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CUSTOMER ENGINEERING

DIAGNOSTIC HANDBOOK

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WANG

8402

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CUSTOMER ENGINEERING

DIAGNOSTIC HANDBOOK

PROFESSIONAL COMPUTER DIAGNOSTIC SYSTEM (PCDS)

741-1435

Preface

This volume discusses the diagnostics used on the Wang PC. It is intended for use as a memory jogger. For specific and detailed information, consult the diagnostic documentation delivered with the diskette.

The PC Diagnostic System occurs at power-up. At this time, the PC runs a built-in test. If all goes well, the PC comes up in customer mode. At that time, if the CE enters the correct code, the PC allows more extensive testing by displaying a test mode selection screen.

To find out about other memory joggers about the PC, consult class code 1506 in the Documentation Control and Processing Catalog/Index (part number 741-0000).

Binders

This material is published for insertion into small white Service Information binders. These binders can be ordered as part number 729-1075-A.

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CHAPTER 1
OVERVIEW

INTRODUCTION

The Wang Professional Computer has two diagnostic packages: one is PROM-based and one is diskette-based. The PROM-based diagnostic is called the Built-In Test (BIT). The diskette-based diagnostic is called the PC Diagnostic System (PCDS).

Built-In Test: Every time the PC is powered-on normally, the BIT runs automatically. It tests only the circuitry necessary to load the operating system. The BIT assumes that the disk drive is working properly, but it also allows CE access to some primitive disk seek and recalibrate operations.

The BIT categorizes failures into two types: fatal and non-fatal. Fatal errors mean that the malfunction is bad enough to prohibit loading the operating system. These fatal errors are reported by the LEDs on the keyboard. Non-fatal errors mean that the operating system can load but that some other hardware module will not function properly. These non-fatal errors are reported on the monitor.

PCDS contains tests for all the modules of a PC or PIC. PCDS has an important part in verifying reliable system operation. This is because it tests all the hardware not tested by the BIT.

PCDS allows the CE to choose both the testing mode (CE or Customer) and the specific tests to perform.

ORGANIZATION OF HANDBOOK

This handbook is divided into three chapters.

Chapter 1	provides an overview of the diagnostics.
Chapter 2	provides error reporting information for the Built-In Test.
Chapter 3	provides error code information for the Diagnostic System.

CHAPTER 2
BUILT-IN TEST

INTRODUCTION

Setting the Serial Port Baud Rate: This rate is set into dip switch 1 on the System Card.

Switch Setting 1	2	3	4	Baud Rate
OFF	OFF	OFF	ON	75
OFF	OFF	ON	OFF	110
OFF	OFF	ON	ON	134.5
OFF	ON	OFF	OFF	150
OFF	ON	OFF	ON	300
OFF	ON	ON	OFF	600
OFF	ON	ON	ON	1200
ON	OFF	OFF	OFF	1800
ON	OFF	OFF	ON	2000
ON	OFF	ON	OFF	2400
ON	OFF	ON	ON	3600
ON	ON	OFF	OFF	4800
ON	ON	OFF	ON	7200
ON	ON	ON	OFF	9600
ON	ON	ON	ON	19,000

Verifying Reliable Error Reporting: Verify that the tone generator issues a beep just as the test begins. Verify that each keyboard LED illuminates one at a time, in a left to right direction. This verification is necessary to assure fatal error interpretation.

End of BIT Testing: At the end of the BIT, the monitor displays the message, "STARTING FROM DRIVE." If you wish to perform any of the following options, press the appropriate letter key within 3 seconds.

Letter	Option
P	Restart the BIT
M	Go to the disk operations menu
Q	Restart without the BIT (warm restart). Place the system disk in drive A.
G	IPL without waiting out the entire 3 seconds .

Disk Operations Menu: This menu allows the CE to perform primitive disk operations. The following operations are available. Type the number of the operation desired.

1 Recalibrate.
2 Seek to track 1.
3 Seek to track 2.
4 Seek to track 3.
5 Seek to track 16.
6 Seek to track 40.
7 Test the RS232 port.
8 Perform cold restart (restart with BIT).
9 Perform warm restart (restart without BIT); in this case, place the system disk in drive A.
0 Test the keyboard's tone generator and LEDs.

Selections 1 to 6 aid in aligning disk drive A. Selection 7 requires an RS232 loopback connector be installed on the serial RS-232-C port.

The keyboard's tone generator is tested if 0 is selected. The tone channel used when illuminating each LED is shown below.

LED	Channel
1	3
2	2
3	1
4	0
5	1
6	0

Tests in Diagnostic:

Test	Description
	Kernel Tests
00H	PROM checksum and System Card.
01H	Keyboard LEDs and alarm.
02H	Clearing system status parity flag.
04H	Accessing of DMA channel 0.
05H	Second access of DMA channel 0.
06H	Clearing of Timer 0's interrupt before an interrupt can occur.
08H	Clearing of Timer 0's interrupt capacity.
09H	Clearing of Timer 0's interrupt flag after the interrupt occurs.
0AH	Clearing of Timer 2's interrupt before an interrupt can occur.
0BH	Clearing of Timer 2's interrupt capacity.
0CH	Clearing of Timer 2's interrupt flag after the interrupt occurs.
0DH	Memory test of temporary stack space and refresh test.
0EH	Removes option cards from data bus.
10H	System memory test of bank 1.
11H	System memory test of bank 2.
12H	System memory test of bank 3.
13H	Verifies system parity errors.
14H	Accesses PIC interrupt mask register.
15H	System card interrupt via vector table.

Test	Description
	System Card Tests
CHK KB I/O	Keyboard interrupt and its flag. Keyboard PROM revision level.
CHK PPI	PPI and attached printer.
SERIAL PORT	The Serial Mode registers.
	Option Card Tests
Winchester	The Winchester option card and drive test.
Hi Res	The character GDC and its memory.
Lo Res	The low resolution option card and its memory.
Md Res	The medium resolution option card and its memory.
928/Loc Comm	The local communications option card's memory and resident Z80 processor.

ERROR CODES

Errors are categorized into two types: fatal errors and non-fatal errors. Each is treated separately below.

Fatal Errors: The keyboard LEDs are used to display kernel test numbers during the system card kernel test. If the test fails, the keyboard audio alarm beeps. The kernel test number displayed is the fatal error code.

All fatal errors listed below indicate a failure that is most likely to be on the System Card. The second most-likely failing module is the power supply.

LED Status*

LED 1	2	3	4	5	6
ON	x	OFF	OFF	OFF	OFF
ON	x	OFF	OFF	OFF	ON
ON	x	OFF	OFF	ON	OFF
ON	x	OFF	OFF	ON	ON
ON	x	OFF	ON	OFF	OFF
ON	x	OFF	ON	OFF	ON
ON	x	OFF	ON	ON	OFF
ON	x	OFF	ON	ON	ON
ON	x	ON	OFF	OFF	OFF
ON	x	ON	OFF	OFF	ON
ON	x	ON	OFF	ON	OFF
ON	x	ON	OFF	ON	ON
ON	x	ON	ON	OFF	OFF
ON	x	ON	ON	OFF	ON
ON	x	ON	ON	ON	OFF
ON	x	ON	ON	ON	ON
OFF	ON	ON	ON	ON	ON
OFF	OFF	OFF	OFF	ON	OFF
OFF	OFF	OFF	ON	OFF	OFF
OFF	OFF	OFF	ON	OFF	ON
OFF	OFF	OFF	ON	ON	OFF

* An x indicates a don't-care status, i.e., the LED could be either on or off.

Fatal errors (continued)

LED Status 1	2	3	4	5	6	FRU
OFF	OFF	ON	OFF	OFF	OFF	PIC IRR bit 0 did not detect Timer 0's interrupt.
OFF	OFF	ON	OFF	OFF	ON	PIC IRR bit 0 cannot clear.
OFF	OFF	ON	OFF	ON	OFF	Timer 2's interrupt flag does not clear.
OFF	OFF	ON	OFF	ON	ON	PIC IRR bit 1 did not detect Timer 2's interrupt.
OFF	OFF	ON	ON	OFF	OFF	PIC IRR bit 1 cannot clear.
OFF	OFF	ON	ON	OFF	ON	System memory error between 0 and 0200H.
OFF	OFF	ON	ON	ON	OFF	Diagnostic hung during first pass.
OFF	ON	OFF	OFF	OFF	OFF	Memory error in bank 1.
OFF	ON	OFF	OFF	OFF	ON	Memory error in bank 2.
OFF	ON	OFF	OFF	ON	OFF	Memory error in bank 3.
OFF	ON	OFF	OFF	ON	ON	Memory parity error.
OFF	ON	OFF	ON	OFF	OFF	PIC mask register failed test pattern.
OFF	ON	OFF	ON	OFF	ON	Live interrupt failed.

Non-Fatal Errors: Errors that don't jeopardize reliable IPL of the PC are considered to be non-fatal errors. These errors are displayed as follows:

Error	Message/Description
*21	Device Name IN ## Defective - a device in slots 1 - 5 is defective.
*22	Device Name DEFECTIVE - a system card is defective.

CHAPTER 3
DIAGNOSTIC SYSTEM TESTS

INTRODUCTION

This chapter contains specific operation and error information for each test listed. The system test error codes are reported on the PC's display. Errors are also logged in the Error Log.

GENERAL PCDS INFORMATION

MODES OF OPERATION

There are five available modes in which to run PCDS. Except for Customer Mode, they are listed in the left-hand column of the top PCDS menu.

Customer Mode: Designed for customer use, this mode eliminates extensive error reporting in English although Error Log entries are still made.

Diagnostic: for field use.

Run-In: automatically runs all tests without any operator intervention; used by manufacturing. When an error is encountered in this mode, PCDS switches automatically to the next diagnostic in the list. Any test that requires operator participation is skipped entirely.

Repair Aids: for use of board repair technicians.

Utilities: allows CE to set default parameters. By using this menu once, the CE can insure that a particular diskette will in the future always power-up to a menu rather than the copyright notice.

SELECTION CRITERIA

The right-hand column of the topmost PCDS menu allows the CE to select the criteria by which tests are selected. There are two selection options.

Select by Option Cards: allows the CE to choose from a list of the option cards installed in the system. This selection mode will automatically run every applicable test for whichever module is selected.

Select by Diagnostic: allows the CE to determine the specific test to run.

SYSTEM CONTROL KEYS

Keys	Description
HELP	Brings up on the CRT a list of the various system control keys and their descriptions.
INDENT	Scope loop.
PAGE	Error loop.
CENTER	Routine loop.
DECTAB	Program loop.
FORMAT	Stop on error.
SHIFT+FORMAT	Set a maximum for the number of errors the diagnostic can accept before it stops completely.
MERGE	Resume from error.
NOTE	Not used.
STOP	Halt (Pause).
SRCH	Not used.
REPLC	Not used.
COPY	Defined by executing diagnostic.
MOVE	Defined by executing diagnostic.
COMMAND	Display Error Log.
SHIFT+COMMAND	Print Error Log.
ARROW	Hotprint future errors.
BLANK	Used in Set Defaults utility.
GOTOPAGE	Terminates current diagnostic. Loads and runs next diagnostic.
CANCEL	Returns to Test Selection Menu.
SHIFT+CANCEL	Returns to Mode Selection Menu after clearing any set options.
TAB	Reboots the system from whatever diskette is in drive A.
SHIFT+COMMAND+ CANCEL	Warm reboot.

OPERATION

Diagnostic Mode:

1. Place the PCDS diskette in disk drive A.
2. Power on the PC.

   [The Copyright Notice appears on the monitor.]
3. Exit the Customer Diagnostics by holding down SECOND and pressing d + m.

   [The Mode Selection Menu will be displayed.]
4. Select the diagnostic mode by moving the cursor using the space bar.
5. Move to the Selection Criteria by pressing the RETURN key.
6. Select the test selection criteria by using the space bar.
7. Once both columns are correctly selected, enter the Test Selection Menu by pressing the EXECUTE key.

   [The Test Selection Menu appears on the screen.]
8. Select the test(s) to execute using the keys as listed at the bottom of the Test Selection Menu.
9. Initiate execution by pressing EXECUTE.

Utilities:

1. Place the PCDS diskette in disk drive A.
2. Power on the PC.

   [The Copyright Notice appears on the monitor.]

3. Exit the Customer Diagnostics by holding down SECOND and pressing d + m.

4. Select the Utilities mode by moving the cursor using the space bar.

   [The Utilities Selection Menu appears on the monitor.]

   - Set Default Menus and Option Keys remembers default selections frm one IPL to another.
   - Display Error Log File brings the log up on the monitor.
   - Print Error Log File prints the Error Log on the system printer.

After the option is selected, control is returned to the Mode Selection Menu.

MAIN MEMORY

OPERATOR INPUT

With the Select by Card option active, this diagnostic runs whenever System Card is selected. With the Select by Diagnostic option active, this diagnostic can be selected individually.

The diagnostic determines how much memory is available and displays this number in a message on the monitor.

Tests in Diagnostic:

Test	Description
01	MACHO: Sizes memory then tests for stuck or open bits in data RAMs and for parity errors.

ERROR CODES

NOTE: Any error indicates a failure on the System Card.

Test	Code	Description
01	01	Data error found on first read of a read/write/read sequence.
	02	Data error on second read of a read/write/read sequence.
	03	Parity error.

MINIFLOPPY DISK

OPERATION

Select Drive Under Test: Select A, B or A & B. If drive A is involved in testing, the diagnostic will ask whether to run read only tests. When write tests are selected, the diagnostic suggests that you remove the diagnostic diskette from drive A and insert a scratch diskette.

Door Open Interrupts: The diagnostic gives operator directions on the monitor.

Tests in Diagnostic:

Test	Description
01	Format: verifies that drive and controller can perform format commands on every track on diskette.
02	Seek: verifies that drive and controller can perform seek commands to every sector on diskette.
03	Write Cylinder: verifies that drive and controller can perform write commands to every track on disk.
04	Read Cylinder: verifies that drive and controller can perform read commands to every track on disk.
05	Door Interrupt: verifies that the disk drive and controller can recognize whether the door is open or closed.

ERROR CODES

The field-replaceable modules which are tested by this diagnostic are the System Card, the disk drive, the cables or the media (the scratch floppy diskette itself).

System Card failures are indicated if any of the following are true:

- The diagnostic times out while waiting for an interrupt to occur.
- There are data compare errors but no read or write errors occured.
- There are data lost errors.
- The same errors occur on both drives.
- There are system crash errors.

The media, the drives and the cables are indicated if the any of the following are true:

- There are recalibrate and seek errors.
- Errors occur on just one drive, not on both.

NOTE: The test entry xx indicates that the error occurs in more than one test.

Test	Code	Description
xx	06	On recalibrate, received bad status from disk drive.
xx	07	On seek, received bad status from disk drive.
01	03	Hard error: on format, number of retries exceeded 4.
01	0D	Soft error: on format, returned status was bad but, after retry, status changed to good.
02	08	On read ID command, received bad status from disk drive.

Test	Code	Description
03	02	Hard error: on read ID, number of retries exceeded 4.
03	0C	Soft error: on read ID, returned status was bad but, after retry, status changed to good.
04	01	Hard error: on read, number of retries exceeded 4.
04	0B	Soft error: on read, returned status was bad but, after retry, status changed to good.
04	04	Data read from memory is not the same as the data that was written to memory.
05	0E	Did not detect that disk drive door was open.

KEYBOARD

OPERATION

As instructed on the monitor, press each key on the keyboard twice.

ERROR CODES

Any error indicates a failure in the keyboard.

MEMORY EXPANSION

OPERATION

This diagnostic can test up to fifteen memory expansion cards. Each board can have a different number of bytes of memory configured. The number of bytes per board can be 128K, 256K or 512K. Boards with 384 kilobytes are not tested.

ERROR CODES

The diagnostic displays on the monitor the number of kilobytes of memory found on each memory expansion board. The slot number is listed as well. The following correspondences can be used to verify that the amount of memory found is correct for each board:

Amount	Number of Banks Loaded with RAMs
128K	1
256K	2
512K	4

When a failure occurs, the diagnostic displays on the monitor the most-likely failing field-replaceable unit(s). When more than one module could be failing, the most-likely unit is listed first and the next most-likely unit is listed second. When running in Diagnostic Mode, more error identification is performed.

Test	Code	Description
	01	MBR failure.
	02	Parity interrupt failure.
	03,04	Parity flag failure.
	05	Shorted bus line.
	06	Open bus line.
	07	RAM addressing failure.
	08	RAM parity failure.

LOCAL COMMUNICATIONS

OPERATION

Disconnect the cables to the OIS or VS Master.

Once this program is started, no further operator intervention is required unless an error is detected. When the error is reported, the most likely failing field-replaceable unit is identified on the PC video display.

The Refresh Test (BUSRQ), which normally runs for 1 minute, can be shortened or bypassed by pressing the 'MOVE' key when prompted. Fault detection for the refresh row address counter circiut will be lost. If the operator does nothing, the test will run for the full minute.

Tests in Diagnostic:

Test No.	Name
01	Segment Map Test
02	Main Memory Word Test
03	Main Memory Byte Test
04	CRT Memory Test
05	DMA Write Test
06	DMA Read Test
07	Primary Interface Test
08	Good Parity Generator Test
09	Bad Parity Generator Test
10	Stop on Parity Error Test
11	Z80 Main Memory MACHO Test
12	Z80 CRT Memory MACHO Test
13	Mutual Addressing Test
14	CRT Mutual Addressing Test
15	Main Memory Contention Test
16	CRT Memory Contention Test
17	8086-Z80 Register Test
18	CRT Section Write Test

Test No.	Name
19	Keyboard Simulation Test
20	CTC Address Line Test
21	CTC Priority Interrupt Test
22	Interrupt Source Test
23	Interrupt Level Test
24	Refresh Test (BUSRQ)
25	RAM Noise Test

ERROR CODES

Any error implies that the Local Communications Option card should be replaced.

Code	Description
1	Data error.
2	Addressing error.

STANDARD MONITOR MEMORY

OPERATION

This diagnostic will run when executed and will either stop to report errors or will enter errors detected into the error log.

If Diagnostic Mode is selected, a menu will be displayed in the message area of the CRT used for error reporting. Enter the test selected and use the MOVE key to stop a menu selection from repeating and allow selection of another option.

If an error occurs, the names of the three most likely failing units are displayed and entered into the error log. For this diagnostic, the most likely failing unit (FRU) is always the Standard Monitor Card.

Tests in Diagnostic:

Test No.	Name
01	Bit Mapped Memory Test

ERROR CODES

Any error implies that the Standard Monitor Memory card should be replaced.

Code	Description
01	Error on the first read of the read/write/read sequence.
02	Error on the second read of the read/write/read sequence.
04	Standard Monitor card ID not detected.

STANDARD MONITOR CONTROLLER ATTRIBUTES

OPERATION

Tests are automatically executed in the sequence listed below. Tests 2 through 4 produce a characteristic display on the monitor which should be verified correct by the operator.

The PCDS 'program pause' function allows the operator to pause the diagnostic in cases where more time is needed than the diagnostic provides.

Tests in Diagnostic:

Test No.	Name
01	Select Device
02	Clear Screen
03	HOHO Display
04	Change/Mix Colors
05	Scroll
06	Enable/Disable Screen Memory
07	Cursor Addressing
08	Vertical Sync. Interrupt

ERROR CODES

In most cases where an error is detected, the Standard Memory Monitor card is the FRU. Other likely FRUs are the Monitor Cable, the CRT, the System Card and the Power Supply.

WANG MONITOR MEMORY

OPERATION

Data is entered as 4 hex digits, memory locations are also 4 hex digets. The memory segment is already assigned as either E000 or F000. When both the location and data are requested, type in the location immediately followed by the date. For example, 1234FFFF means write FFFF to location 1234 in the default segment.

Press EXECUTE after completing inputs. The function will repeat until the MOVE key is pressed, after which the menu will be displayed.

If an error occurs, the names of the three most likely failing units are displayed and entered into the error log. For this diagnostic, the most likely failing unit (FRU) is always the Wang Monitor Card.

Tests in Diagnostic:

Test No.	Name
01	Memory Test Frame Buffer
02	Memory Test Font Memory

ERROR CODES

Any error implies that the Wang Monitor Memory card should be replaced.

Code	Description
01	Error on the first read of the read/write/read sequence.
02	Error on the second read of the read/write/read sequence.

WANG MONITOR CONTROLLER ATTRIBUTES

OPERATION

Customer Mode

The diagnostic will display the customer screen until the MERGE key is pressed, at which point the diagnostic will be exited.

Diagnostic and Repair Mode

The diagnostic will display the diagnostic attribute screen. The MOVE key must be pressed in order to view the alignment screen. The MOVE key must be pressed again to continue.

Run-In Mode

The same as the Diagnostic and Repair Mode except that the displays are timed. The MOVE key is not needed to step through the screens.

The PCDS 'program pause' function allows the operator to pause the diagnostic in cases where more time is needed than the diagnostic provides.

Tests in Diagnostic:

Test No.	Name
01	Customer Attribute Display
02	Diagnostic Attribute Display
03	Alignment Display

ERROR CODES

In most cases where an error is detected, the Wang Memory Monitor card is the FRU. Other likely FRUs are the Monitor Cable, the CRT, the System Card and the Power Supply.

WANG MONOCHROME MONITOR/ IBM PC EMULATOR

OPERATION

The diagnostic will determine which type of card (8343 or 9443) is installed and run the appropriate tests. The diagnostic runs without operator intervention with the exception of the video display tests which require visual verification.

NOTE: The tests performed on the Wang Monochrome Monitor Card (8343) are identical to the former Wang Monitor Memory/Attributes Diagnostics.

Tests in Diagnostic:

Test No.	Name
Wang Monochrome Monitor Card (8343):	
01	Frame/Font Memory Test
02	Video Displays
IBM PC Emualtor	
01	Wang-Mode Frame/Font Memory Test
02	IBM-Mode Frame Memory Test
03	Auxiliary Memory Test
04	EPROM Checksum Verification
05	I/O Trap - Status Test
06	I/O Trap - Read/Address Test
07	I/O Trap - Write Data Test
08	Interrupt/Timing Test
09	IBM-Mode Video Displays
10	Wang-Mode Video Displays

ERROR CODES

Errors, except for video circuitry types, are reported via the Test Display Console (TDC); however, it is recommended that an alternative console output device be connected while running this test since errors on the video controller card may prevent displaying messages on the TDC. Faults in the video circuitry can only be detected by careful visual observation of the video display screens.

WANG GRAPHICS MONITOR MEMORY

OPERATION

Data is entered as 4 hex digits, memory locations are also 4 hex digets. The memory segment is already assigned as either E000 or F000. When both the location and data are requested, type in the location immediately followed by the date. For example, 1234FFFF means write FFFF to location 1234 in the default segment.

Press EXECUTE after completing inputs. The function will repeat until the MOVE key is pressed, after which the menu will be displayed.

If an error occurs, the names of the three most likely failing units are displayed and entered into the error log.

Tests in Diagnostic:

Test No.	Name
01	Memory Test Frame Buffer
02	Memory Test Font Memory

ERROR CODES

Any error implies that the Wang Monitor Memory card should be replaced.

Code	Description
01	Error on the first read of the read/write/read sequence.
02	Error on the second read of the read/write/read sequence.

WINCHESTER CONTROLLER

OPERATION

Diagnostic Mode

The system prompts 'Is a Winchester drive is attached to the controller?'

If No - only those tests that do not require a drive will be run. They are Initial, I/O and DMA.

If Yes - A menu is of available tests is displayed. Select all tests by pressing EXECUTE. Select individual tests by entering the number(s) in the order in which they are to be run.

NOTE: The Initial test must always be run first.

The special function test has no diagnostic purpose other than informing the operator of the number of media defects in the File Allocation Table (FAT). The operator must press the MOVE key after the test has completed in order to re-load the diagnostic menu.

Repair Aids Mode

The diagnostic displays a menu of the repair aid functions available. Refer to Appendix B for a detailed description of Repair Aids.

Tests in Diagnostic:

Test No.	Name
01	Initial Controller
02	Controller I/O
03	CPU-Winchester DMA

Tests in Diagnostic:(continued)

Test No.	Name
04	Drive Select/Ready
05	Rotational Speed
06	Initial Read
07	Coverging/Diverging Seeks
08	Head Select
09	Write/Read Cylinders
10	ECC
11	Sequential Reads
12	Repair Aids
13	Total Media Defects in FAT

ERROR CODES

Customer and Diagnostic Modes

Any error while running in either mode implies that the Winchester Controller Card should be replaced. In addition, a detailed error message will be displayed.

Run-In Mode

The most likely FRU is not displayed. The first 69 characters of the detailed error message will be displayed in it's place.

Code	Description

ERRORS FROM INIT TEST

1	Could not find winchester board in system.
2	Time-out occurred before winchester completed prom based test. STATUS = WINI SLOT =
3	First location of buffer RAM could not hold zero.
4	First location of user RAM could not hold zero.
5	Memory testing data error detected.

Code	Description
6	Memory testing addressing error detected.
7	CTC timer mode test interrupt error detected.
8	Bad status sent by winchester, unknown error code.

ERRORS FROM I/O TEST

9	Time-out occurred before the winchester BUSY bit cleared.
A	Data echoed back by winchester was incorrect.
B	Time-out on Winchester command phase. STATUS = xx
C	Time-out on Winchester results phase. STATUS = xx

ERRORS FROM DMA TEST

D	Error found while testing DMA Ch. x Bad status from Winchester after down-load operation. WCB = 00 00 00 00 00 00 00 00 Winch Controller Status = xx Winch Interrupt Status = xx
E	Error found while testing DMA Ch. xx Bad status from Winchester after up-load operation. WCB = 00 00 00 00 00 00 00 00 Winch Controller Status = xx Winch Interrupt Status = xx

ERRORS FROM DMA TEST(Continued)

F	Time-out occurred before Winchester EOP interrupt. Winch Controller Status = xx Winch Interrupt Status = xx

Code	Description
10	Winchester I/O fault occurred. Winch Controller Status = xx Winch Interrupt Status = xx
11	Error found while testing DMA Ch. xx Bad data found after last transfer from Winchester Number of Bad Bytes = xxxx Winch Controller Status = xx Winch Interrupt Status = xx

ERROR FROM FORMAT DISK ROUTINE

12	Bad status returned after format disk operation.

ERRORS FROM FLOPPY DISK ACCESS ROUTINES

13	File not found on floppy FCB=00 00 00 00 00 00 00 00 00 00 00 00
14	File access conflict FCB=00 00 00 00 00 00 00 00 00 00 00 00
15	Programmer error FCB=00 00 00 00 00 00 00 00 00 00 00 00
16	Not enough space FCB=00 00 00 00 00 00 00 00 00 00 00 00
17	Unknown floppy problem FCB=00 00 00 00 00 00 00 00 00 00 00 00

ERRORS FROM DOWNLOAD CONTROL ROUTINES

18	Time-out occurred before BUSY set after down-loading a test.
19	Bad status from Winchester after down-load operation. WCB = 00 00 00 00 00 00 00 00 Winch Controller Status = xx Winch Interrupt Status = xx

Code	Description

ERRORS FROM DOWNLOAD CONTROL ROUTINES (continued)

1A	Winchester Prom rev. level is wrong, the diagnostic cannot be run.
21	The drive select bit did not set.
22	The drive did not become READY within the 25 seconds allowed.
31	First index pulse interrupt did not occur within 1 second; therefore, we were unable to begin the timing sequence.
32	Time-out occured before second interrupt. Therefore no useful timing measurement was taken.
33	Rotational period interval was too long. The error exceeded the 1 percent tolerance window by xxx micro-seconds.
34	Rotational period interval was too short. The error exceeded the 1 percent tolerance window by xxx micro seconds.
35	The drive was not selected.
41	WARNING! This disk might not be formatted.
51	Could not find all the sectors needed for head select test. Bad format or media on diagnostic cylinder.
52	Bad status returned after disk write operation. STATUS = TRACK = HEAD = SECTOR =
53	Bad status returned after disk read operation. STATUS = TRACK = HEAD = SECTOR =

Code	Description
ERRORS FROM DOWNLOAD CONTROL ROUTINES (continued)	
54	Bad data found after disk read operation. Received Data = Expected Data = TRACK = HEAD = SECTOR =
Write/Read Diagnostic Cylinder	
71	WRITE ERROR: Status = xx CYL = xxx HD = xx SEC = xx
72	READ ERROR: Status = xx CYL = xxx HD = xx SEC = xx
73	BAD DATA: Errors = xxxx CYL = xxx HD = xx SEC = xx
74	BAD DATA: Errors = xxxx CYL = xxx HD = xx SEC = xx
ECC test	
81	Bad status returned after attempt to format first surface of diagnostic cylinder.
82	No ECC error was detected after reading newly formatted surface.
83	Bad status returned after attempt to write zeros to first surface of diagnostic cylinder.
84	Writing zeros did not restore good ECC to diagnostic cylinder.
91	Format error detected during disk verify operation. STATUS = TRACK = HEAD = SECTOR =
92	ECC error detected during disk verify opeation. STATUS = TRACK = HEAD = SECTOR =

Code	Description
ERRORS FROM DOWNLOAD CONTROL ROUTINES (continued)	
93	Unknown error detected during disk verify operation. STATUS = TRACK = HEAD = SECTOR =
A1	SEEK ERROR: Could not verify seek to CYL xxx
B1	Disk not properly formatted, could not verify BOOT SECTOR.
B2	Disk not properly formatted, could not verify File Allocation Table (FAT).
B3	Bad data found in last sector read from disk. STATUS = TRACK = HEAD = SECTOR = Number of bad bytes =
B4	ECC error found: CYL = xxx HD = xx SEC xx
B5	FORMAT ERROR: CYL = xxx HD = xx SEC = xx
B6	DRIVE FAULTS: CYL = xxx HD = xx SEC = xx
B7	UNKNOWN STATUS:(xx): CYL = xxx HD = xx SEC = xx
B8	Bad status returned after request for retry count.
B9	SOFT FORMAT ERROR: CYL = xxx HD = xx SEC = xx
BA	Bad Status returned after request for ECC count.
BB	SOFT ECC ERROR: CYL = xxx HD = xx SEC = xx
BC	CORRECTED ECC ERROR: CYL = xxx HD = xx SEC = xx

SERIAL PORT LOOPBACK

OPERATION

A loopback connector must be installed before running the diagnostic. Once running, the diagnostic must be allowed to finish. Attempting to exit by pressing CANCEL or GO TO or by removing the loopback connector will cause the serial port to hang. This condition can be cleared by turning the ac power switch OFF then ON again .

Continuing the diagnostic with some fatal errors will cause more errors. Under these conditions a RESTART is required. Use the error loop or scope loop functions to debug the first error detected.

Tests in Diagnostic:

Test No.	Name
01	Loopback Detect and Control Check
02	Interrupt Check
03	Multi-Baud and Parity Data Loopback

ERROR CODES

In most cases the FRU will be the 9221/9521 PCS CPU board or the loopback connector.

WANGNET LIO

OPERATION

Customer Mode

Tests are selected via test-table selections. Only three tests are performed: On-Board PROM Checksum, RAM Test, and Interrupt Level Test. If an error is detected, the FRU is displayed on the screen.

Diagnostic Mode

The operator may select tests which require only one board (OB PROM, RAM, Interrupt) or the Two Boards Communication Test Once tests have been selected, they will run until CANCEL is pressed.

Run-In Mode

Runs all non-operator intervention tests once for each board selected. Runs the Two Board Communications test continuously on all boards selected. If the COPY key is pressed all tests are run continuously.

Repair Aids Mode

The operator may select each test individually. Select the desired tests from the menu.

NOTES: The boards under test must be located in slot pairs 2 & 3, 4 & 5, 6 & 7 etc. for each testing mode except Repair Aids. In Repair Aids mode the operator selects the test board slot and the reference slot.

Tests in Diagnostic:

Test No.	Name
01	RAM Test
02	Interrupt Level Test
03	Two Boards Communications Test
04	On-Board PROM Checksum Test
05	Toggle Switch Test
06	Board ID Switch Test

Diagnostic Tests/Error Information:

Error Code	FRU
0001	LIO/PC Wangnet Card; Cable
0002	LIO/PC Wangnet Card; Cable
0003	LIO/PC Wangnet Card; Cable
0004	LIO/PC Wangnet Card; Cable
0005	Cable; LIO/PC Wangnet Card
0006	LIO/PC Wangnet Card; Cable
0007	LIO/PC Wangnet Card
0008	LIO/PC Wangnet Card; Cable
0009	LIO/PC Wangnet Card; Cable
000A	LIO/PC Wangnet Card; Cable
000B	LIO/PC Wangnet Card; Cable
000C	LIO/PC Wangnet Card; Cable
000D	LIO/PC Wangnet Card; Cable
000E	LIO/PC Wangnet Card; Cable
000F	PROM; LIO/PC Wangnet Card
0010	PROM; LIO/PC Wangnet Card
0011	PROM; LIO/PC Wangnet Card
0012	PROM; LIO/PC Wangnet Card
0013	PROM; LIO/PC Wangnet Card
0014	LIO/PC Wangnet Card; Cable
0015	LIO/PC Wangnet Card; Cable
0016	LIO/PC Wangnet Card; Cable

CP/M-80 OPTION

OPERATION

No operator intervention is required unless an error is reported.

Tests in Diagnostic:

Test No.	Name
01	8086 Segment Map/ Addressability Test
02	8086 Main Memory Test a: Word Test
03	Good Parity Generation Test
04	Bad Parity Generation Test
05	DMA Write Test/ DMA Read Test
06	Primary Interface Test
07	Interrupt Source Test
08	Interrupt Level Test
09	Refresh Test (BUSRQ)
10	Z-80 Main Memory Test
11	CTC Address Line Test
12	CTC Timer/Down Counter Test
13	CTC Priority Interrupt Test
14	Memory Contention Test
15	Mutual Addressing Test

ERROR CODES

On error, the FRU is identified on the Test Display Console (TDC).

OPERATION

Customer and Diagnostic Modes

The diagnostic will prompt the operator to place the RS-232 loopback connector (P/N 420-1040) on each port at the proper time. The port under test will be displayed on the Test Console Unit (TDC).

Repair Aid and Run-In Modes

Three special loopback connectors are must be installed prior to running the diagnostic. Build instructions for the loopback connectors are given below. The prewired DB-25P Male Plug assembly part number is 421-0025. The port under test will be displayed on the Test Console Unit (TDC).

Parts: 3 - DB-25P Male Plugs (P/N 350-1030)
Wire to connect pins

Connect wires	From (Pin #)	To (Pin #)
	2	3
	4	5
	6	8
	6	20
	5	22
	11	15
	15	17
	11	12

Tests in Diagnostic:

Test No.	Name
01	Card Initialization Tests
02	SIO/DART Data Bus Test
03	Chip Addressing Test

Tests in Diagnostic:(continued)

Test No.	Name
04	Channel Initialization Test
05	Request To Send (RTS) Tests
06	Data Terminal Ready (DTR) Tests
07	Wait/Ready Tests
08	Asynchronous Transmit/Receive Tests
09	Bisynchonous and NRZI Tests
0A	TBE and 8086 Interrupt Tests
0B	External Status Change Interrupt Test
0C	Receive Character Interrupt Test
0D	Special Receive Condition Interrupt
0E	External DART/SIO Reset Test

ERROR CODES

On error, the FRU (MCC Card or Loopback Connector) is identified on the Test Display Console (TDC).

REMOTE TELECOMMUNICATIONS CONTROLLER

OPERATION

The operator selects tests to be run via the Main Diagnostic Menu. Loopback connectors are required. The type and part number for each loopback connector follows:

Type	Part Number
RS-232-C	420-1040
ACU	420-1104
X.21	421-0010

Tests in Diagnostic:

Test No.	Name
PROM Resident Built-In-Test	
01	RAMA
02	RAMC
03	CTC1
04	CTC2
05	CTC3
06	SIO
07	DMA
08	DMAM
09	LINKTEST
Downloaded Tests	
81	SIO Internal Loopback Test
82	SIO External Loopback Test
84	External Control Signals Test
85	ACU Loopback Tests
86	DMA Address Lines Test
87	Ctrl Char. Recognition RAM Tst
88	DMA/SIO Loopback Test
89	DMA Memory-to-memory Test
8C	User Option Switch Test

Tests performed directly by the PCDS monitor

01	PC/RTC Interface Reg. Test
02	PC/RTC Interrupt Signals Test
03	PC/RTC DMA Data Path Test
8B	RTC PROM/RAM Decoder Test

ERROR CODES

Error handling depends on the mode of testing being used.

Customer Mode - testing stops and the FRU is displayed on the screen.

Run-In Mode - the error is noted in the 'Error Count' field and the program continues to the next test. After all tests have been performed and any errors noted, the Pass Count is incremented and the diagnostic is repeated.

Diagnostic and Repair Modes - the diagnostic stops and the FRU is displayed.

ERROR INTERPRETATION FOR B.I.T.

No.	Test	Code	Translation
PROM	CKSM	00	RTC Status remains 00 if this test fails.
1	RAMA	01	Missing Power or Data Line Stuck Test failed.
		02	Quick check of the Parity Logic failed.
		03	Erroneous NMI during the Shorted Address Test.
		04	Data error during the Shorted Address Test.
		05	Address error during the Shorted Address Test.
		06	Open Address Line Test failed.
		07	Data error during the Address MUX Test.
		08	Address error during the Address MUX Test.

No.	Test	Code	Translation
2	RAMC	09	Error during the Marching Inversions Test.
		0A	Bad RAM Parity Chip.
		0B	Forced Bad Parity failed to generate an NMI.
		0F	Parity NMI during RAMATEST.
3	CTC1	11	CTC 1 failed the Channel Address Line Test.
		12	CTC 2 failed the Channel Address Line Test.
4	CTC2	15	CTC 1 failed the CTC Timer Interrupt Test.
		16	CTC 2 failed the CTC Timer Interrupt Test.
		17	CTC 1 Interrupt Vector equals hex FF.
		18	CTC 2 Interrupt Vector equals hex FF.
5	CTC3	19	CTC 1 failed the Interrupt Priority Test.
		1A	CTC 2 failed the Interrupt Priority Test.
		1B	CTC 1 failed the Extended Timer Trigger Test.
6	S10	21	Hunt Bit failed to set (Sync Mode).
		22	Not receiving Sync Characters (Sync Mode).
		23	Not sending Sync Characters (Sync Mode).
		24	Not sending Data Characters (Sync Mode).
		25	Not receiving Data Characters (Sync Mode).
		26	Sync Tx and Rx Data do not compare.
		27	Async Tx and Rx Data do not compare.

No.	Test	Code	Translation
7	DMA	31	DMA Temporary Register failed to clear.
(Registers)		32	Word Count or Current Address Register Test failed.
		33	Channel Selection Test failed.
		34	Low Order Address Test failed.
		35	DMA wrote to the wrong RAM address.
		36	High Order Address Test failed.
8	DMA	37	Data error after DMA Memory to Memory Transfer.
(Mem/Mem)		38	T.C. (Transfer Complete Flag failed to set
		39	DMA Status Register failed to clear after being read.
		3A	DMA Status Register failed to clear from Reset.
		3B	DACK 2 + EOP failed to decrement CTC 1, Channel 2.
		3C	Parity NMI during Memory read. Suspect DMA Write.
LINKTEST			To enter this test, the CPU must Reset, the RTC, send a hex A5 to the Outbound Status Register, and wait for the RTC to transfer control to a Prom resident routine, called the LINKTEST.
		A5	RTC has entered Task 1, and is ready to echo bytes.
		F0	RTC is ready to do Task 2 of the LINKTEST.
		F1	86INT Test passed.
		F2	Outbound Buffer Ful Flag Interrupt Test passed.

F3	Inbound Buffer Empty Flag Interrupt Test passed. Ready for the Outbound DMA data transfer.
F4	Outbound DMA data transfer completed.
F6	Inbound DMA data transfer completed.
F7	Outbound DMA has completed, but data was incorrect.

ERROR INTERPRETATION FOR PC/RTC INTERFACE TESTS

No.	Test	Code	Translation
1	01	81	Could not find RTC devide ID.
	02	82	RTC Interrupt Request was not cleared by Reset.
	03	83	RTC Status was not cleared by Reset.
	04	84	RTC Status was not A5 after Reset and Power up Test.
	05	85	RTC Status was still 00 after Reset and Power Up Test.
	06	86	RTC Status Registers did not echo data correctly.
	07	87	Outbound Data Buffer Empty Flag did not set as expected.
	08	88	Inbound Data Buffer Full Flag did not set as expected.
	09	89	RTC data Buffer (low byte) did not echo data correctly.
	0A	8A	RTC Data Buffer (high byte) did not echo data correctly.
	0B	8B	Inbound Data Buffer Full Flag did not reset as expected.
2	0C	8C	RTC Status was not FO after Interface Test.
	OD	8D	Timeout occurred before RTC acknowledged 861NT.
	OE	8E	Timeout occurred before Outbound Buffer Empty Interrupt.

No.	Test	Code	Translation
	OF	8F	Timeout occurred before Inbound Buffer Full Interrupt.
3	10	90	Outbound DMA failed to complete.
	11	92	Timeout occurred before RTC requested an interrupt.
	12	93	RTC Status was incorrect after Inbound DMA
	13	91	Outbound DMA completed, but the data was incorrect.
	14	94	Inbound DMA completed, but the data was incorrect.
	15	95	PC and RTC not synchronized.
8B		96	RTC failed to enter the PCIPC Code.

ERROR INTERPRETATION FOR DOWNLOADED CODE

No.	Test	Code	Translation
81		51	Failed S10 Internal Loop back Test (Sync Mode).
		52	Failed S10 Internal Loop back Test (ASync Mode).
82		53	Failed S10 External Loop back Test (Sync Mode).
83		54	Failed S10 External Loop back Test (ASync Mode).
84		58	DCD (Data Carrier Detect) loop back failed.
		59	CTS (Clear to Send) loop back failed.
85		56	Failed ACU Zeroes Test.
		57	Failed ACU Bit Slide Test.
86		25	Not receiving Data Characters.
		61	No DMA Transfer Complete Status.

No. Test	Code	Translation
	62	Failed DMA Address Test.
87	63	Erroneously recognized Control Character (CCRR).
	64	Failed to recognize Control Character (CCRR).
88	65	Transfer Complete failed (DMA/S10 Loop back).
	66	Transferred Data Was incorrect (DMA/S10 Loop back.)
89	71	Temporary Register failed to clear.
	72	Current Address and Word Count Register test failed.
	73	Selected wrong DMA Channel.
	74	Address error (Low byte).
	75	Address error.
	76	Address error (High byte).
	77	Data error during DMA Transfer.
	78	T.C. (Transfer Complete) Flag failed to set.
	79	DMA Status Register failed to clear after a read.
	7A	DMA Status Register failed to clear from Reset.
	7B	DACK2 + EOP failed to decrement CTC 1, Channel 2.
	7C	Parity NMI during Memory read. Suspect DMA Write.
	7D	Operator did not select an error handling option.
	7F	Parity NMI occurred during user program.

MEDIUM RESOLUTION MONITOR ALIGNMENT

OPERATION

This diagnostic requires minimum operator intervention. Press any key except CANCEL to move from one alignment screen to another. Pressing CANCEL will end the diagnostic.

Tests in Diagnostic:

The diagnostic consists of five screens, a heading screen and four alignment screens.

Heading Screen - displays the test name, release number, release date and instructions on how to run the alignment sequence.

Inverse Video Screen - displays an eight inch by six inch inverse video pattern.

Monitor Alignment Screen (Boxes) - a pattern consisting of an eight inch by six inch rectangle with five, two inch boxes arranged inside is displayed. Two lines, one horizontal and one vertical are placed on each of the boxes. Four lines of HOHO characters are centered within each of the five boxes. The lines of HOHO characters in the center box are alternating normal and bold face type.

Monitor Alignment Screen (Circles) - the pattern is similar to the one above with the exception of using circles instead of boxes.

Grid Pattern Screen - a grid consisting of 17 vertical lines spaced one-half inch apart and 13 horizontal lines also spaced one-half inch apart is displayed.

INTERCONNECT CONTROLLER

OPERATION

Repair and Diagnostic Modes

Select the desired mode. Select the PC Interconnect Card. Follow prompts displayed on the TDC. In the two board test, the second board is considered the reference and is expected to be a known good board.

NOTE: The first test in the RAM test is of the COM 9026 status, which is written into the RAM. This does not indicate if the RAM or the COM 9026 was at fault. To gain RAM Data test information, key the 'Resume From Error' function key to step past the COM 9026 status check error.

Run-In Mode

Load the Interconnect cards into adjacent pairs starting at an even slot (i.e. pair one in slots 2 and 3, pair two in slots 4 and 5).

Connect the outputs of each pair together. Load PCDS. Select Run-In mode and Select by option. Select all option cards to be run in.

Tests in Diagnostic:

Test No.	Name
01	Memory Test
02	Interrupt Level Test
03	Two Board Communication Test

ERROR MESSAGES

Message	Meaning
Board missing	Board with ID 30h in the selected slot is not found.

ERROR MESSAGES (Continued)

Message	Meaning
Reset circuit of board is not working.	Option board reset status bit not reset after reset command.
COM error,9026 did not respond to an access	Logic indicating possible wait state may be 9026 malfunctioning or incoming data are active causing 9026 to take longer than 2 microseconds to respond to an I/O access.
COM error, ETS1 not set	ETS1 (Extended Timeout Status 1) should reflect logic value of pin 3 on the COM 9026.
Reconfiguration Error (check cable)	Reconfiguration timeout indicates RX output was idle for 78.2 microseconds.
Bad COM status	Status returned not the status expected (C1h, mask RECON and TMA). Check data displayed instatus table.
Test Board is disabled	Expected 2K buffer, transmission and interrupts enabled.
Two boards have same ID	Two board communication test reqiures that all boards have unique network IDs. (thumb wheel switches)
Bad COM 9026 status in RAM buffer location 0	Location 0 on successful completion of the internal power-up, the 9026 chip writes D1h in location 0.

ERROR MESSAGES (Continued)

Message	Meaning
Bad COM 9026 status in RAM buffer location 1	Location 1 on successful completion of the internal power-up, the 9026 chip reads network ID switch and writes in location 1.
Memory test failed	Data patterns (0000h, FFFFh, 5555h, AAAAh) written into memory were not equal to the data pattern read from memory.
Address Line Test Failed	Data patterns write into memory was not equal to the data pattern read from memory, refer to RAM test header.
Interrupt Test Failed	Set interrupt level is not equal to the interrupt level read from PIC (Programmable Interrupt Controller).
Test Board Re-configuration	Timeout waiting for reconfiguration complete after transmitter enabled.
Test Board cannot transmit message (TA not TMA)	Reference board did not acknowledge messages sent by test board.
Test Board data transmit error	Data transmitted by test board did not compare with data received by the reference board.
Reference Re-configuration	Timeout waiting for reconfiguration complete after transmitter enabled.
Test Board cannot receive message. (TA not TMA)	Test board did not acknowledge messages sent by reference board.

ERROR MESSAGES (Continued)

Reference Board data receive error	Data transmitted from the reference board did not compare with data received by the test board

TEXT/IMAGE/GRAPHICS CARD MEMORY

OPERATION

Diagnostic/Repair Mode

A dual monitor system is required. Prompts are displayed on the secondary monitor while the primary monitor is being tested.

This mode also contains a utility package for reading or writing to the GDCs (Graphics Display Console) , initializing the GDCs and reading or writing to the ports on the PIC.
To enter the utilities option, press the MOVE key before running the diagnostic

Diagnostic Tests/Error Information:

Test No.	Name	Error Description or FRU
00	Find Slot	No Board (ID not found)
01	GDC Initiate	Char. GDC will not initialize
02	Vert. Sync.	Vert. Sync. not active
03	Char. Memory	Character Memory Error
04	Font Memory	Font Memory Error
05	GGDC Initiate	Graph. GDC will not initiate
06	Graph. Memory	Graphics Memory Error

PIC TEXT/IMAGE/GRAPHICS ATTRIBUTES

OPERATION

Customer Mode

Minimal operator intervention required. The Attribute Table Test will not run in this mode.

Run-In Mode

All tests proceed automatically one after another until the loop is stopped. The Special 4 Level Video Test will not run in this mode.

Diagnostic/Repair Mode

All tests can be run in this mode. If COPY is pressed before testing begins, the first two tests (Hardware Attributes and Attribute Table) are skipped. During alignments, press the EXECUTE key to progress from one screen to another.

If running the Attribute Table Test in Run-In, Diagnostic or Repair modes, the operator selects the special functions desired. These special functions are listed below.

Key	Function
INDENT	Loops on one attribute in table until reset
CENTER	Loops on displayed screen until reset
DECTAB	Loops on high resolution monitor attributes test
REPLC	Toggles between manual and automatic testing
MOVE	Moves to the next screen
STOP	Pauses the test until reset

Tests in Diagnostic:

Test No.	Name
01	Hardware Attribute Test
02	Attribute Test Table
03	Inverse Video Test
04	Monitor Alignment (Boxes)
05	Monitor Alignment (Circles)
06	Grid Pattern Test
*	Special 4 level Video Test

* this test may be used at any time and does not require a number.

PRINTER/SCANNER INTERFACE

OPERATION

Testing is automatic in Customer or Run-In Modes. Operator intervention consisting of test selection and manual hardware checks is required in Diagnostic mode.

Tests in Diagnostic:

10.1 Printer/Scanner Interface Tests

- UART Tests
- Camera Tests
- Printer Tests

10.2 Scanner Tests

- Scanner Select Tests
- Scanner Command Tests
- Scanner Download Tests

10.3 Printer Tests

- Printer Select Tests

ERROR INFORMATION

NO.	TEST NAME	CODE	FRU or DESCRIPTION
10.1 PRINTER/SCANNER INTERFACE			
001	UART	00	UART Xmitter Never Empty
001	UART	01	Characters not received
001	UART	02	UART Parity Error
001	UART	03	UART Framing Error
001	UART	04	UART Overrun Error
001	UART	05	UART Xmit - Receive Error

NO.	TEST NAME	CODE	FRU or DESCRIPTION
001	UART	06	UART Overrun was not Generated
002	Camera	07	Bad Camera Verify
003	Printer	08	Bad Printer Verify
002	Camera	09	Camera Locked in Diagnostic Mode
003	Printer	0A	Printer Locked in Diagnostic Mode
002	Camera	0B	Camera D.M.A. Bad
003	Printer	0C	Printer D.M.A. Bad

10.2 SCANNER DIAGNOSTIC

001	All Tests	Receive Time Out Error
001	Select	Camera Not Attached
001	Select	320 Checksum Error
001	Select	320 CPU Failed
001	Select	Z8 Checksum Error
001	Select	Z8 CPU Failure
001	Select	Home Sensor Failure
001	Select	Illegal Command
002	Command	Scanner Command Loop Error
003	DWN/UP Load	Down Load Ack Error
003	DWN/UP Load	Data Ack Error
003	DWN/UP Load	Data Error
003	DWN/UP Load	Upload Ack Error
003	DWN/UP Load	Receive Time Out Error

10.3 PRINTER DIAGNOSTIC

001	Select	Printer Not Responding
001	Select	Printer De-Selected
001	Select	Printer Status Error
	Printing	No Errors To Detect

IBM COLOR EMULATOR CARD

OPERATION

The diagnostic diskette must remain in the drive while this diagnostic runs.

Operator intervention is required only for the Color Video Displays routine. There is a total of 18 screens, each requiring visual verification. The method for advancing to the next screen varies with the diagnostic mode selected as described below.

Diagnostic and Repair Aids Modes

Press the MOVE key.

While the program is waiting, press the SRCH key. This toggles the 'Pass-Through bit, switching the display between video generated on the IBM Color Emulator Card and the video coming into the external video connector. If the PC contains a Wang Low Resolution Color Card connected to the IBM card with a 'Pass-Through' cable, the PCDS screen will be displayed.

Run-In Mode

The screens advance automatically. Press the STOP key to pause the diagnostic.

Customer Mode

Press the EXEC key. A screen will be displayed telling the operator what to expect from the diagnostic. Only 15 of the 18 screens are displayed since three are alignment screens and do not pertain to the customer.

Tests in Diagnostic:

Test No.	Name
01	Frame Memory Test
02	Font Memory Test
03	Auxiliary Memory Test
04	EPROM Checksum Verification
05	I/O Trap - Status Test
06	I/O Trap - Read/Address Test
07	I/O Trap - Write Data Test
08	Interrupt Timing Test
09	Color Video Displays

8087 CO-MATH PROCESSOR

OPERATION

This diagnostic runs without operator intervention.

Tests in Diagnostic:

Test No.	Name
01	8087 Present Test
02	8087 Memory Access Test
03	8087 Interrupt Test
04	8087 Math Function Test

ERROR CODES

Code	FRU
0001	8087 (L40 - PC CPU PCA), PC CPU PCA
0002	8087 (L40 - PC CPU PCA), PC CPU PCA
0003	8087 (L40 - PC CPU PCA), PC CPU PCA
0004	8087 (L40 - PC CPU PCA), PC CPU PCA
0005	8087 (L40 - PC CPU PCA), PC CPU PCA
0006	8087 (L40 - PC CPU PCA), PC CPU PCA

PROGRAMMABLE SIGNAL PROCESSOR

OPERATION

Diagnostic and Repair Aids Modes

The diagnostic will display a prompt which allows the operator to set-up the TMS-320 emulator. If the TMS-320 emulator is not being used, press EXEC.

Customer and Run-In Modes

The diagnostic will run without customer intervention.

Tests in Diagnostic:

Test No.	Name
01	Control Port Test
02	Shared Memory Test
03	DMA Port Test
04	Initialize 8089 Test
05	SPC 8089 Port Test
06	8089 Read/Write Buffer Test
07	Parallel to Serial Test
08	Host 8089 DMA Test
09	CODEC Only Loopback Test
0A	CODEC with 8089 Loopback Test

ERROR CODES

Any error implies that the Programmable Signal Processor (PSP) card should be replaced.

Code	Description
01	Rd Dev ID numbers. PSP Card not found.
02	PSP Control Port is not ready to write to.
03	PSP Control Port is not ready to read from.

Code	Description
04	PSP Control Port did not send back the correct data.
05	PSP board failed its memory test. The PSP is now looping on the memory test.
06	PSP board did not receive DMA data.
07	PSP board did not send DMA data.
08	PSP DMA port did not send back the correct data.
09	PSP board is not ready to download tests.
0A	8089 did not initialize.
0B	8089 Channel 2 did not send correct data to the TMS-320.
0C	8089 Channel 2 did not receive correct data from the TMS-320.
0D	Parallel to Serial Port received incorrect data.
0E	CODEC chip did not initialize or loopback data.
0F	Failed 8089 read/write buffer test.
10	Did not receive correct data from the read/write buffer that was read from CODEC.
11	PSP board did not respond to test.

PM-012 DAISY PRINTER

OPERATION

The operator controls the diagnostic and receives information from the diagnostic at the TDC. The operator also receives printouts from the attached printer. These printouts must be interpreted by the operator to determine if the printer is functioning properly.

Tests in Diagnostic:

Test No.	Name
Mechanical Adjustment Tests	
01	Platten Height Test
02	Underscore Test
03	Ribbon Advancement Test
04	Ribbon Adjustmemt Test
05	Hammer Impact Test
06	Standard Document Test Page
Print Exerciser Tests	
07	Overstrike Test
08	Character Set Test
09	Line Buffer Test
10	Worst Case Pattern Test
11	Carriage Motion Data Test
12	Vertical Movement Test
13	Paper Tension Test
14	Tabs Test
15	Graphics Test

ERROR CODES

Code	FRU
0001	EPCI, Printer
0002	EPCI, Printer
0003	EPCI, Printer
0004	EPCI, Printer
0005	EPCI, Printer
0006	EPCI, Printer

For any other printer errors, the printouts must be interpreted.

PC DIAGNOSTICS OPTIONS INSTALL UTILITY

LOAD PROCEDURE

This program will autosize the PC and copy PC option diagnostics from the Diagnostic Options Diskette to the PC System Diagnostics Diskette.

Bring up the PC from the operating system (MSDOS) to the main menu. Press the space bar to move the acceptance block next to OTHER. Press the EXECUTE key. The following line appears on the screen:

File Spec:

Insert the Diagnostics Option Diskette into drive A and the close the door.

Type - A:PCDSINST.COM, Press EXECUTE. The screen displays a list of Wang PC option diagnostic test programs that are on the Diagnostic Options Diskette.

OPERATION

View the initial screen for content and instructions. Press CANCEL to terminate the program; press EXECUTE to display the CARD SELECTION menu.

Use the INSERT key to select Card Selections, DELETE to deselect Card Selections, SPACEBAR to move the cursor ahead one position, and BACKSPACE to move the cursor back one space.

Press EXECUTE when all selections have been made. Follow system prompts to finish routine. A log will be displayed when copying is complete.

APPENDIX A
PART NUMBERS AND REVISION HISTORIES

PCDS

Software Part Number: 732-0022F/732-8015
Documentation Part Number: 760-0001E
Package Part Number: 195-2459-9
Revision History:

2311 - First Release

238A - diagnostics were changed and added.

2423 - new features added, diagnostics changed and added.

2500 - new features added.

2520 - PCDS divided into two diskettes.

MAIN MEMORY

Documentation Part Number: 760-1035-A
Revision History:

1311 - First Release

MINI FLOPPY

Documentation Part Number: 760-1036-B
Revision History:

12C4 - First Release

1374 - Added test for door disturb switch. Added test to prevent writing on the PCDS diskette. Errors are entered into the error log. Descriptions of FDC status bits are included in this documemt.

1384 - Corrected problem with PCDS diskette being destroyed if door left open for any length of time. Turn off drive LED when asking operator to change diskette. Corrected problem that verify Ready mode can be entered from Customer Mode by typing A, RETURN, EXECUTE.

KEYBOARD

Documentation Part Number: 760-1034-A
Revision History:

12CO - First Release

1334 - The program was made more compatible with a new version of PCDS. No functions were changed that a user would notice.

MEMORY EXPANSION

Software Part Number: not available
Documentation Part Number: 760-1150-B
Revision History:

1330 - First Prerelease

133C - First Release

1355 - The program now recognizes the Wang monitor graphics card as a valid video output device. The 5 second pause period prior to the start of the MACHO test has been eliminated in customer mode. The full screen MACHO display has been eliminated in customer mode. The program stops on error in all tests while in customer mode. PCDS selects which expansion memory cards are tested in customer mode.

13C6 - Previous releases of this diagnostic only supported 5 option slots. The full screen display used during the RAM test (MACHO screen) has been removed from this release. An additional Repair-Aid has been added to assist in troubleshooting I/O problems. User messages have been modified to meet international specifications. No DMA activity is tested.

14B4 - Code was modified to run on the 1 meg CPU board and a wait message was displayed during the RAM test.

LOCAL COMMUNICATIONS OPTION

Documentation Part Number: 760-1151-B
Revision History:

1360 - First Release

13B4 - Enhanced Memory Contention Test added replacing the Main & CRT Memory Contention Tests. Main & CRT Memory Mutual Addr. Tests rewritten. Z-80 Code Check Routine added. CTC Interrupt Channel Test added. Modified to prevent enabling Data Link on Tempest units. Message formats changed to conform to standards for International. Known bugs fixed.

1498 - Modified to work in PC with 1 meg. CPU board. Modified to run on either 1 or 2 board LCOs. Modified to run on military LCOs. Changed Memory Contention Test to prevent enabling Data Link in CUSTOMER MODE or RUN-IN MODE or of toggle switch = LOCAL.

STANDARD MEMORY MONITOR

Documentation Part Number: 760-1148-A
Revision History:

1320 - First Release

1421 - Convert messages to International format. Memory disabled to help PCDS.

STANDARD MONITOR CONTROLLER ATTRIBUTES

Documentation Part Number: 760-1155-A
Revision History:

1330 - First Release

1380 - Software change on change/mix colors to display HOHO test on full (80x25) character screen. Add extra time delay between color changes.

1495 - Software update to enable execution of diagnostic on a two card system. Software enhancements to display individual test procedure messages on single card systems and change/mix colors to display color bar chart of the sixteen color pallette. Software change to video I/O procedure to enable output of 40 column screen mode. Conversion of diagnostic messages to International format.

WANG MONITOR MEMORY

Documentation Part Number: 760-1032-B
Revision History:

12C0 - First Release

12C4 - Modifications included the omission of the memory select/de-select test, and ability to run board repair routines without another video device.

1321 - Internal modifications for compatibility with the new PCDS. No differences relative to revision 12C4 are noticable to the user.

WANG MONITOR ATTRIBUTES

Documentation Part Number: 760-1031-A
Revision History:

12C0 - First Release

12C4 - Modifications to the Customer screen to make them more understandable. Diagnostic mode was modified to add a row of column numbers and row numbers on the last five lines of the display.

1321 - Internal modifications for compatibility with the new PCDS. No differences relative to revision 12C4 are noticable to the user.

GRAPHICS MEMORY

Documentation Part Number: 760-1147-A
Revision History:

1320 - First Release

14A6 - Conversion of diagnostic messages to International format.

WINCHESTER CONTROLLER

Documentation Part Number: 760-1153-B
Revision History:

1342 - Sequential Reads Test modified to use the FAT table so that bad sectors are not accessed.

1346 - First Prerelease

1347 - First version with Repair Aids added. Detailed error message displayed on the FRU line when in RUN-IN mode.

1350 - Second version of Repair Aids with DMA routine.

1352 - The following bugs fixed: Disable system retries during Seek Tests, Program name not re-written with loop on program, Default to drive present in RUN-IN mode. Enhancememts made: Report soft and corrected ECC errors, Report soft format errors, Repair Aids 'Loop on Disk' command and 'Do disk command once' feature now supports read, write, up-load and down-load commands using DMA.

1357 - Make the 'list of test' menu unique only to DIAGNOSTIC MODE. Fix bug in Sequential Reads Test so that media defects in FAT table are correctly interpreted.

1360 - Fix bugs in DIAGNOSTIC MODE so that parameters only have to be entered once. Also, added utility to total number of media defects in FAT table. In Sequential Read Test, changed the number of sectors requested on each disk access from 8 to 1 to allow for more precise error reporting on soft errors. Raised the minimum winchester PROM rev. level for which the diagnostic will run to 2.

13B1 - The Initial Controller Test modified to eliminate Time-Out Failures (Error 0B). The results of the Get Drive Size Firmware Command (FC) is displayed briefly in order to let the user verify that the winchester drive is being tested accurately. The Sequential Reads Test modified to allow for accurate testing of 30 meg. winchester drives.

Customer Mode of this test has been modified to test intervals of cylinders to save execution time. The Rotational Speed Test modified to compensate for variations in speeds among the drives allowed on the PC.

1464 - Converted to International format.

13B4 - Increased maximum acceptable rotational speed to 17.45 msec. This enables testing of 10 meg. removable cartridge.

SERIAL PORT LOOPBACK

Documentation Part Number: 760-1146-A
Revision History:

1341 - Changes made to inhibit the display of user messages in Customer Mode. The problem of truncating the rev. number of the program name was remedied.

13C4 - Modified to allow international conversions testing at all possible baud rates with different protocols.

1418 - Modified to run on Tempest PCs.

WANGNET LIO

Documentation Part Number: 760-1332
Revision History:

1527 - First Prerelease

CP/M-80

Documentation Part Number: 760-1152-A
Revision History:

1362 - First Release

1494 - International version of the diagnostic

MULTIPORT COMMUNICATIONS CONTROLLER

Documentation Part Number: 760-1154
Revision History:

1384 - First Release

REMOTE TELECOMMUNICATIONS CONTROLLER

Documentation Part Number: 760-1198-B
Revision History:

1380 - First Release

1381 - Modified for compatibility between the RTC and Winchester Disk diagnostics.

135C - Adheres to the PCDS International Standard and Tempest requirements.

1415 - Features CANCEL from menus.

1454 - Remaned files per PCDS requirement. Added six more special routines. Menu selections are saved.

MEDIUM RESOLUTION MONITOR ALIGNMENT

Documentation Part Number: 760-1195-A
Revision History:

8380 - First Release

1491 - International version of diagnostic.

PC INTERCONNECT CONTROLLER

Documentation Part Number: 760-1306
Revision History:

1430 - First Release

TEXT/IMAGE/GRAPHICS MEMORY

Documentation Part Number: 760-1243
Revision History:

1410 - First Release

PIC TEXT/IMAGE/GRAPHICS ATTRIBUTES

Documentation Part Number: 760-1244-A
Revision History:

1421 - First Release

6454 - International version of the diagnostic.

CAMERA/PRINTER INTERFACE

Documentation Part Number: 760-1246
Revision History:

1410 - First Release

IBM COLOR EMULATOR

Documentation Part Number: 760-1316
Revision History:

14C0 - First Release

8087 MATH CO-PROCESSOR

Documentation Part Number: 760-1315
Revision History:

14B0 - First Release

PROGRAMMABLE SIGNAL PROCESSOR

Documentation Part Number: 760-1314
Revision History:

14B0 - First Release

PM-012 DAISY PRINTER

Documentation Part Number: 760-1317
Revision History:

14B0 - First Release

INSTALL UTILITY

Documentation Part Number: 760-1318
Revision History:

8520 - First Release

APPENDIX B
WINCHESTER CONTROLLER REPAIR AIDS

Repair Aids Menu:

0=Loop on disk command
1=Do disk command once
2=Input wini status
3=Reset wini controller
4=Output wini command port
5=Input wini command port
6=Input wini slot ID port
7=Loop on DMA write
8=Loop on DMA read
9=One DMA write
A=One DMA read
B=Input 8086 port
C=Output 8086 port
D=Set Wini Slot number

RESULTS STRING: 00 00 00 00 00 00 00 00 00

1st byte of command string

Use of repair aids general:

All functions are performed by placing the function number into the first byte of the command string followed by any parameters and then pressing the EXECUTE key.

The functions are of two different types, repeating and the non-repeating. The repeating functions are 0,7,8. Once a repeating function is running it will continue indefinitely until either the diagnostic is exited or the MOVE key is pressed. Pressing the MOVE key will allow continued use of the repair aids.

All the remaining functions are non-repeating. They perform their specified function once and then return to wait for another command. Their primary importance is that they return specific information.

Function 0 Loop on disk command

This function will continuously execute any disk command supported by the BIOS. Put the function number into the first byte of the command string and fill the last 8 bytes per Winchester Control Block specification.

The data entered into the command string is copied into the results string when the function is terminated.

Function 1 Do disk command once

This function is similar to function 0 except that it is performed only once and the results string returned by the Winchester is displayed.

Function 2 Input Wini Status

This function returns Winchester status in the second byte of the results string.

Function 3 Reset Winchester Controller

This function performs the appropriate I/O instructions to reset the winchester the controller.

Function 4 Output wini command port

This function performs the appropriate I/O instructions to output the data contained in byte 2 of the command string to the winchester command register.

Function 5 Input wini command port

This function performs the appropriate I/O instructions to input from the winchester command register and put the data into byte 2 of the results string.

Function 6 Input wini slot ID port

This function performs the appropriate I/O instructions to input from the winchester slot identification port and put the data into byte 2 of the results string.

Function 7 Loop on DMA write

This function is implemented by using the winchester power-up code. The winchester controller is reset and a code is sent instructing the controller to do the interface test. After completing the RAM and CTC test the power-up will send status to the 8086. The 8086 will have been waiting for the status and upon receiving it outputs one byte to the winchester command register to force it out of the I/O test and into the DMA test. A feature of the power-up DMA test is that it can be forced to perform either a DMA read or write on any channel simply by sending the appropriate code to the winchester command register. The repair aids use this feature both for single Beginning of DMA loop:

For this function CPU DMA chip is set up to write 512 bytes to the winchester. A zero is sent to the wini command register causing it to set up for a DMA write from the CPU. The 8086 enters a software timer. When the 8086 exits the timer, repeat DMA loop.

Function 8 Loop on DMA read

This function is performed exactly as the preceding one except that a code of one is sent to the winchester command register to start it running.

Function 9 One DMA write

This function is the same as function 7 except that no looping is done. When the 8086 exits the timer it reads the DMA command register and puts the contents into byte 2 of the results string, and read the DMA byte count register twice to get the full 16 bit byte count and stores it in bytes 4 and 5 of the results string. Then returns to the repair aids menu.

Function A One DMA read

This function is the same as the preceding one.

Function B Input 8086 port

This function does an I/O read of the port supplied in byte 1 and 2 of the command string. It returns the one byte results in byte 3 of the results string.

Function C Output 8086 port

This function does an I/O write to the port supplied in byte 1 and 2 of the command string.

Function D Set Wini slot number

This function sets the value of the Winchester slot number used by the other functions. The slot number is entered in byte 1 of the command string. This function is necessary only if the Initial Test (Test 1) in the previous menu was not run. The Initial Test is where the winchester slot number is automatically found and set. Failure to set the slot number either automatically or manually will results in most of these functions not working.

APPENDIX C
REVISION CODE INTERPRETATION

Diagnostic Revision Codes are broken down into the following format:

TYMR, where T, Y, M, and R each have a significant meaning. (i.e. Rev 5490 would have a T=5, Y=4, M=9, and R=0)

T = the Type of diagnostic material.

Y = the Year the material was released.

M = the Month the material was released.

R = the Reason the material was released.

a) Reason (R) could change for any one of, or combination of the following:

0 - First release
1 - Bug fix
2 - Test addition
4 - Performance enhancement
8 - Related to change in hardware

If there is more than one reason for the change, the R numbers may be added. For instance, if a released diagnostic had a bug fix (R=1), a test added (R=2), and a performance enhancement (R=4), then the overall R value would be 7.

b) The Month (M) can range from 1 to C:

1 - January	5 - May	9 - September
2 - February	6 - June	A - October
3 - March	7 - July	B - November
4 - April	8 - August	C - December

c) The Year, of course, (Y) could have a value from 0 through 9.

d) The Type of material (T) could be any of the following:

0 - Not supported
1 - Diagnostic program
2 - Monitor Package (When the term monitor is used here, it is not in reference to video display tubes. A monitor is a software control module that supervises the execution of a diagnostic program. A package consists of multiple programs that function under the monitor)
3 - Monitor program (Runs under the supervision of a monitor. Routines to control the program's screen and file manipulations, etc. reside within the monitor, as opposed to residing within the program itself.
4 - Burn in test
5 - Power up test/Built in Test
6 - Exerciser test (Designed to simulate the function of an existing system)
7 - Board repair test
8 - Utility program (Programs that perform specific functions and/or provide useful information to user)
9 - Documentation

Example: In September (M=9) of 1984 (Y=4) the 140 Class Master Built in Test (T=5) was modified to support a new series of disk drives (R=8). The new Revision code (TYMR) is 5498.

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