

**WANG**

**CUSTOMER ENGINEERING**

**PRODUCT MAINTENANCE MANUAL**

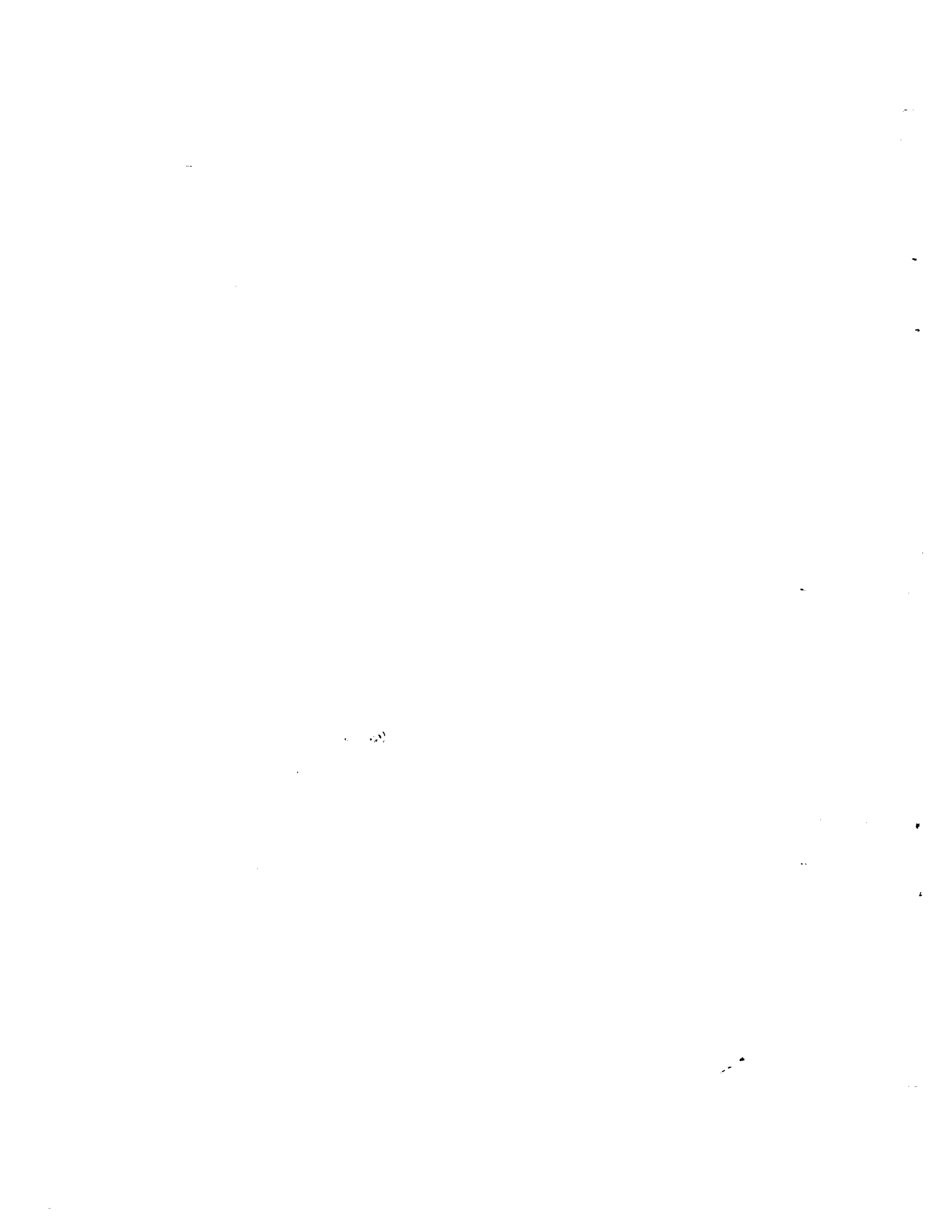
**2236 MXE  
TERMINAL  
CONTROLLER  
(EARLY FIELD SUPPORT)**

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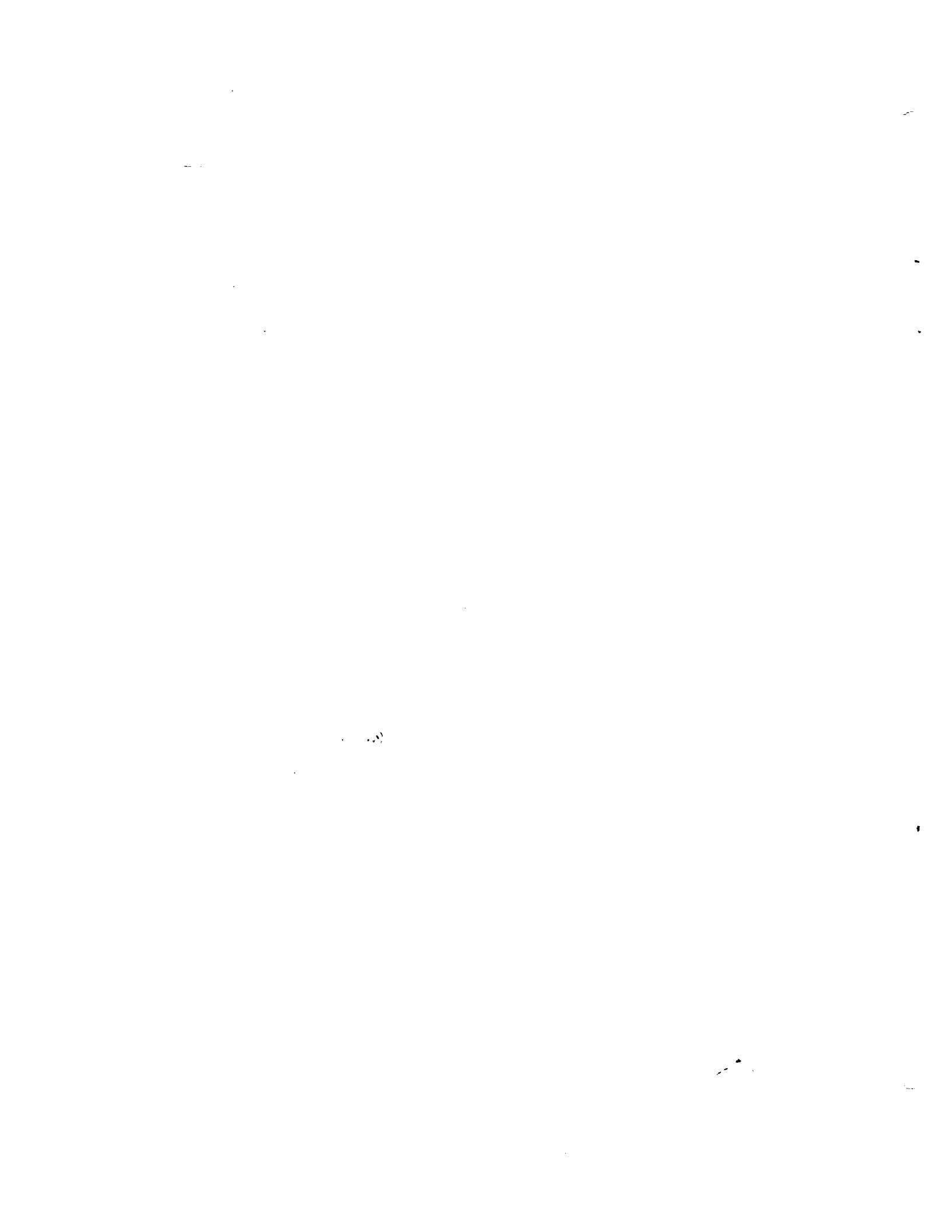
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2236 MXE TERMINAL CONTROLLER BOARD

(EARLY FIELD SUPPORT)



2236 MXE TERMINAL CONTROLLER  
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# 2236 MXE

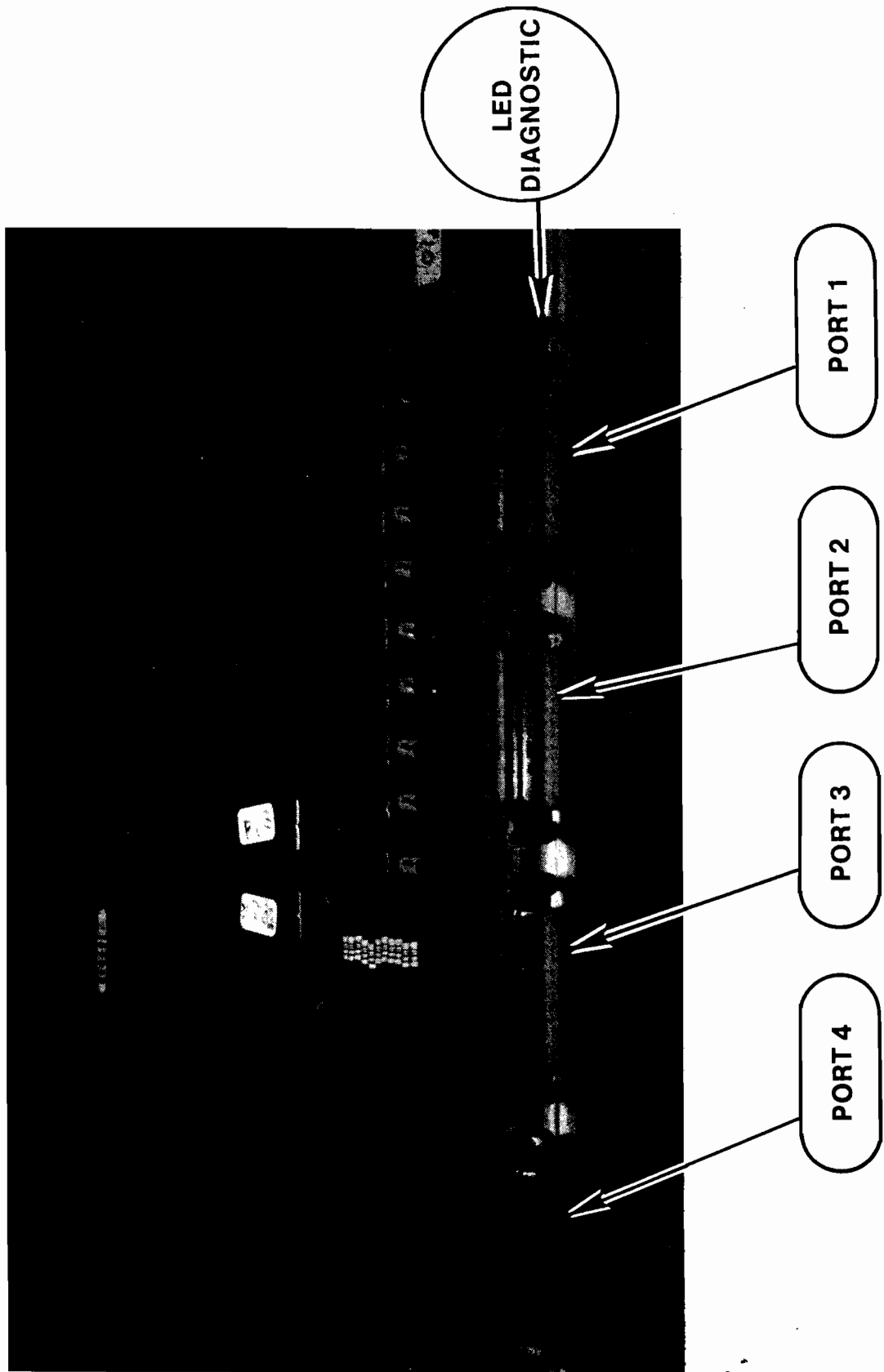
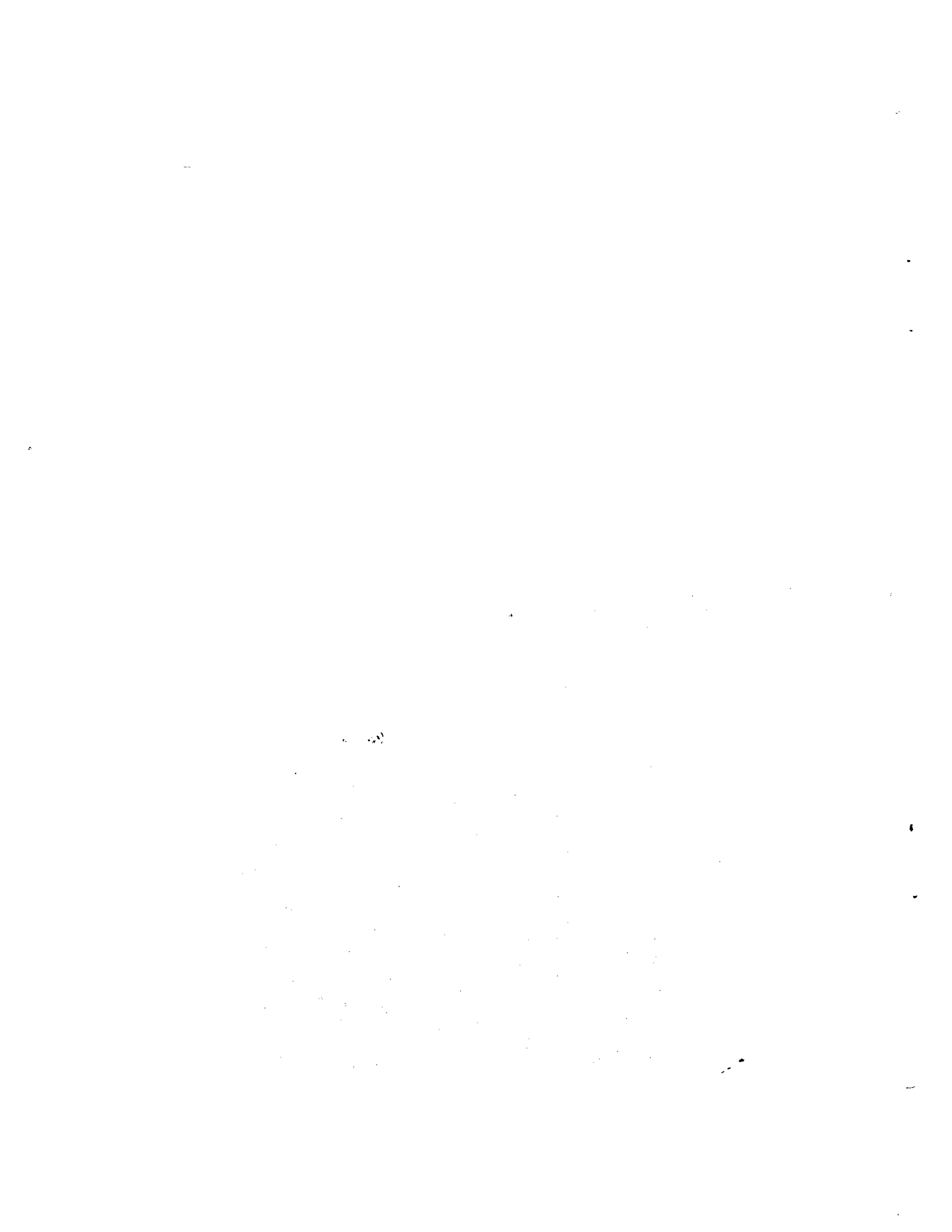


Figure 1



## SECTION 1

### INTRODUCTION

#### 1.1 SCOPE

This manual provides the Customer Engineer with information needed to install, operate, and troubleshoot the 2236 MXE Terminal Multiplexer.

#### 1.2 DESCRIPTION

The Model 2236 MXE Terminal Controller is an intelligent Z-80 based terminal controller for 2200 MVP and 2200 LVP Central Processing Units (CPU's). This device controls I/O operations between the CPU and the terminals, and buffers data entered from or transferred to the terminal.

Each Model 2236 MXE supports four Model 2236D, 2236DE, 2236DW and 2336DW terminals concurrently, in any combination. The 2236 MXE performs many terminal control functions normally executed by the CPU, thereby freeing the CPU for processing.

The Model 2236 MXE software is loaded into 48K of Random Access Memory (RAM) from a 2200 CPU. This allows the Model 2236 MXE to perform a variety of additional functions, and provides a convenient mechanism for future device enhancements. The MXE also contains 8K of PROM for bootstrap and power up diagnostics.

Other features of the Model 2236 MXE include software and hardware selectable transmission rates, software selectable terminal ports, a time of day clock, and ability to alert the 2200 CPU when a local or remote terminal connects or disconnects. Additionally, the MXE can perform diagnostic tests, enabling it to test the board components, RAM parity, and local and remote modems.

The 2236 MXE Terminal Multiplexer is an enhanced controller for all asynchronous terminals attached to the 2200 MVP and LVP computers. It is downward compatible with the 2236 MXD Terminal Controller. The MXE is an enhanced version of the MXD in which four terminals or modems are multiplexed on the 2200 I/O bus.

A detailed list of new MXE enhancements are as follows:

- a. Full modem support for each of four RS-232 Interface connectors.
- b. An activity time out circuit for the RS-232 interface to support European modems through automatic disconnect.
- c. "Time of Day" clock circuitry, (optional battery back-up).

- d. The baud rate can be selected for each terminal by setting switches or software selectable.
- e. A 4-Mhz, Z-80A Microprocessor based CPU.
- f. RAM size up to 48K, permits downline loading of microcode and allows interface capabilities to non-Wang terminals.
- g. An 8K on-board prom provides for bootstrap functions, power up diagnostics, and remote diagnostics capabilities.
- h. All four channels have the control circuitry to perform a software controlled local analog loopback, and the remote digital loopback test. This test will only work on Wang-(Vadic) WA3451 modems.
- i..A software selectable local digital loopback capability at the DART chip for each port.
- j. Motherboard and Daughterboard combination.
- k. The capacity to set any terminal as the Primary User.

### 1.3 RELATED PUBLICATIONS

Refer to \_\_\_\_\_ for further details on Error Detection Codes and Detailed Fault Diagnostic tests.

### 1.4 SPECIFICATIONS

The following sections provide the specifications on the 2236 MXE Board.

- a. Operating Environment  
Same as the CPU
- b. Power Requirments  
Supplied by the CPU
- c. I/O Slots Required  
One (option up to three)
- d. Wang Terminal Format  
  - Communications Mode: Asynchronous, full-duplex
  - Character Format: 1 start bit, 1 stop bit, 8 data bits,  
1 odd parity bit
  - Transmission Rate: 50, 110, 134.5, 300, 600, 1200, 2400,  
4800, 9600, or 19,200 bps

e. Asynchronous Mode

Communications Mode: Asynchronous, full-duplex, half-duplex

Character Format: 1 start bit, 1, 1.5, 2 stop bit, 7 or 8 data bits, even or odd parity

Transmission Rate: 50, 110, 134.5, 300, 600, 1200, 2400, 4800, 9600, or 19,200 bps

STANDARD FOR  
TERMINALS  
1 START  
1 STOP  
8 DATA  
ODD PARITY

\* f.. MXE Motherboard (210-7874-A)

Dimension

11.54" length X 7.0" height

\* g. MXE Daughterboard (210-7973-A)

Dimension

11.02" length X 6.3" height

h. New Faceplate (no Wang P/N)

Dimension

14.00" length X 1.18" height

RS-232 Ports

4

LED

1

i. Voltage Requirements on Mother/Daughter Boards

Mother (210-7874-A)

+5VR, +12V, -12V, +0V

Daughter (210-7973-A)

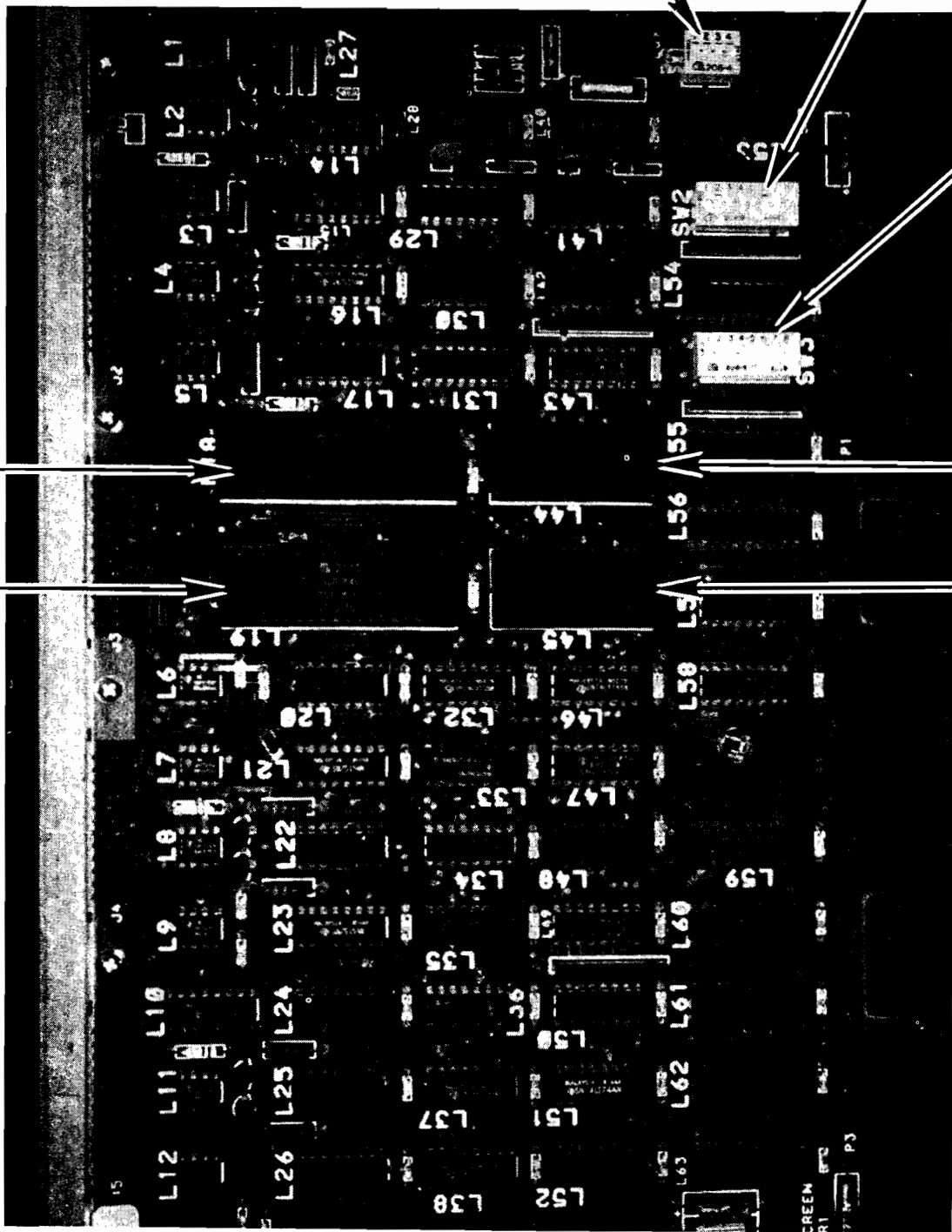
+5VR, +12V, -12V, ±0V

\* NOTE--When ordering the 2236 MXE board the mother and daughter boards are always attached, becoming the complete 2236 MXE board. You must order the entire board, the part number for the 2236 MXE is as follows:

Model 2236 MXE----Wang P/N 212-3032

Z80A  
DART

L19 | L18



SWITCH 1  
DEVICE ADDRESS

SWITCH 2  
PORTS 3 & 4  
BAUD RATE

SWITCH 3  
PORTS 1 & 2  
BAUD RATE

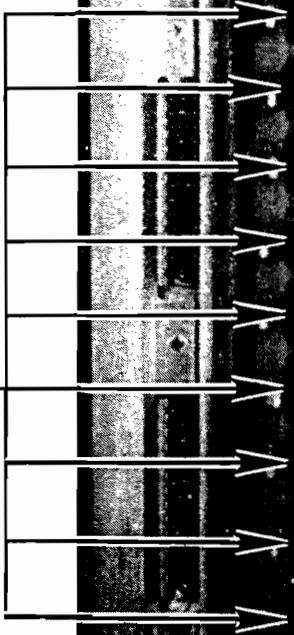
L45 | L44

Z80A  
CTC

**MXE MOTHER PCB 210-7874**

L13 TO L5

64 X 1  
MEMORY



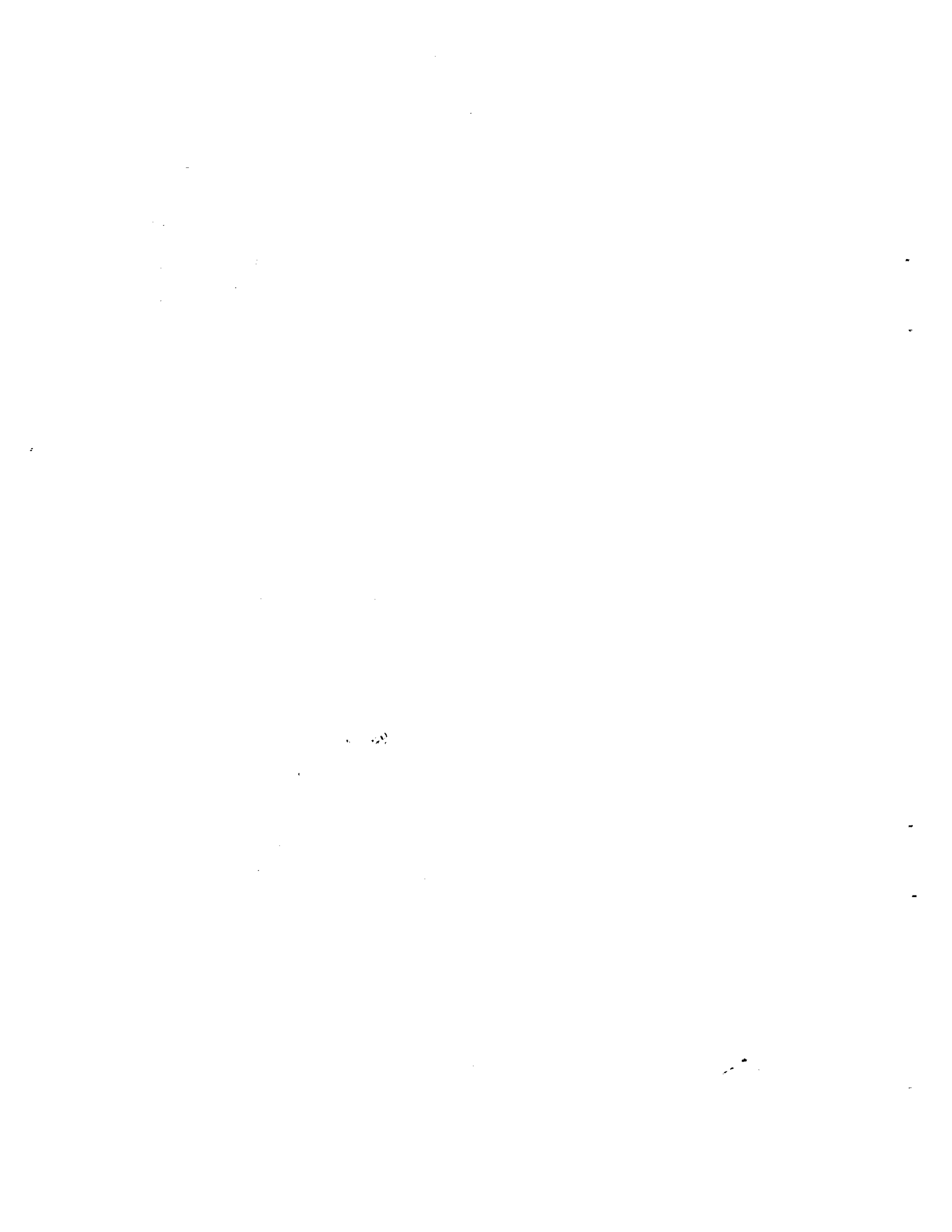
L17  
Z80A  
CPU



POWER-UP  
DIAGNOSTIC PROMS



**MXE DAUGHTER PCB 210-7973**



SECTION 2  
INSTALLATION

2.1 INSPECTION

Before installing any MXE board inspect the board for any broken components and make sure all plugable chips are seated properly in their sockets. Check for bent pins on the plugable sockets.

2.2 INTERCONNECTION

There are three sets of switches connected to the Mother board (210-7874-A). Two switches are 8-bank type and one is a 4-bank type. The two 8-bank type switches are use to set the baud rate for each of the RS-232 Port connectors. The one 4-bank switch is used for setting the device type. Set the 8-bank switches to whatever baud rate desired. The following is a list of desired baud rate and device type settings:

2.2.1 BAUD RATE SWITCH SETTINGS

Refer to Figure 2-1.

2.2.2 DEVICE TYPE SETTING

Refer to Figure 2-2.

# HARDWARE SWITCH SETTINGS

BAUD RATE		SWITCH 3								SWITCH 2							
		PORT 1				PORT 2				PORT 3				PORT 4			
DEC BAUD RATE	HEX	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
0	110	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1	134.5	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF
2	150	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF
3	200	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF
4	300	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF	OFF
5	600	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF
6	1200	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF
7	UNDEFINED	ON	ON	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	OFF
8	2400	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON
9	UNDEFINED	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON
10	4800	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
11	UNDEFINED	ON	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	OFF	ON
12	9600	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON
13	19,200	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	OFF	ON	ON
		L	S	D	M	L	S	D	M	L	S	D	M	L	S	D	M
		S	D		S	D		S	D	S	D		S	D	S	D	S
		D			D		D		D	D			D		D		D
		1	2	4	8	1	2	4	8	1	2	4	8	1	2	4	8
	BINARY																

BAUD RATE SWITCH SETTINGS

<b>SWITCH BANK 1</b>					
<b>MXE DEVICE ADDRESS SWITCH SETTING</b>					
<b>HEX</b>	<b># OF MXE</b>	<b>SW-1</b>	<b>SW-2</b>	<b>SW-3</b>	<b>SW-4</b>
<b>00</b>	<b>1ST</b>	<b>OFF</b>	<b>OFF</b>	<b>OFF</b>	<b>OFF</b>
<b>40</b>	<b>2ND</b>	<b>ON</b>	<b>OFF</b>	<b>OFF</b>	<b>OFF</b>
<b>80</b>	<b>3RD</b>	<b>OFF</b>	<b>ON</b>	<b>OFF</b>	<b>OFF</b>

**NOT USED**

DEVICE TYPE SWITCH SETTING

## 2.3 INSTALLING MXE BOARD

After inspecting and setting all switches correctly, the MXE board is ready to be installed. If you are upgrading from a MXD to a MXE the following steps are to be taken:

- a. Turn power OFF on the system.
- b. Remove all direct connect cables or RS-232 cable connectors from the MXD board.
- c. Remove the MXD board.
- d. Before inserting the MXE board make sure the device address and all baud rate settings are correct.
- e. Insert the New MXE board in the same slot as the MXD.
- f. Reconnect the RS-232 cable connectors to their respected port locations.
- g. Make sure MXE board is seated properly and screw down all RS-232 connectors to ensure proper seating.

### 2.3.1 WANG TERMINAL TO MXE CONTROLLER INTERFACE

Each terminal can either be attached locally to the Model 2236 MXE Terminal Controller at distances ranging up to 2,000 feet or remotely by using modems and standard four-wire communications lines (RS-232-C). Communication between the terminal and the Model 2236 MXE Terminal Processor is asynchronous and full-duplex, with selectable line speeds ranging from 50 to 19,200 bits per second (bps). The four ports on the MXE are 25-pin, RS-232-C compatible.

A local cable connection between the Model 2236 MXE and a terminal is less than 25 feet. For cable distances from 25 feet to 2,000 feet, optional direct connection cable are available. For cable distances beyond 2,000 feet, two asynchronous full-duplex, 11 bit, RS-232-C compatible modems per terminal must be used to provide the communication link over switched lines. One modem is connected to a port on the terminal processor; the other is connected to a terminal. The Wang Model WA3451 Asynchronous/Synchronous Modem, which is compatible with Wang Model 2236D and DE terminals, is the recommended modem for switched remote connection of these terminal to 2200LVP or MVP systems.

Cable is optionally available for modem connections to Wang equipment in lengths of 12 feet, 25 feet and 50 feet. Two lengths of modem cable for each terminal connection provide the necessary link between the terminal processor and its modem, and between the terminal and its modem.

2.3.1.1

Direct Connection Cables

<u>Length</u>	<u>Part Number</u>	<u>Length</u>	<u>Part Number</u>	<u>Length</u>	<u>Part Number</u>
25 feet	120-2236-25	500 feet	120-2236-5	1000 feet	12-2236-10
50 feet	120-2236-50	600 feet	120-2236-6	1250 feet	12-2236-11
100 feet	120-2236-1	700 feet	120-2236-7	1500 feet	12-2236-12
200 feet	120-2236-2	800 feet	120-2236-8	1750 feet	12-2236-13
300 feet	120-2236-3	900 feet	120-2236-9	2000 feet	12-2236-14
400 feet	120-2236-4				

2.3.1.2

RS-232-C Compatible Modem Cables

<u>Length</u>	<u>Part Number</u>
12 feet	220-0113
25 feet	220-0219
50 feet	220-0220

2.4 INITIAL TURN-ON

The MXE board is equipped with a power-up diagnostic. It checks the majority of the MXE Hardware prior to passing control to the firmware. The power-up diagnostic run time is approximately 6 seconds. The LED at the top of the MXE board indicates a GO or NO GO diagnostic condition.

On initial turn-on the LED will turn ON. If the Power-Diagnostic finds no fault in the hardware, then the LED will turn OFF in approximately 6 seconds. If the LED stays ON after 6 seconds, then there is a problem in the hardware of the MXE board. At this time you would refer to the troubleshooting section of this manual.

The LED turns off and verifies that the hardware test portion of the MXE has successfully been completed. The terminals connected to ports 1 through 4 of the MXE board should prompt like the following:

2236DE R01 19200BPS 8+0 (USA)

This prompt is called the self-identification message and consists of several fields separated by spaces. The followingt is a brief description of the self-identification message:

2236DE	is the model number, preceded by an asterisk.
R01	is the revision number of terminal firmware preceded by R.
19200BPS	is the data rate, followed by BPS.

8+0 is the number of data bits (7 or 8); E is even parity, O is odd parity, N is no parity.

(USA) is the version of the keyboard and CRT character set, enclosed in parenthesis.

Type in 'RESET' once, the prompt should look like:

KEY SF'?

## 2.5 LOADING MXE COMMAND CODE

The Model 2236 MXE responds to certain user commands by entering a "Command Mode". By using this feature, the user can set both the transmission rate and which port is to perform as Terminal 1 on the system by means of the software alone, without manually resetting any switches. Command mode can be used to set a system password, to print a message on all terminals connected to the Model 2236 MXE, to test the memory in the RAM of the board, to restart the power on diagnostics, to lock the current transmission rate of the port issuing the command, and to list all possible commands. Command mode can also be used to test particular ports on the Model 2236 MXE. All command mode statements are password protected so that only a privileged user has access.

To enter the MXE command code press the "LOAD" key three times (do not type LOAD). After pressing LOAD three times the prompt on the screen will display "ENTER MXE COMMAND:" followed by a new line of "%". The user should then enter the desired MXE command. A description of the commands and how to enter the commands will follow. The MXE will process the command and prompt for another command until a blank line is entered thus putting the user back in the previous mode. The MXE command should not be entered until the MXE prompts for it.

Any terminal may enter MXE COMMAND MODE at ANY time. If the 2200 is printing to the screen during MXE command mode the 2200 output will be temporarily suspended to prevent the two outputs becoming intermixed!

### 2.5.1 COMMAND DESCRIPTIONS

In the command descriptions that follow, use these definitions:

The command 'psw' is a six character password containing no blanks, (the default is 'MXE<sup>SYSTEM</sup>PSW').

The command 'port designator' is a one character designator that is as follows:

0=The port at which the command is being typed (this is so that the user need not know which port s/he is connected to), and 1, 2, 3, 4 are the absolute MXE port addresses.

All commands begin with a ONE character command code. Most commands then have a six character password, which is the MXE password (similar in use to the 2200 system password) followed by any needed parameters in the order specified below. The user can always type help (while in MXE command mode) to obtain a list of command codes.

The command line is divided into different fields. The first field is a one character field, that states the program or command to be run. The second field is a six character field that contains the desired password for the MXE command.

NOTE--The password will not be printed on the screen. Instead, the MXE will print the numbers 0 through 5 as characters are typed so that the password can be protected. The third field is used for setting the desired command such as the 'port designator', 'baud rate', 'new password' and other commands. On initial turn-on the password default is 'MXEPSW'.

## 2.5.2 COMMANDS

This section covers the commands and step by step procedure for entering the proper commands. There are two command modes that are very important to aid the C.E. in setting up a 2236 MXE board.

The first important command mode is 'H' (HELP). This command allows you to see all the command code letters and definitions. Proceed with the following steps to enter the 'H' (HELP) command code:

### 2.5.2.1 'H' (HELP) ALL COMMAND CODES

Steps:

1. Type 'H'
2. Return

Example: %H

### 2.5.2.1 'H' continued

CRT DISPLAYS: A Set VP user  
B Set Baud Rate  
C Set psw  
D Download  
\* E Analog Loopback  
\* F Digital Loopback  
\* G Print  
H Help  
\* I Ram Test  
J Restart  
L Lock  
? Status

\* NOTE--Refer to Troubleshooting Section 5.4.1 for these 2236 MXE Command Codes.

The second important command code is '?' (Status). '?' shows the status of all ports on the 2236 MXE board. In detail it shows the following: 'ON' or 'OFF' line condition; 'Software Baud Rate' 'L'(Lock); '(Hardware Baud Rate)'; 'Local' or 'Remote'; 'Wang Terminal'. Proceed with the following steps to enter the ? (Status) command code:

### 2.5.2.2 '?' (STATUS)

#### Steps:

1. Type '?'
2. Return

Example: %?

CRT DISPLAYS: 2236 MXE RO (BOOTSTRAP)  
\* PORT 1 'ON' 19200 L / (19200) LOCAL WANG TERMINAL  
PORT 2 OFF 19200 / (19200) LOCAL WANG TERMINAL  
PORT 3 OFF 19200 / (19200) LOCAL WANG TERMINAL  
PORT 4 OFF 19200 / (19200) LOCAL WANG TERMINAL  
SOFTWARE / (HARDWARE)

NOTE \*-Indicates the Primary User.

### 2.5.2.3 'A' SET PRIMARY USER

#### Steps:

1. Type 'A' 'SYSTEM'
2. Password(psw), type 'MXEPSW' (any 6 characters)
3. Port Designator, type 'X' (ports 1 through 4)
4. Return

Example: %AM012345

CRT DISPLAYS: OK

The port designated has become the new primary user in the MVP Mode.

2.5.2.4 'B' SET BAUD RATE

Steps:

- |                          |                                |                     |
|--------------------------|--------------------------------|---------------------|
| 1. Type                  | 'B'                            |                     |
| 2. Password(psw), Type   | ' <del>SYSTEM</del><br>NEWPSW' | (any 6 characters)  |
| 3. Port Designator, Type | 'X'                            | (ports 1 through 4) |
| 4. Baud Rate, Type       | '1200'                         | (1200=example)      |

Example: %BM0123451200

CRT DISPLAYS: 2236 RO (BOOTSTRAP)  
\* PORT 1 ON 19200 L / (19200) LOCAL WANG TERMINAL  
PORT 2 OFF 19200 / (19200) LOCAL WANG TERMINAL  
PORT 3 OFF 19200 / (19200) LOCAL WANG TERMINAL  
PORT 4 OFF 19200 / (19200) LOCAL WANG TERMINAL  
Are you SURE?(Y/N): Y (answer Y or N)  
OK

To assure that the new Baud Rate has been set properly, perform a '?' (STATUS) check. Refer to 2.5.2.2 '?' (STATUS).

NOTE: Setting the baud rate through software overrides any hardware switch setting. The baud rate desired is now set at the port designated.

2.5.2.5 'C' SET PASSWORD

STANDARD PASSWORD IS "SYSTEM"

Steps:

- |                               |                                |                    |
|-------------------------------|--------------------------------|--------------------|
| 1. Type                       | 'C'                            |                    |
| 2. Password(psw), Type        | ' <del>SYSTEM</del><br>NEWPSW' | (any 6 characters) |
| 3. New Password(newpsw), type | 'NEWPSW'                       | (any 6 characters) |
| 4. Return                     |                                |                    |

Example: %C012345EWPSW

CRT DISPLAYS: C //////////////////////////////////////  
OK

'NEWPSW' becomes the new password.

### 2.5.2.6 'D' DOWNLOAD CODE

NOTE: Format 'D' Download is not used at this time. Download will be used at a later date for future enhancements.

### 2.5.2.11 'J' RESTART

Steps:

1. Type 'J'
2. Password(psw), Type 'MXEPSW' (any 6 characters)
3. Return SYSTEM

Example: %JM01234

CRT DISPLAYS: #

NOTE: The CRT will blank out after approximately five seconds. The LED on the MXE board will be lit for approximately six seconds during the 'RESTART' program.

This command restarts the MXE at its power-on diagnostics. This command can only be issued while in the bootstrap. The current state of MXE will be completely reinitialized! All baud rates which have been set through MXE command mode will be reset to their hardware defaults!!

### 2.5.2.12 'L' LOCK

Steps:

1. Type 'L'
2. Password(psw), Type 'MXEPSW' (any 6 characters)
3. Return SYSTEM

Example: %LM01234

CRT DISPLAYS: BAUDRATE LOCKED

This command locks the current baud rate of the port issuing it. No port may change the baud rate of a port which is locked. This command is a toggle. Each time it is issued the state of the baud rate lock will be reversed.

To unlock the baud rate at the designated port, repeat steps 1 through 3 in the 'LOCK' command.

Example: %LM01234

CRT DISPLAYS: BAUDRATE UNLOCKED

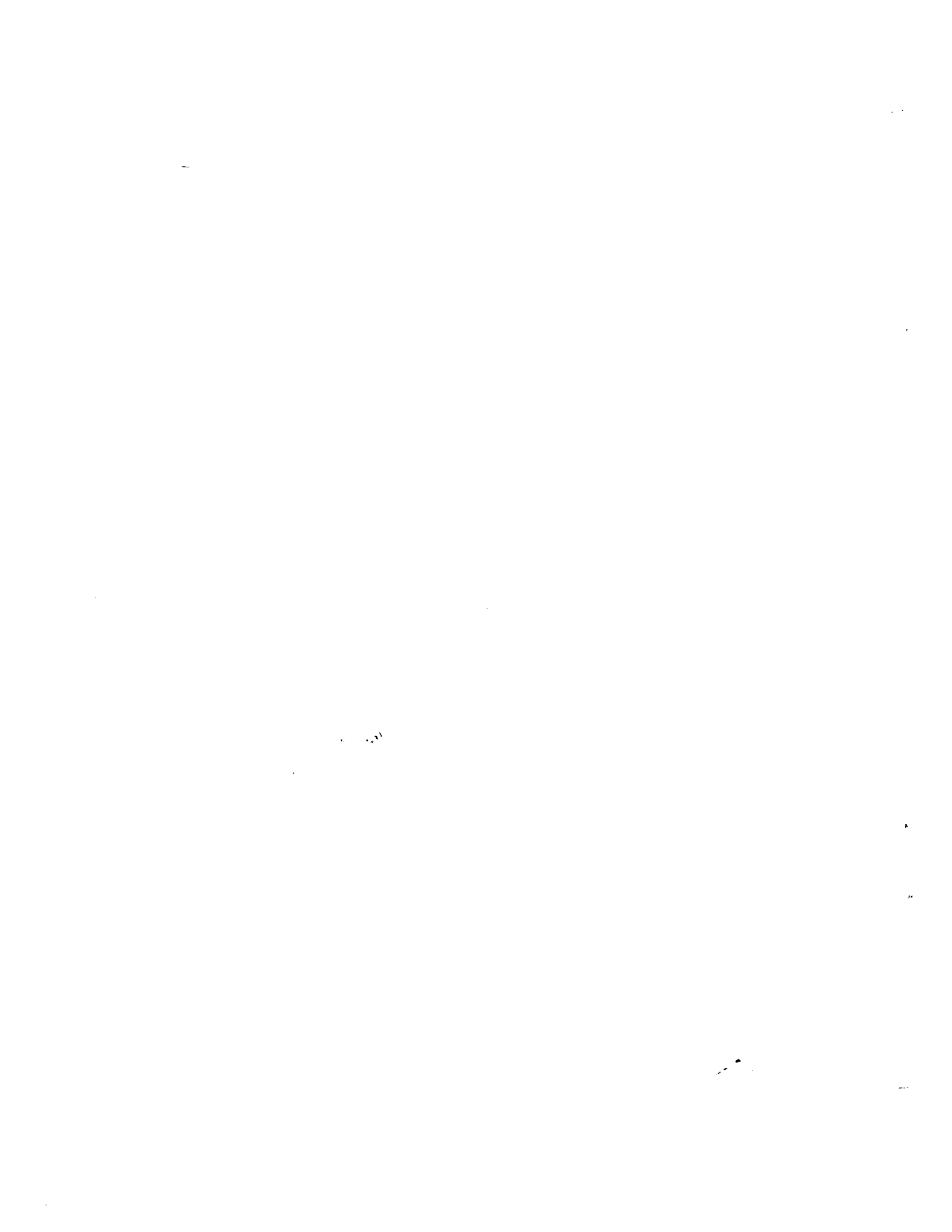
NOTE: During many of the above commands the performance of the MXE will be impaired. Generally, this consists of all the ports slowing down somewhat. But in the case of analog and digital loop-back ALL port I/O will cease until the loop-back is completed. Therefore, it is absolutely imperative that all users connected to the MXE when loopback is to be performed be notified that the MXE will not be functioning smoothly.

## 2.6 VOLTAGE CHECKS

The MXE board voltages can be checked at the following location:

P1 Connector on the Daughter board (210-7973-A)

Voltages	Pin Location
+5VR-----	51/52
+12V-----	53/54
-12V-----	57/58
+0V-----	59/60



## SECTION 3

### OPERATION

#### 3.1 LED INDICATIONS

After 6-seconds of powering-up the LED located on the mounting bracket (see Figure \_), will give two indications.

##### A. LED EXTINGUISHES (BOARD PASS)

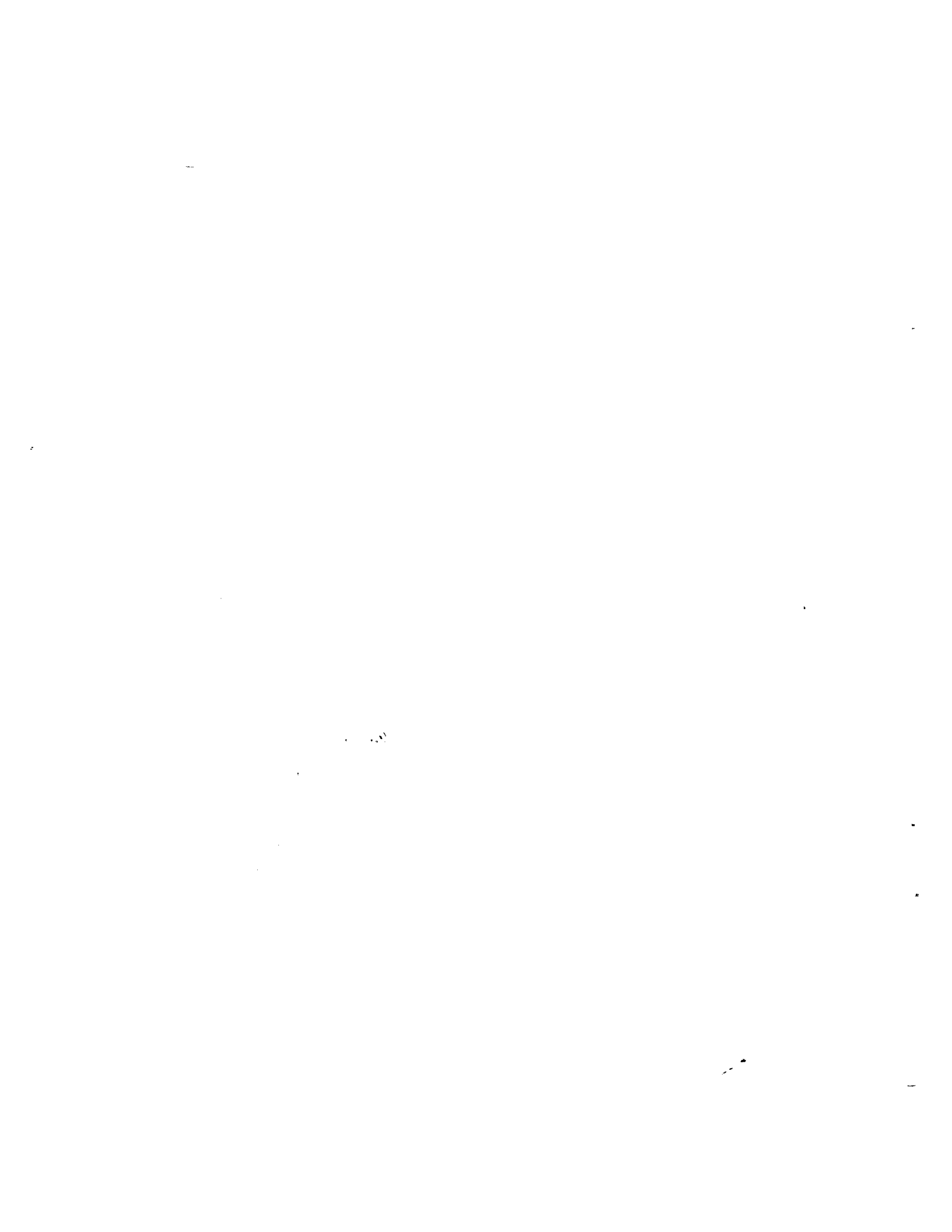
The LED extinguishes 6-seconds after initial turn-on. This indicates that all of the MXE board Power-Up tests have passed.

##### B. LED REMAINS ON (CATASTROPHIC FAILURE)

When the LED remains on for more than approximately 6-seconds than that indicates a catastrophic failure. Perform diagnostic test or replace the MXE board.

#### 3.2 LOADING SOFTWARE

In order for the 2236 MXE to operate a new revision level of the operating system Revision Level 2.4 is needed for the 2236 MXE Operation.



SECTION 4

THEORY OF OPERATION

To Be Supplied

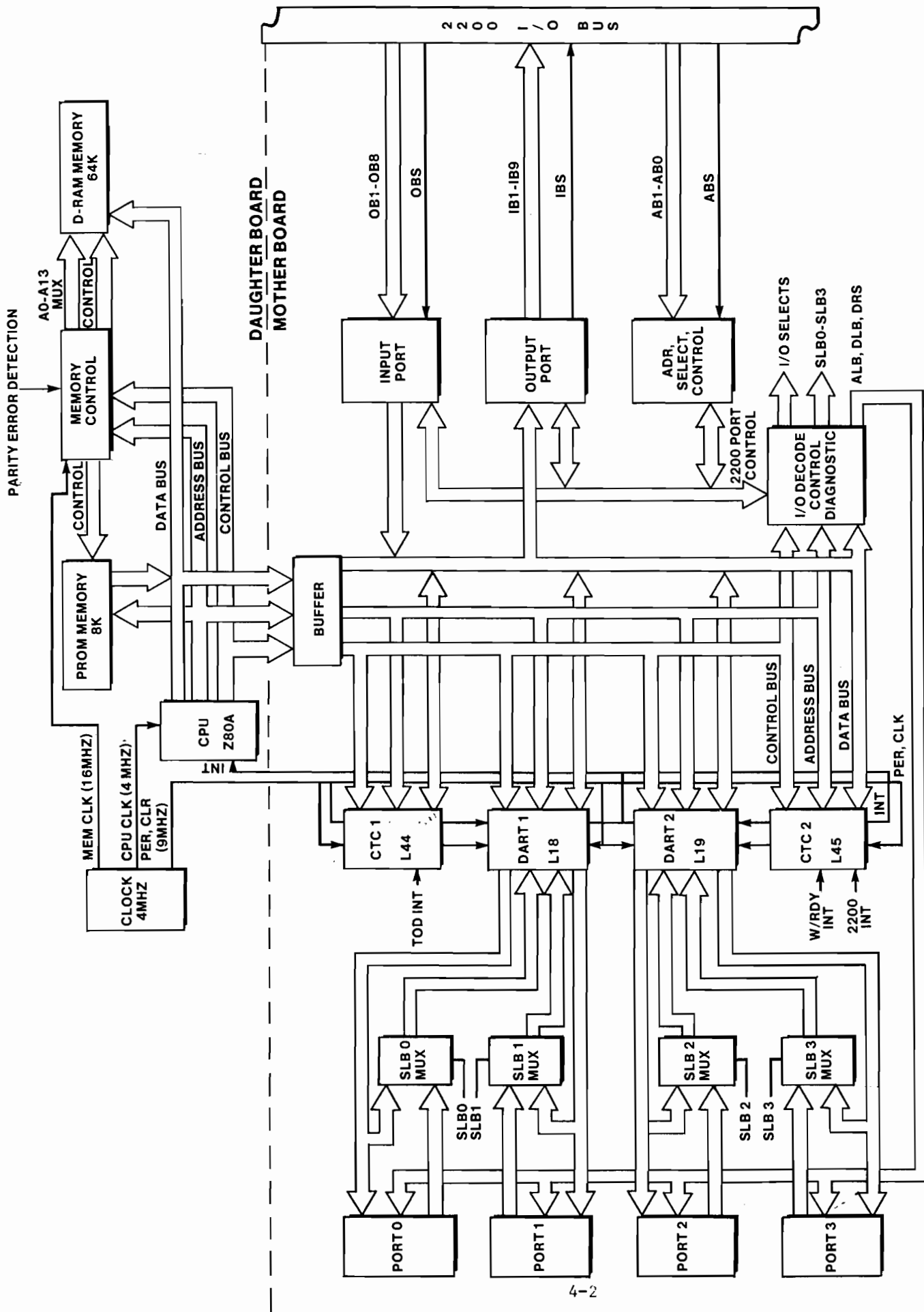


Figure 4-1 SYSTEM BLOCK DIAGRAM

## SECTION 5

### MAINTENANCE

#### 5.1 INTRODUCTION

This section describes the proper procedure for maintaining and testing the 2236 MXE Board

#### 5.2 PREVENTIVE MAINTENANCE

The 2236 MXE has no voltage adjustments and is dependent on the voltages supplied by the CPU. Preventive Maintenance on the MXE should be performed at the same time as the CPU.

#### 5.3 DISASSEMBLY AND REPLACEMENT

Disassembly and Replacement of the 2236 MXE Board should be in the following manner:

- a. Power down the entire system.
- b. Remove all cables connected to the 2236 MXE board. (Make a note on the position of each cable being removed and what port they are connected to.)
- c. There are three banks of switches on the 2236 MXE board. Before replacing the board, be sure to match the switch settings of the OLD MXE board to the NEW MXE board. If not sure of the switch settings then refer to the Baud Rate Switch Setting Table or the Device Address Switch Setting Table.
- d. After verifying that all switches are set correctly, then insert the new 2236 MXE board in the same slot as the old MXE board.
- e. Replace all cables to their original positions. Make sure all cable connectors are secure by screwing down the connector screws.
- f. Power-On the 2200 system and watch the LED on top of the 2236 MXE board. The LED should stay illuminated for approximately six seconds and go OFF. If LED turns OFF then the MXE power-on diagnostics are successful. If LED stays ON then the power-on diagnostics have failed. The MXE board is D.O.A., replace it and refer to steps a. through f.
- g. Load the NEW Revision Level Operating System Diskette.

## 5.4 TROUBLESHOOTING

This section covers some troubleshooting procedures to verify or correct most problems on the Model 2236 MXE Terminal Controller.

### 5.4.1 POWER-UP DIAGNOSTICS FOR 2236 MXE

The MXE board is equipped with a power-up diagnostic. It checks the majority of the MXE hardware prior to passing control to the firmware. The power-up diagnostic run time is approximately 6 seconds. The LED at the top of the MXE board indicates a GO or NO GO diagnostic condition.

On initial turn-on the LED will turn ON. If the power-on diagnostic circuitry finds no fault in the hardware, then the LED will turn OFF in approximately 6 seconds. If the LED stays ON after 6 seconds, then there is a problem in the hardware of the MXE board.

There are two states in which the 2236 MXE operates.

1. LED turns OFF approximately 6 seconds after initial turn-on. This indicates a normal operation.
2. LED remains ON after 6 seconds indicates a catastrophic board failure.

Corrective action: Replace the 2236 MXE board.

The LED turns off and verifies that the hardware test portion of the MXE has successfully been completed. All terminals connected to the MXE board should prompt like the following:

2236DE R01 19200BPS 8+0 (USA)

Type in 'Reset' once, the prompt should look like:

KEY SF'?

Depress 'LOAD' key 3 times, the prompt should look like:

Enter MXE Command:  
%

At this time the C.E. can enter in the desired Command Codes.

## 5.4.2 TROUBLESHOOTING COMMAND CODES

The following Command Codes will aid the C.E. in troubleshooting typical problems related to the 2236 MXE Terminal Controller. The 2236 MXE is designed to perform ALB and DLB test directly from the Terminal. It is not necessary to perform any switch settings on the WA3451 Modem. The Front Panel and Rear Panel switches of the WA3451 Modem should be set like the following:

### WA3451 MODEM SWITCH SETTINGS

<u>Switches</u>	<u>Position</u>
DLB/OFF/ALB	OFF(Normal Operation)
OFF/ST	OFF(Normal Operation)
ANS	FORCE ANSWER
DATA/AANS/OFFL	AUTO ANSWER
HIGH/LOW	HIGH/LOW

### 5.4.2.1 'E' ANALOG LOOP-BACK

#### Steps:

1. Type 'E'
2. Password(psw), Type 'MXEPSW' (any 6 charaters)
3. Port Designator, type 'X' (ports 1 through 4)
4. Return

Example: %EM012345

CRT DISPLAYS: ANALOG LOOPBACK SUCCESS  
or  
ANALOG LOOPBACK ERROR

The Analog Loopback Test takes approximately 6 seconds to run. This test answers in two states, SUCCESS or ERROR(failure). The Analog Test checks the local end of the communications link. This isolates the modem from the telephone line and connects the transmitter output to the receiver input. The Modem must be on hook to perform the ALB test. The test will perform Analog Loopback in the 11 bit mode using a 256 byte data pattern testing Wang WA3451 Modem, MXE Circuitry, the specific port circuitry in which the ALB test was designated to test. This command will cause all I/O's at all ports to be temporarily suspended!

NOTE:--The Digital and Analog Loopback test could be utilized to test only the designated MXE port by inserting the RS-232 loop-back plug.  
RS-232 Loopback Plug part number (WLI# 420-1040)

5.4.2.2 'F' DIGITAL LOOP-BACK

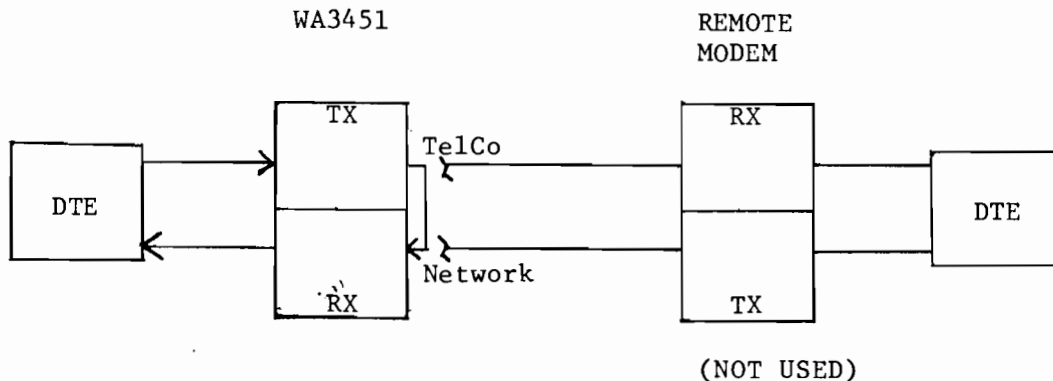
Steps:

- |                          |                             |
|--------------------------|-----------------------------|
| 1. Type,                 | 'F'                         |
| 2. Password(psw), Type   | 'MXEPSW' (any 6 characters) |
| 3. Port Designator, Type | 'X' (ports 1 through 4)     |
| 4. Return                |                             |

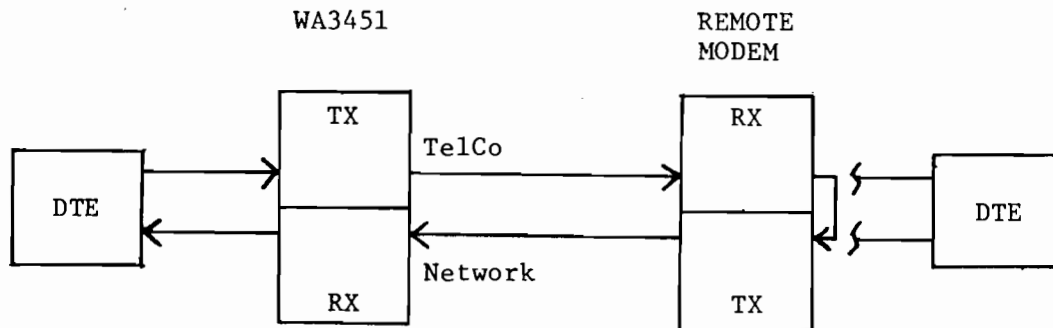
Example: %F0123451

CRT DISPLAYS: DIGITAL LOOPBACK SUCCESS  
or  
DIGITAL LOOPBACK ERROR

Digital loopback is executed at the port designated. The digital loopback checks out the information transferred from one modem to another. While checking out the transferred information which consist of 256 byte data pattern. The DLB test checks the MXE, the local Modem, the Remote Modem, and the TeleCo line. If the DLB test is successful, a 256 byte bit pattern will be displayed on the Remote Terminal (2236DE). Also, a "Digital Loopback Success Message" will be displayed on the 2236DE terminal that initiated the test. If any malfunction occurs during the digital loopback test the prompt will be 'DIGITAL LOOPBACK ERROR'. This test takes approximately eight seconds. During this command all I/O at all ports will be temporarily suspended.



5-1 ALB Test Diagram



5-1 DLB Test Diagram

### 5.4.2.3 'G' PRINT TO ALL SCREENS

#### Steps:

- |                        |                                 |
|------------------------|---------------------------------|
| 1. Type                | 'G'                             |
| 2. Password(psw), Type | 'MXEPSW' (any 6 characters)     |
| 3. Message, Type       | 'message' (up to 80 characters) |
| 4. Return              |                                 |

Example: %GM012345 THE QUICK BROWN FOX JUMPED OVER THE LAZY DOG.

CRT DISPLAYS: THE QUICK BROWN FOX JUMPED OVER THE LAZY DOG.

The 'message' will be printed on all terminals connected to the MXE. The 'message' must not run over the 80 byte limit of the command. Also, the 'message' will be inserted in the output stream of all terminals regardless of their state and a 3 second pause will be executed to allow all users to read the message.

### 5.4.2.4 'I' MEMORY TEST

#### Steps:

- |                        |                             |
|------------------------|-----------------------------|
| 1. Type                | 'I'                         |
| 2. Password(psw), Type | 'MXEPSW' (any 6 characters) |
| 3. Return              |                             |

Example: %IM01234

CRT DISPLAYS: NO MEMORY ERROR  
                  or  
                  MEMORY ERROR`

Memory Test command is used to test the RAM in a nondestructive way. There are two prompts to answer the memory test. 'NO MEMORY ERROR' indicates no catastrophic failure. 'MEMORY ERROR' indicates a catastrophic error. This test divides the RAM into three 16K increments for the purpose of being able to store and display errors should one or two of the three increments contain errors. Port activities will slow down during memory test but, there will be no destructive damage to the memory.

NOTE: If errors are detected and displayed on the 2236DE terminals refer to Documentation release 9220.

### 5.4.3 MODEL WA3451 MODEM OPERATION

#### 5.4.3.1 CONTROL AND INDICATORS

Figure 5-3 (a.)+(b.) shows the location of the controls and indicators. Table 5-1 contains a listing of the controls and indicators and their functions.

a.) Front View

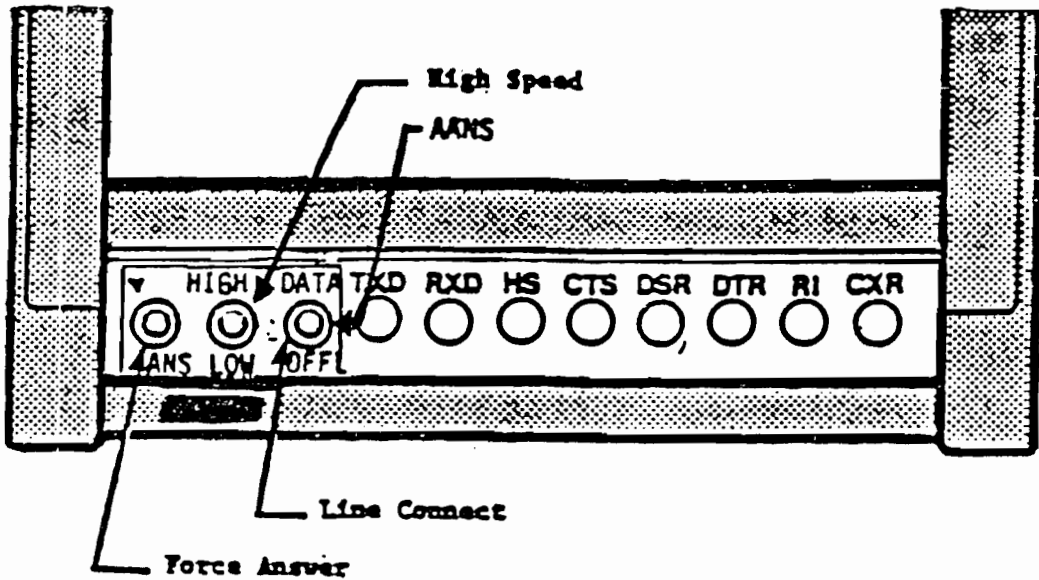
b.) Rear View

Figure 5-3  
CONTROLS AND INDICATORS

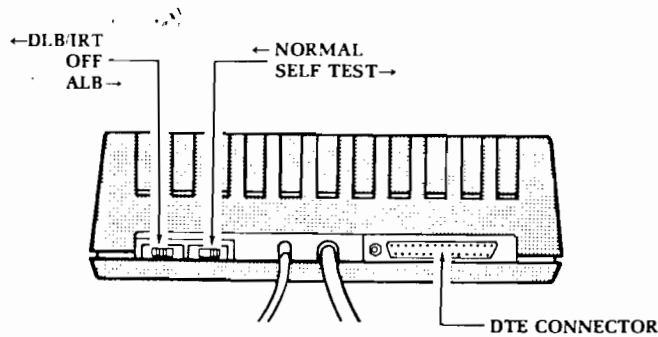
5.4.3 MODEL WA3451 MODEM OPERATION

5.4.3.1 CONTROL AND INDICATORS

Figure 5-3 (a.)+(b.) shows the location of the controls and indicators. Table 5-1 contains a listing of the controls and indicators and their functions.



a.) Front View



b.) Rear View

Figure 5-3  
CONTROLS AND INDICATORS

<u>Controls/Indicators</u>	<u>Function</u>
<u>REAR PANEL</u>	
<u>DLB/OFF/ALB</u>	When this switch is positioned to DLB, the modem will go into a Digital Loop Back mode. This switch, when set to the ALB position, will cause the modem to go into an Analog Loop Back mode and will busy out the TelCo line.
<u>NORMAL/SELF TEST</u>	This switch, when set to the ST position, will cause the modem to go into self test mode and overrides the DTR circuit, forcing it to ON condition.
<u>FRONT PANEL</u>	
<u>ANS</u> (Force Answer)	This switch is used manually answering a call. After answering the call, and when in Off-Line (OFFL) or Auto Answer (AANS) switch position, the attendant activates the momentary ANS switch to allow the modem to enter a normal answer tone routine by turning ON the RI circuit.
<u>HIGH/LOW</u> (Speed)	This switch set to High Speed position, will cause the modem to go into High Speed data mode. When the switch is in the Low Position, the modem will go into Low Speed data mode. This switch is only operative in the originate mode.
<u>DATA/AANS/OFFL</u>	For use with a standard telephone. In the Off-Line (OFFLO position, the modem will not answer the line automatically, while in the Auto Answer (AANS) position, the modem will answer the line automatically. In the Data position, the modem will sieze the line and will not disconnect until the switch is returned to the OFFL or AANS position.
<u>LED Indications</u>	
<u>TXD</u>	Transmit Data--This lamp is lit when spacing data is being transmitted from the local DTE to a remote modem.
<u>RXD</u>	Receive Data--This lamp is lit when spacing data is being received at the local DTE from a remote modem.

LED(continued)

HS High Speed--This lamp is lit when the modem is in the (3400/212 mode and off when the incoming data is in 103 mode.

CTS Clear to Send--When ON, this lamp indicates that the modem is ready to accept data from the DTE.

DSR Data Set Ready--When On, this lamp indicates that the modem is connected to the TelCo line. This lamp will flash when the modem is in a test mode.

DTR Data Terminal Ready--When ON, this lamp indicates that the DTE is ready, connected to the modem.

RI Ring Indicator--When ON, this lamp indicates that the modem is receiving a ring signal from the TelCo line. This lamp will also flash twice per second whenever the modem fails the idle test or self-test.

#### 5.4.4 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.

LEVEL INDICATORS	ACTIVITY INDICATORS	.....	Transmit Clock
Transmitted Data			Receive Clock
Received Data	INDICATOR THRESHOLD	.....	+ 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.

## 5.4.4.2 Functional Description Digital Interface

Pin

- 1 Chassis Ground  
This is protective ground, tied to the AC power ground and is isolated from the signal ground (Pin 7; SG) unleto Send (CTS) (from Modem)
- 2 Transmitted Data (TXD) (to Modem)  
Signals on this circuit are generated by th Data Terminal Equipment and transferred to the modem for transmission to the Remote Data Terminal equipment. The modem should not transmit data on this circuit unless an ON condition is present on the CTS circuit. This circuit is held to the "MARK" state by the modem whenever the CTS circuit if OFF.
- 3 Received Data (RXD) (from Modem)  
Signals on this circuit are generated by the modem receiver in response to signals transmitted by the remote modem except when the modem is in analog loopback test mode. This circuit is clamped to "MARK" whenever the CXR circuit if OFF. When the modem is operated in the 1200 bps character (asynchronous format), the clock signals SCT and SCR are clamped to "MARK" on the interface.
- 4 Request to Send (RTS) (to Modem)  
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.

- 5 Clear to Send (CTS) (from Modem)  
An ON condition of the CTS circuit indicates to the terminal equipment that the modem will transmit any data which is present on the TXD circuit. If CTS is OFF, the modem will internally clamp TXD to MARK and ignore the customer transmit data circuit. The CTS circuit is always turned OFF when the modem is in the digital loop mode (locally or remotely activated). The CTS circuit will turn OFF whenever circuit CXR is OFF. CTS is also strapped optionally to follow RTS.
- 6 Data Set Ready (DSR) (from Modem)  
This signal from the modem indicates that the modem is powered ON and connected to the telephone line (OFF-HOOK) or not in a test mode and DSR control option enabled or no Switch Hook (SH) indication and the unattended disconnect option is enabled. The ON condition of the DSR circuit indicates that the modem is in the data mode and is capable of transmitting and receiving data signals. The ON condition of both DSR and CTS is required when transmitting data.
- 7 Signal Ground (SG)  
Common ground reference point for all interface circuits except protective ground (Pin 1; FG).
- 8 Carrier Detect (CXR) (from Modem)  
Informs DTE that the modem is receiving a data signal suitable for demodulation. Mode selection is based on the type of MARK carrier detected. It also initiates the Clear To Send Delay.
- 9 +12V and -12V
- 10 These signals provide test points to verify the presence of power in the mode. This is supplied through 1k ohm resistors and is not intended as a source of power for peripheral equipment.
- 11 No Connection
- 12 Speed Mode Indication (CI) (from Modem)  
Circuit will be in the ON (positive voltage) state when the modem is in the high speed data mode and OFF (negative voltage) state in the low speed data mode.
- 13 No Connection
- 14 No Connection
- 15 Serial Transmit Clock (SCT) (from Modem)  
This interface circuit is associated with the high speed synchronous format when the transmit timing is set for internal timing. The SCT signal is used to provide the DTE with signal element of the transmitted data (TXD) circuit.
- 16 No Connection

PIN

- 17 Serial Receiver Clock (SCR) (from Modem)  
This interface circuit is associated with the synchronous format in the high speed mode. The square wave signal on the circuit at the nominal 1200 Hz rate is used to provide the DTE with receiver timing information for the RXD Circuit. The ON to OFF (negative-going) transition on circuit SCR indicates the center of each signal element on the RXD circuit.
- 18 Analog Loop/Delayed Busy Out (CN) (to Modem)  
The make busy lead is used to make the data set busy and/or in conjunction with the DTR lead to go into the analog loop mode. If CN is ON and DTR is OFF, the data set will be made busy. If DTR and CN are both ON, the data set will go into the analog loop mode as well as make busy. An OPEN circuit on CN will be interpreted as a mark. The CN function is available on Pin 18 of the customer interface when the TM function is optioned for Pin 25. The CN function may be optioned on Pin 25.
- 19 No Connection
- 20 Data Terminal Ready (DTR) (to Modem)  
Control signal used to prepare modem for connection to the communications channel and maintain the connection once established. In automatic answering applications, the modem will connect to the line upon receipt of the trailing edge of the ringing signal if DTR is ON. DTR may be forced on internally regardless of interface voltage, with switch option. DTR must be turned ON in order for the modem to automatically answer an incoming call.
- 21 Remote Test Control (RTC)  
This circuit is used optionally to initiate a remote digital loop test from the local modem. An ON (positive) condition of this circuit will cause the remote modem to enter the digital loop mode if all the necessary conditions have been established. The rear panel DLB/OFF/ALB switch can also be used to initiate the loopback test.
- 22 Ring Indicator (RD) (from Modem)  
The ON condition of this circuit indicates that a ringing signal is being received by the modem. When the telephone line is OFF-HOOK, or when ringing stops, the RI circuit will turn OFF.
- 23 Data Rate Select (to Modem)  
This interface circuit is used on an optional basis to establish the speed mode of a data call at the originating modem. Speed control at Pin 23 can be accomplished by the DTE, when the speed mode switch is set to low. An open circuit on Pin 23 will be interpreted as a mark.

- 24 External Serial Transmit Clock (SCTE) (to Modem)  
Signals on this circuit are used to provide the modem transmitter with signal element timing information when the transmitter timing external strap option is selected and the high speed mode when synchronous format is used. The ON to OFF transition of this circuit should nominally indicate the center of each signal element on the TXD circuit.
- 25 Test Mode (TM)  
This circuit is ON (positive) when the modem is in a test mode (either locally or remotely controlled) and is OFF (negative) when the modem is in any other mode. The TM circuit turns ON immediately by activating the DLB/OFF/ALB switch in the rear panel. The CN function is available on Pin 18 of the customer interface when the TM function is optioned for Pin 25.

# CS / 2200 Ramblings

Collected by: Tyler B. Olsen

## 2236MXE Terms:

CCV Communications Control Vector -- 29 Bytes to setup Async TC code.

Byte 01	Number stop bits	Transmission rate
Byte 02	Transmission mode	Break signal enable
Byte 03	Number data bits per character,	Parity option
Byte 04	Received data substitute character for parity framing errors.	
Byte 05	Received data timeout interval, in units of 0.1 seconds.	
Byte 06	End of record detection flag.	
Byte 07	Upshift character.	
Byte 08	Downshift character.	
Byte 09	Break signal transmit interval, in units of 10 milliseconds.	
Byte 10	Break signal detect interval, in units of 10 milliseconds.	
Byte 11-18	Up to four pairs -- Special character with transmission delay.	
Byte 19-20	reserved.	
Byte 21-29	are MXE vector byte positions for flow control options.	

CSV Communications Status Vector -- 8 bytes flow control options.

Byte 01	Break signal received.
Byte 02	Modem signals. (DSR and received line signal detector)
Byte 03	Parity / framing errors.
Byte 04	Binary count of number of characters in receive buffer.
Byte 05	Binary count of number of EOR characters in receive buffer.
Byte 06	Received data timeout countdown.
Byte 07	Binary count of number of characters in transmit buffer.
Byte 08	Modem signals. (DCD, RI, DSR, CTS, DTR, RTS, XOFF rcvd, XOFF sent)

\$GIO commands for Async communications on MXE port.

- . Set CCV
- . Read CSV
- . Load transmit code translation table
- . Load receive code translation table
- . Disconnect
- . Send Break Signal
- . Start receiving data.
- . Transfer received data to CPU.
- . Send data
- . Send, then receive data
- . Stop transmitting
- . Continue transmitting
- . Reset controller
- . Set signals.

