DRAWING NUMBER

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