NEWS LETTER NO. 65

CUSTOMER ENGINEERING

WORD PROCESSING NEWSLETTER NO. 65

CONFORM/EXECUTE	
INFORMATION ONLY	X

SYSTEMS 10/20/30

April 3, 1979

SYSTEM 5 DIAGNOSTIC

REVISION 1.0

The System 5 Diagnostic is composed of 7 programs containing one or more routines each and a Monitor. These programs are disk loaded and, under Monitor control, test all hardware items and features associated with the System 5 exclusive of the modem and archive workstation. These programs and their routines are described later. Selection of the programs and routines to be used is done by the CE, once selected they will be run each time the diagnostic programs are loaded until changed by the CE.

It is recommended that a CE unfamiliar with the System 5 diagnostic programs acquire "hands on" experience using these programs before performing them in the field.

NOTE

As of this writing the part number assigned to the System 5 Diagnostic REV 1.0 Diskette is 702-0001.

WANG LABORATORIES, INC.
ONE INDUSTRIAL AVENUE, LOWELL, MASSACHUSETTS 01851, TEL (617) 851 4111, TWX 710 343 6769, TELEX 94 7421

Printed in U.S.A.
13-909
11-76-3C

A. PROCEDURE

1. Insert the diagnostic disk in the system drive and reset the system. Menu #0 will be presented on the screen. The left side of the menu is used to indicate to the system diagnostic whether or not a printer is connected. The right side is used by the diagnostic to indicate the hardware switch settings on the Disk-I/O card (7311-7411). To indicate a printer is connected place an asterisk next to the appropriate line in each group. If a printer is attached and an asterisk does not appear,as below:

    PRINTER: A. ATTACHED

    strike the A key and you will see:

    PRINTER: * A. ATTACHED

To remove the asterisk (no printer attached) strike the A key again. If a printer is present, complete the remaining groups by striking the appropriate letter key. Strike NEXT SCRN.

2. Menu #1 will now appear on screen. This Menu lists all the programs in the System diagnostic. Automatic tests do not require assistance once underway but non-automatic ones do. Test selections made the last time the disk was used appear now, marked by asterisks, to change them strike the associated letter key. Strike the DELETE key to clear the screen. The order in which the programs are selected determine the order in which they are executed. Once selections are made strike NEXT SCRN.

3. Menu #2 is now on screen. It is the menu for the first program selected and it lists all routines within the program. These routines are selected or deleted in the same manner as the programs. Again, the order of selection determines the order of execution. Strike NEXT SCRN again.

4. If Disk Test is the program being dealt with, Menu #3 for that program is now being displayed. Key in the drive to be tested as well as setting other parameters. If a random selection of any parameter is desired, insert $$.

   Menu #2 for the selected program will be displayed if the program selected is not the Disk Test. Routine selection is the same. All Menu #2's are in a loop starting and ending at Menu #1, step ahead by striking NEXT SCRN or step back by striking PREV SCRN. When the routines for all the chosen programs have been selected strike EXECUTE.

5. Menu #4 is now displayed and it allows the selection of many differing modes of execution such as looping on routine, on program, on program set, or on error. To select an option, strike the key that appears to the right of the option in (). The current program and routine being executed appears at the top left and counter totals appear at the bottom. Strike EXECUTE.

6. The diagnostic is now executing. Error messages will appear at the bottom of the screen with the testing status displayed at the upper right. It is possible to step to the next routine by striking GO TO PAGE or to the next program by striking CANCEL. Do not step to the next program until the previous one is executed or the system may hang up. To halt testing, strike (COMMAND); to resume testing, strike (COMMAND) again. Do not confuse this with Continue (SRCH) which is used to resume testing after the diagnostic has halted on Error.

7. Strike PREV SCRN at any time to return to the Menu #2 loop to make changes. Remember that a scratch disk must be inserted if a floppy drive is under test. The diagnostic disk must be removed before executing the Disk Test to test the system drive.

B. PROGRAM SET

1. Reference to the following pages will explain the program set in some detail. Keep in mind that this is a disk loaded diagnostic that resides in memory and failures in some parts of the system will prohibit its use. In such cases the solution is to resort to the PROM loaded diagnostics that are available. They are:

Keyboard/CRT Diagnostic----------378-2194
Memory Diagnostic----------378-2195
378-2196
Disk/Memory Diagnostic----------378-2197
378-2198

2 The disk loaded diagnostic is loaded into memory using the event handler software. A disk layout is included below:

Sectors	Contents
0000	Disk Identification
0001	IPL sector.
0002	Menu #0 & Menu #1 defaults.
0004 thru 0005	Menu #1 HELP.
0008 thru 000A	Menu #2 HELP.
0020 thru 0040	Menu #2 & Menu #3 defaults.
0040 thru 0080	Main MONITOR software.
00E0 thru 0100	KEYBOARD diagnostic.
0140 thru 0160	DISK diagnostic.
0160 thru 0180	LOWER RAM diagnostic.
0180 thru 01A0	CTC diagnostic.
01A0 thru 01C0	UPPER MEMORY diagnostic.
0200 thru 0220	CRT MEMORY diagnostic.
0300 thru 0320	DAISY PRINTER diagnostic.
0440 thru 0460	Menu #0 text.
0460 thru 04A0	Save upper monitor.
04A0 thru 04C0	Save lower monitor.

3 The Initial Program Load is made from disk to memory pages 8000-AA00. Program modules are stored on the disk on even tracks and are read into pages 60 thru 80. The upper memory test moves the monitor to pages 1C-34 and the program modules to pages 10-1B.

C. DISK TEST

1. TEST ROUTINE DESCRIPTIONS

a. Worst Case Seek

This test routine uses all circuitry necessary to: check status, move to a track, seek a sector using the CTC as a sector counter, get interrupts from the CTC and short read, do a short read, and check preamble information. The purpose of this test is to determine whether or not the track and sector seeking circuitry and mechanics are working properly. A short read is the basic method used.

- Description

(1) Move head in track 77 (4C)
(2) Seek sector
(3) Do short read
(4. Check format information, status, preamble, and page data
(5) Move head to random track
(6) Do steps 2, 3, & 4
(7) Move head to track 0
(8) Do steps 2, 3, & 4
(9) Move head to random track
(10) Do steps 2, 3, & 4
(11. CRT status table is updated after each operation (See CRT Status Table Below)
(12) Any errors are passed to the monitor for display

NOTE

CRT STATUS TABLE

Drive = the present drive selected
Track = the last track used
Sector = the last sector used
Page = the last page used
Status = the last status word from the Disk PIO port
# Reads = the total number Disk reads done
# Writes = the total number Disk writes done

b. Random Seek

This test routine uses all circuitry necessary to: check status, move to a track, seek a sector using the CTC as a sector counter, get interrupts from the CTC and short read, do a short read, and check preamble information. The purpose of this test is to determine whether or not the track and sector seeking circuitry and mechanics are working properly. A short read is used to verify operations.

- Description

(1) Move head to random track
(2) Seek sector
(3) Do short read
(4) Update CRT status table (See Table Above)
(5) Check format information, status, preamble, and page data
(6) Pass any errors to monitor for display
(7) Do steps 1 thru 6 nine more times

c. Write/Read 1 (AA55)

This test routine uses all circuitry necessary to: check status, move to a track, seek a sector using a short read, write, read, get interrupts from all disk operations, and check preamble circuitry. The purpose of this test is to determine whether or not the writing and reading circuitry works properly when using an AA55 data pattern. The method used to check operations is the comparison of the data in memory to a known test pattern.

- Description

(1) Fill page with AA55 data pattern
(2) Seek track and sector
(3) Write to disk and read every other time
(4) Update CRT status table (See Table above)
(5) Check status, preamble, and page data
(6) Pass any errors to monitor
(7) Do steps 1 thru 6 nineteen more times

d. Write/Read 2 (0FF0)

This test routine uses all circuitry necessary to: check status, move to a track, seek a sector using a short read, write, read, get interrupts from all disk operations, and check preamble circuitry. The purpose of this test is to determine whether or not the writing and reading circuitry works properly when using an 0FF0 data pattern. The method used to check operations is the comparison of the data in memory to a known test pattern.

- Description

  (1) Fill page with 0FF0 data pattern
  (2) Seek track and sector
  (3) Write to disk and read every other time
  (4) Update CRT status table (See Table above)
  (5) Check status, preamble, and page data
  (6) Pass any errors to monitor
  (7) Do steps 1 thru 6 nineteen more times

e. Write/Read 3 (1F2F)

This test uses all circuitry necessary to: check status, move to a track, seek a sector using a short read, write, read, get interrupts from all disk operations, and check preamble circuitry. The purpose of this test is to determine whether or not the writing and reading circuitry works properly when writing and reading a 1F2F data pattern on TRACK 77 (4C). The method used to check operations is the comparison of the data in memory to a known test pattern.

- Description

  (1) Fill page with 1F2F data pattern
  (2) Seek track 77 (4C) and sector
  (3) Write to disk and read every other time
  (4) Update CRT status table (See Table above)
  (5) Check status, preamble, and page data
  (6) Pass any errors to monitor
  (7) Do steps 1 thru 6 nineteen more times

f. Variable Write/Read

This test uses all circuitry necessary to: check status, move to a track, seek a sector using a short read, write, read, get interrupts from all disk operations, and check preamble circuitry. The purpose of this test is to determine whether or not the writing and reading circuitry works properly when writing and reading any data pattern. The method used to check operations is the comparison of the data in memory to a known test pattern.

- Description

(1) Fill page with data pattern
(2) Seek track and sector
(3) Write to disk and read every other time
(4) Update CRT status table (See Table above)
(5) Check status, preamble, and page data
(6) Pass any errors to monitor
(7) Do steps 1 thru 6 nineteen more times

g. Track Splash

This test uses all circuitry necessary to: check status, move to a track, seek a sector using a short read, write, read, get interrupts from all disk operations, and check preamble circuitry. The purpose of this test is to determine whether or not the trim erase coils on the read/write head are working properly.

- Description

(1) Writes

* Tracks 33, 35, 37, 39, 38, 36, and 34 in that order on the same sector with different data patterns
* Updates CRT status table after each write (See Table above).
* Checks status, preamble, and page data after each write
* Passes any errors to monitor after each write

(2) Reads

* Tracks 33, 35, 37, 39, 38, 36, and 34 in that order
* Updates CRT status table after each read (See Table above)
* Checks status, preamble, and page data after each read
* Passes any errors to monitor after each read

D. ERROR MESSAGES

1. Address = XXXX Good Data = XX Bad Data = XX

This error message after a read means that the disk had bad data on it.

This error message after a write means that the write function is affecting a portion of memory.

2. Not Ready to Write

This error message indicates that the status bit write protect is true.

3. Sector Overrun

This is a status bit which comes to the PIO port from the Disk I/O from the disk drive.

4. CRC Error

This is a status bit which comes to the PIO port from the disk I/O from the disk drive.

5. Preamble Error

This error is always followed by an address which indicates what part of the preamble is bad. This could indicate an incorrectly formatted disk or that some operation is affecting this area of memory.

6. Disk Read Interrupt Error

This error indicates that a disk read operation was started but an interrupt signalling the end of the operation was never received.

7. Disk Write Interrupt Error

This error indicates that a disk write operation was started but an interrupt signalling the end of the operation was never received.

8. CTC Interrupt Error

This error indicates that CTC channel 1 did not cause an interrupt. Sector pulses coming from the Disk I/O from the Disk Drive should cause the CTC to count down and interrupt the program.

9. Index Pulse Error

The program expects an index pulse at least every 200 ms. This error message is issued if the pulse is not received.

10. Not on Track Zero

This error is issued if the program issues 77 backward steps to the Disk I/O to the Stepper motor and the program does not receive a track zero indication.

11. Remove System Disk from Drive 00

The diagnostic software disk is in drive zero, but the disk diagnostic will not allow any write tests on this disk.

12. Page Error

See "Address = XXXX" error, above.

E. LOWER RAM TEST/UPPPER RAM TEST

NOTE

The System 5 Diagnostic Monitor loads the Upper RAM Diagnostic into memory starting at location 6000, as it does all System 5 tests. It is then transfered with the Monitor to lower memory during test execution. If a hard fault exists in those upper memory locations normally used by the Monitor, test execution may be impaired.

1. PURPOSE

The Lower RAM Test provides a comprehensive test of memory locations 0000-5FFF and associated address decoders. The UPPER RAM TEST provides a comprehensive test of memory locations 6000-AFFF and associated address decoders. These tests are accomplished by applying various data patterns, each designed to test a particular failure mode. Both the Upper and Lower Tests are performed alike, the test descriptions are the same.

2. TEST ROUTINE DESCRIPTIONS

a. Address Decoder Test

An alternating pattern of 55AA is written into memory and verified. The pattern is then complemented to AA55 and verified again. The test is designed to pick out errors associated with a faulty address decoder and errors caused by noise coupling.

b. Memory Refresh Test

Memory will be filled with all zeroes, then, after a one-second wait, all locations will be checked for zero. Memory is then complemented and after another one-second delay it will be checked for all ones. The one-second delay is enough time for the chips to degrade if memory refresh circuitry is not functioning properly.

c. Random Number Test

The Random Number Test writes and then reads random data starting at several pre-determined addresses and for various pre-determined lengths of memory. The random data patterns will show pattern sensitivity not detected by other tests.

d. Walking One Test*

Memory is first written with all zeroes. A single one is written into one cell of each 4K RAM chip. That cell is then verified for a one and the four adjacent matrix cells are also checked to insure they have not been altered. This procedure is continued until all cells have been checked in this manner.

e. Walking Zero Test*

Memory is first written with all ones. A single zero is written into one cell of each 4K RAM chip. That cell is then verified for a zero and the four adjacent matrix cells are also checked to insure they have not been altered. This procedure is continued until all cells have been tested in this manner.

*Failures in these tests are due to destruction of data caused by noise coupling between cells in the same column or row. The tests are designed specifically for the Texas Instrument 4050 RAM. They cannot be considered as effective on chips manufacturered by others.

f. Execution Time

The execution time of the System 5 Lower RAM Diagnostic is approximately 30 seconds. The Upper RAM Diagnostic time is also 30 seconds.

g. Sample Error Message

FAILURE IN ADDRESS DECODER TEST

ADDRESS OF FAILURE = 3003
DATA EXPECTED = AA
DATA RECEIVED = BA

RAM CHIPS ASSOCIATED WITH FAILURE = L48

F. CTC TEST

1. TEST ROUTINE DESCRIPTION

The CTC Diagnostic consists of one go/nogo routine that tests each channel as a 1 ms timer in both divide by 16 and divide by 256 modes, and tests the priority interrupt structure by checking the priority and channel of each interrupt. Program takes 1 second or less to run.

a. Error Message

CTC channel zero failure = bad CTC chip.
CTC channel one failure = bad CTC chip.
CTC channel two failure = bad CTC chip.
CTC channel three failure = bad CTC chip.

G. CRT MEMORY TEST

1. PURPOSE

The purpose of the CRT Memory Diagnostic is to provide a comprehensive test of CRT control and character memory and associated address decoders.

2. TEST ROUTINE DESCRIPTION

a. CRT Control 8020 Pattern

An alternating pattern of 8020 is written into CRT Control Memory, alternatly setting the cursor bit and the intensity bit. After testing all locations, the pattern is reversed to 2080 and the test is performed again.

b. CRT Control Random Pattern

This test alternately writes random patterns into memory starting from the low address (C000) to the high address (D79F) back to low (C001) etc., until all CRT Control Memory is written. The memory is then read in the same manner.

c. CRT Character AA55 Pattern

An alternating pattern of AA55 is written into CRT Character Memory and verified. The pattern is then complemented to 55AA and verified again.

d. CRT Character Random Pattern

This test alternately writes random patterns into CRT Character Memory starting from the middle (EB9F) and working towards the ends.

e. Execution Time

The execution time of the System 5 CRT RAM Diagnostic is approximately 5 seconds.

f. Sample Error Message

(See paragraph E.2.g.)

I. KEYBOARD TEST

1. HARDWARE TESTED

a. Keyboard Assembly (7229)

- o Keys
- o Encoder Board

2. PROGRAM DESCRIPTION

The Keyboard Diagnostic is a non-automatic test program and is not meant to run unattended. It is made up of only one routine which runs as follows:

a. A Hex value is generated and received by the program by striking a key.

b. The received Hex value is complemented and the resultant is used to enter a translation table to convert to an ASCII equivalent character.

c. The character associated with the ASCII value is displayed on the menu along with the ASCII value found in the table and the Hex value used to enter the table.

NOTE

An error is detected and noted if no ASCII value is found in the translation table for the complemented Hex value. Note, however, that should an ASCII value be found for the complemented hex value, and it is incorrect for the key struck, it will be displayed as if no error occurred. It is the responsibility of the operator to note such errors.

H. PRINTER TEST

1. PROGRAM DESCRIPTION

The System 5 Daisy Printer Test is broken into nine (9) test routines, each designed to exercise a particular function or to allow necessary mechanical alignments. The tests are:

a. Lamps and switches check
b. Quick check
c. Character set
d. Overlay
e. Carriage accuracy
f. Ribbon Alignment
g. Half space
h. Worse case print
i. Alignment exercise

2. TEST ROUTINE DESCRIPTIONS

a. Lamps and Switches

A prompter on the CRT will instruct the operator to verify the proper operation of all printer indicator lamps as well as the two pushbutton switches (Top of Page, Select), and the buzzer.

b. Quick Check (Test Pattern 1)

This routine will allow the operator to quickly verify a majority of the printer's functions by printing two complete passes of the print wheel.

c. Character Set (Test Pattern 2)

Each character on the print wheel is printed several times to verify the operation of the carrier and print wheel.

d. Overlay Test (Test Pattern 3)

The printer prints the phrase 'OVERLAY TEST' at two locations on the paper. The carrier is returned to the left most position before repeating the previous exercise. The operator should verify that the phrase was printed over clearly.

e. Carriage Accuracy (Test Pattern 4)

On the successive lines the printer will print the letter 'X' at the left margin and at the right margin as well as near the center of the paper. This exercise will be executed with the carrier moving in both directions. The operator should verify that all the 'X's printed are lined up properly.

f. Ribbon Alignment (Test Pattern 5)

A sentence is written then underscored. This exercise allows the operator to check the alignment of the ribbon head and make any necessary mechanical adjustments.

g. Half Space Move (Test Pattern 6)

The Half Space Move test moves the carrier 1/120 of an inch. The pattern created is a five inch ruler which can be verified by the operator.

h. Worse Case Print (Test Pattern 7)

This exercise causes the printer to print a four character pattern which requires the print wheel to move the maximum (180 degrees) between each character.

i. Alignment Exercise (Test Pattern 8)

Eight lines of an 'HA' pattern are printed across the paper. This will allow the operator to perform the necessary mechanical adjustments to the platen.

j. Execution Time

The execution time of the System 5 Daisy Printer Test is approximately 3 minutes and 30 seconds.

NOTE

The print wheel conversion table is designed for either the Wang 41W Printer or the Diablo Printer.

3. TEST PATTERNS

```
¶¨"#ß%v'()*+,-./0[23456789§·¸=°?@ABCDEFGHIJKLMNOPQRSTUVWXYZ£]‗¨_^abcdefghijklmn
opqrstuvwxyz´`|´`
```

TEST PATTERN 1

```
¶¨"#ß%v'()*+,-./0[23456789§·¸=°?@ABCDEFGHIJKLMNOPQRSTUVWXYZ£]‗¨_^abcdefghijklmn
opqrstuvwxyz´`|´`
¶¨"#ß%v'()*+,-./0[23456789§·¸=°?@ABCDEFGHIJKLMNOPQRSTUVWXYZ£]‗¨_^abcdefghijklmn
opqrstuvwxyz´`|´`
¶¨"#ß%v'()*+,-./0[23456789§·¸=°?@ABCDEFGHIJKLMNOPQRSTUVWXYZ£]‗¨_^abcdefghijklmn
opqrstuvwxyz´`|´`
¶¨"#ß%v'()*+,-./0[23456789§·¸=°?@ABCDEFGHIJKLMNOPQRSTUVWXYZ£]‗¨_^abcdefghijklmn
opqrstuvwxyz´`|´`
¶¨"#ß%v'()*+,-./0[23456789§·¸=°?@ABCDEFGHIJKLMNOPQRSTUVWXYZ£]‗¨_^abcdefghijklmn
opqrstuvwxyz´`|´`
¶¨"#ß%v'()*+,-./0[23456789§·¸=°?@ABCDEFGHIJKLMNOPQRSTUVWXYZ£]‗¨_^abcdefghijklmn
opqrstuvwxyz´`|´`
```

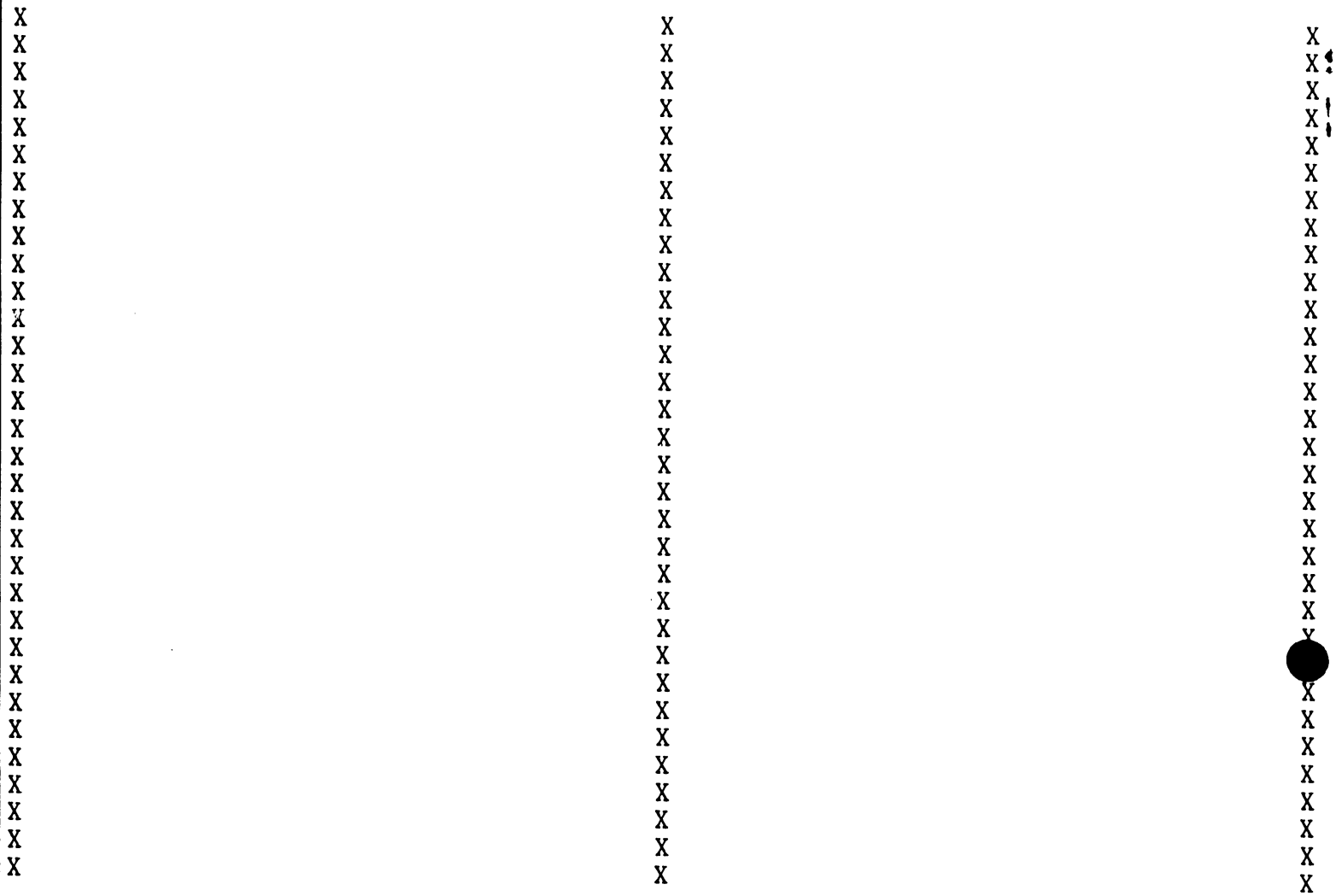
TEST PATTERN 2

OVERLAY TEST

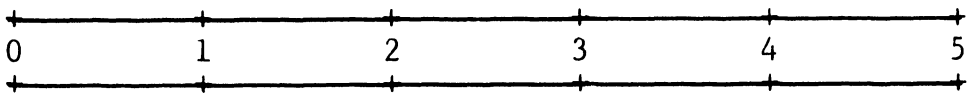
OVERLAY TEST

TEST PATTERN 3

CARRIAGE ACCURACY TEST



TEST PATTERN 4



Ribbon Alignment Exercise   This line in BLACK.

TEST PATTERN 5

HALF MOVE TEST

```
0          1          2          3          4          5
```

FIVE INCH RULER

TEST PATTERN 6

WORSE CASE PRINT PATTERN

```
eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX
eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX
eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX
eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX
eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX
eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX
eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX
eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX eIaX
```

TEST PATTERN 7

ALIGNMENT EXERCISE

HAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHA
HAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHA
HAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHA
HAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHA
HAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHA
HAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHA
HAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHA
HAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHAHA

TEST PATTERN 8

END