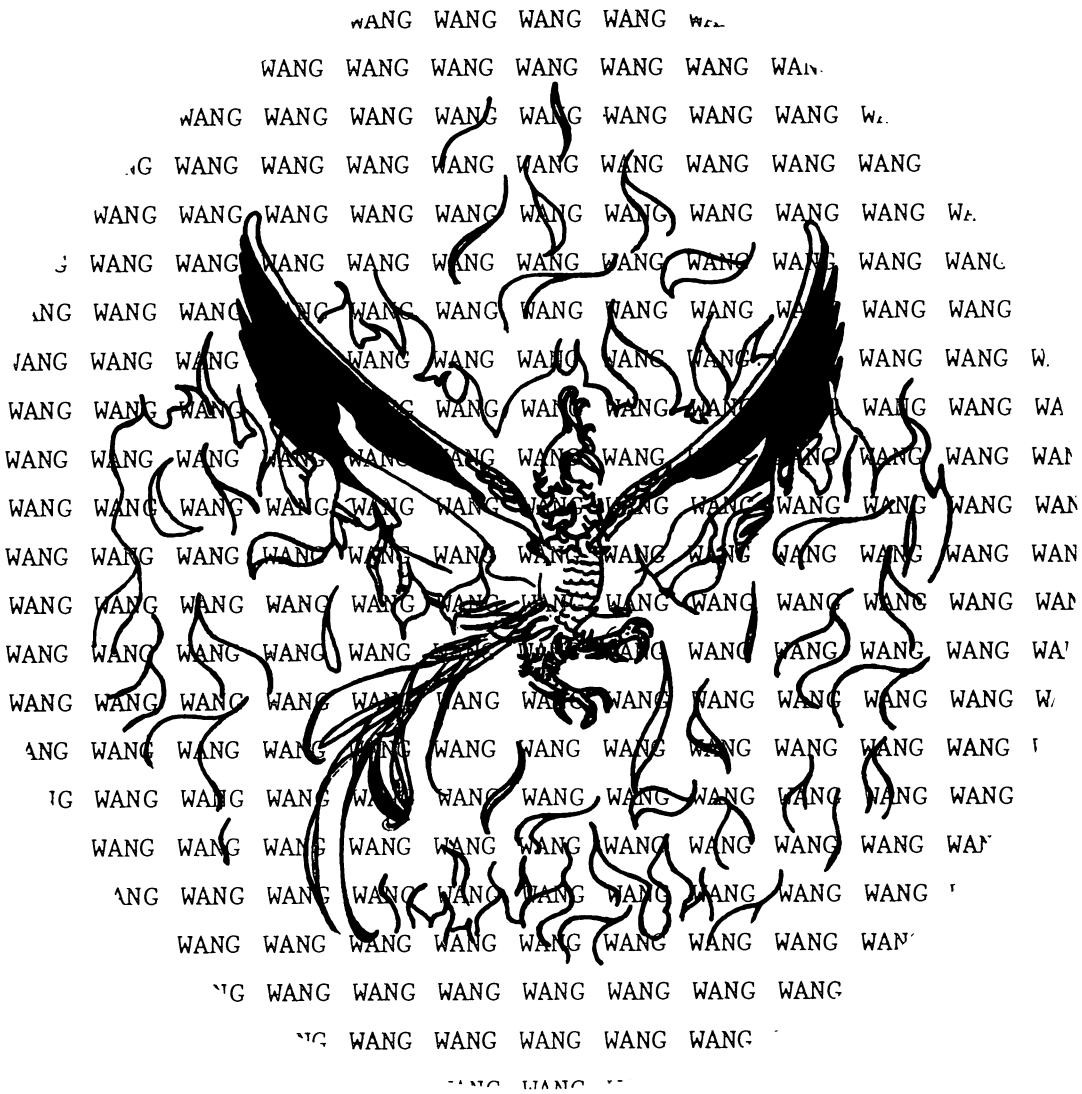
03-0080-A
June 22, 1979

CUSTOMER ENGINEERING DIVISION

WANG CARTRIDGE MODULE DISK DRIVE
CDC MODEL 9448 CMD
(PHOENIX DRIVE)



ADDENDUM ONE

WANG

2280 "PHOENIX" ADDENDUM TO FIELD-LEVEL MAINTENANCE MANUAL 03-0080

GENERAL DESCRIPTION

The newest disk drive, the Model 2280 has been added to the line of Mass Storage Devices that are available for use with the 2200 VP/MVP computer systems. The 2280 "PHOENIX" already exists in the Field-Level Maintenance Manual 03-0080. This addendum deals strictly with the use and operation of the "PHOENIX" drive when installed with the VP/MVP systems.

Unlike other large capacity disk systems where the storage media is only available as either an entire fixed volume or an entire removable cartridge, the 2280 provides a single 13.4 megabyte removable cartridge and 13.4 to 67 megabytes of fixed volume storage which is all within the same drive unit.

The 2280 is available in three models; 2280-1, 2280-2 and 2280-3. The smallest model 2280-1 provides approximately 27 megabytes of storage and the largest model 2280-3 approximately 80.5 megabytes. The 2280 disk controller and microprocessor permits two such drives to be daisy-chained, providing up to 161 megabytes of on-line storage.

PHYSICAL CHARACTERISTICS

The Model 2280 for the VP/MVP 2200 systems is composed of a CDC Phoenix disk drive and a Wang manufactured microprocessor. Both the drive and microprocessor are contained in a single free-standing unit. The drive unit features a hinged front door for easy loading and removal of the one removable cartridge that the drive accomodates. The disk drive units 2280-1,2 and 3 are delivered to the customer with the storage capacity being specified by way of a selection jumper configuration that is located in the disk drive. The jumper configuration is based on the model number.

STORAGE CAPACITY

As previously stated, the number of fixed platters required for each model is as follows:

1. Model 2280-1 utilizes one fixed platter.
2. Model 2280-2 utilizes two fixed platters.
3. Model 2280-3 utililzes three fixed platters.

One surface of the removable platter provided with all three models contains servo information which is used by the disk drive which is not available to the user. The remaining surface of the removable platter is accessible by the user.

The fixed platters are normally referred to as the fixed volume. Regardless of the model, only one surface in the fixed volume is a servo surface and is not accessible by the user. The remaining fixed surfaces (1 for a 2280-1, 3 for a 2280-2 and 5 for 2280-3) are

available to the user. Each usable surface, fixed and removable, has a unique device address in the 2200 system software. The addresses for each surface of each fixed platter and removable platter are arranged in numerical sequence as follows: D10 (D20, D30), D11 (D21, D31), D12 (D22, D32), D13 (D23, D33), D14 (D24, D34) and D15 (D25, D35). The relationship between the usable surfaces along with their addresses and the physical disk platters is shown in TABLE 1.

TABLE 1

CARTRIDGE (Removable)	SERVO
	D10
FIXED PLATTERS	D12
	D13
	SERVO
	D11
	D14
	D15

Each usable surface is divided into 823 concentric recording cylinders (tracks) and every cylinder is subdivided into 64 sectors.

A sector is the smallest addressable unit on the disk platter surface which can store 256 bytes of data. The sectors on each surface are sequentially numbered and individual sectors can be addressed directly.

In addition there are 64 sectors (1 cylinder) reserved on each usable surface for alternate sector addressing.

The exact storage capacities of the three models are shown below:

DISK UNIT	2280-1	2280-2	2280-3
Sectors/surface	52,608	52,608	52,608
Total sectors	105,216	210,432	315,648
Bytes Removable	13,467,648	13,467,648	13,467,648
Bytes Fixed	13,467,648	40,402,944	67,338,240
Total Bytes	26,935,296	53,870,592	80,805,888

PERFORMANCE

Rotation Speed	3600 RPM
Average Access Time (position head to track)	30ms
Latency Time- Average (one-half revolution)	8.33ms @ 3600 RPM
Read/Write Time -One 256 byte sector including CPU/Controller overhead	9.33ms
Move/Copy Time	Approx. 5 min per surface (13.4 Megabytes)

GENERAL SPECIFICATIONS

Physical Dimensions (w/cabinet stand enclosure)

Height	36 inches (91.4 cm)
Width	20.4 inches (51.8 cm)
Depth	32.6 inches (82.8 cm)

Weight 170 lb (77.1kg)

Power Requirements

Voltage	120 or 230 VAC ± 10%, 50 or 60 HZ ± 1 cycle
Current	
Start-up	15 amps (@ 120 VAC)
Running	8.2 amps (@ 120 VAC)

Cabling	10 ft (3m) cable to the disk controller board in CPU. 8 ft (2.5m) cable to power source.
Operating Environment	50 deg. F to 95 deg. F. (10 deg. C to 35 deg. C) (20% to 80% relative humidity)

OPERATING SYSTEM REQUIREMENTS

The following items are the minimum VP/MVP requirements for the installation and operation of the 2280 disk drive.

1a. 2200 VP	Operating Software 2.0	WL #701-2118 J
1b. 2200 MVP	Operating Software 1.7	WL #701-2294 H

2. The VP/MVP Bootstrap Proms (3) must be an R1 version.
   a. WL #378-2045
   b. WL #378-2046
   c. WL #378-2047

3. A single jack Disk Controller modified for MVP use must be used on both VP and MVP systems (P/N 210-6541-2).

4. A dual jack (Printer/Disk) controller may be used if single jack is not available (P/N 210-7042-2). See Figure 2 for details.

NOTE: The 2280 disk drive is not supported on 2200B, C, S or T CPUs or workstations.

Before either the fixed or removable disk volume surfaces can be used to store programs and/or data, each surface must be formatted. WANG provides a utility FORMAT program, for formatting the platter surfaces. This format program resides on the VP/MVP operating system disk of each 2280 disk drive which can be used to FORMAT the disk surfaces.

This utility requests that the operator identify the surface which is to be formatted with its logical address, and then automatically issues the appropriate instruction sequence to certify, format and verify the designated surface. Formatting should be necessary only once for each surface unless the surface begins to produce frequent read/write errors; in this case, reformatting may correct the problem. Reformatting, however, destroys all information previously recorded on the surface.

During the process of formatting, the disk controller writes control information (including sector address and error checking information) onto each disk sector and then fills the 256 byte user data area of the sector with zeroes on the last pass. The disk controller also automatically performs a verification check to insure that the media is suitable for system use. The formatting processes are performed automatically under software control and if any sectors are found bad, the disk controller reassigns the bad sector to another sector in the spare cylinder (822). Sector zero of cylinder 822 contains a map of sectors that have been alternately assigned. When all sectors on the surface are formatted, the surface is ready to store programs and data. An I93 error that occurs during formatting indicates the surface is unacceptable for use because either sector zero of track 822 is bad or more than 2 sectors are bad on cylinder 822.

INSTALLATION PROCEDURE

CONTROLLER - VOLTAGE ADJUSTMENT PROCEDURE

1. Remove top cover of controller.
2. Place L567 circuit board on an extender board (P/N 210-0556). (See figure 1 for location of L567.)
3. Turn Power Supply ON
4. Using a Digital Voltmeter check voltages for specified value(s) between the point indicated and $\pm$0V as listed in Table 2. Adjust L567 labelled trimpots to obtain desired voltage levels only where necessary.

NOTE: Never permit the -15VR power supply to exceed -17VDC, otherwise permanent damage to the controller will result.

5. With an oscilloscope and X1 probe, measure the ripple at the points indicated in Table 2. AC ripple should not exceed the limits specified. If any voltage or ripple measurement is out of specification, troubleshoot the power supply.

6. Turn power OFF, remove extender board and replace the L567 circuit board.

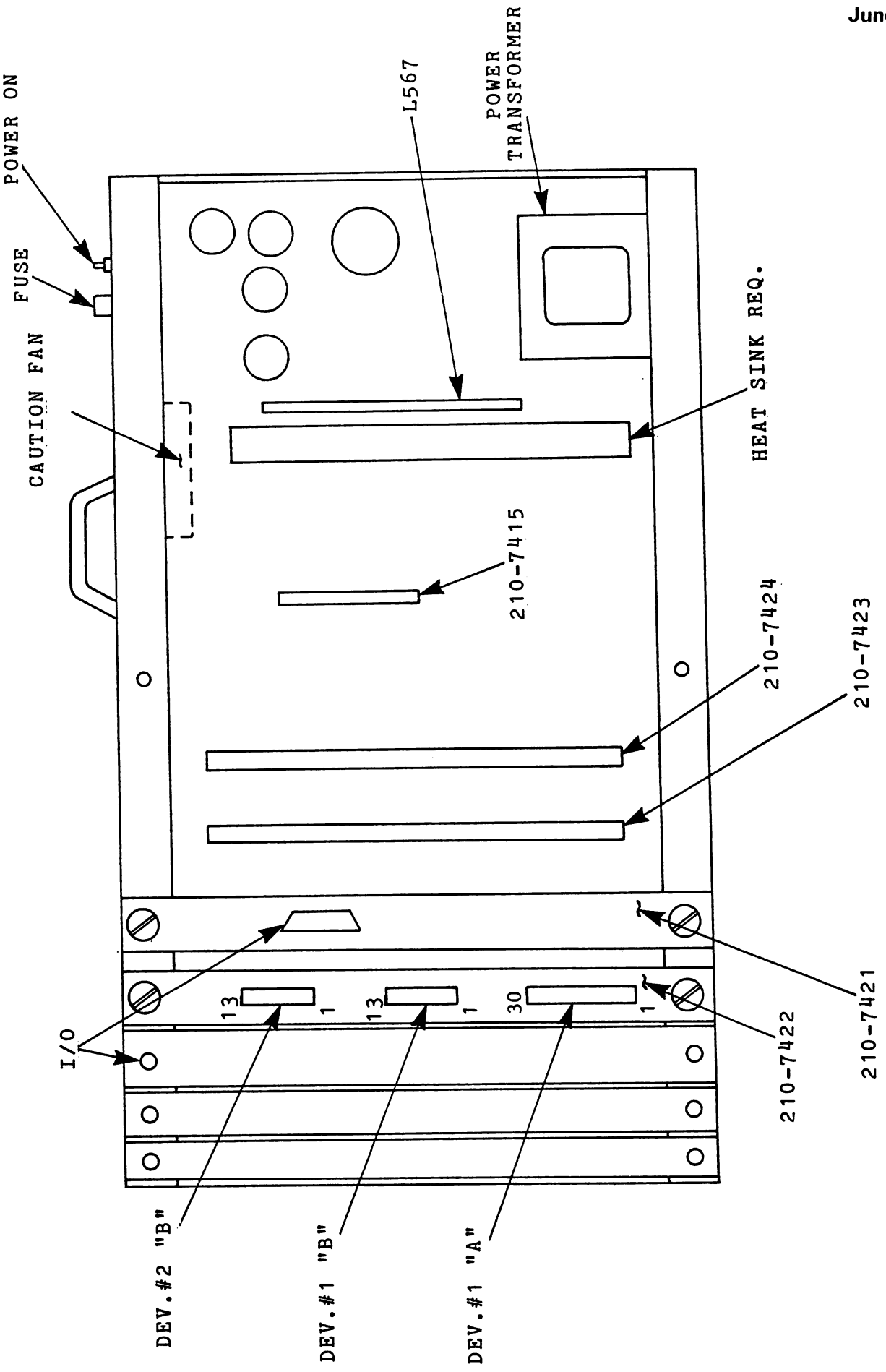


FIGURE 1 2280 MICROPROCESSOR - LAYOUT

TABLE 2

LOCATION	VOLTAGE	LIMITS	ADJ	RIPPLE
L567 Pin 1_1	+5VRM	+4.90 vdc to +5.10 vdc	R17	15mvp-p
L567 Pin 2_1	+5VRL	+4.90 vdc to +5.10 vdc	R2	15mvp-p
L567 Pin 12_1	+8VR	+8.50 vdc to +8.80 vdc	R13	20mvp-p
L567 Pin 15_1	+12VR	+11.80vdc to +12.20vdc	R30	15mvp-p
L567 Pin 5_2	-12VR	-11.80vdc to -12.20vdc	R34	15mvp-p
L567 Pin 6_2	-15VR	-14.80vdc to -15.20vdc	R40	25mvp-p

CABLE CONNECTIONS (See Figure 2)

FROM	TO	CABLE #
Single Drive		
6541-2 (7042-2)	210-7421	220-0138
7422	Drive 1	220-3032 "A" Cable
7422	Drive 1	220-3033-5 "B" Cable
Daisy Chain (Same as above plus the following)		
Drive 1	Drive 2	220-3032 "A" Cable
7422	Drive 2	220-3033-5 "B" Cable

BOARD LAYOUT

Board	Description
210-7421	ALU/MUX
210-7422	Ecc/Disk Interface
210-7423	PROM/RAM
210-7424	Disk I/O Control

DRIVE SET-UP

1. Before appying power, check the Control Mux board in the PHOENIX drive to make sure the drive capacity selected, matches the drive capacity listed on the work order by using Table 3.

TABLE 3

Drive Type	Setting of U33 on Control Mux Board
2280-1	Cut jumper on U33 between pins 6-11
2280-2	Cut jumper on U33 between pins 6-11 and 7-10
2280-3	Cut jumper on U33 between pins 6-11 and 8-9

2. It is also necessary to ensure the system is set up for 64 sectors/cylinder operation. The setting of switch #7 on the Servo Coarse PWA board in slot EM3 of the Electronic Module must be in the OFF position and all others to the ON position.

3. Install a ground strap (WLI #220-1198) at least 18 AWG from the terminal at the rear of the drive marked DC GRD to the 2280 controller ground.

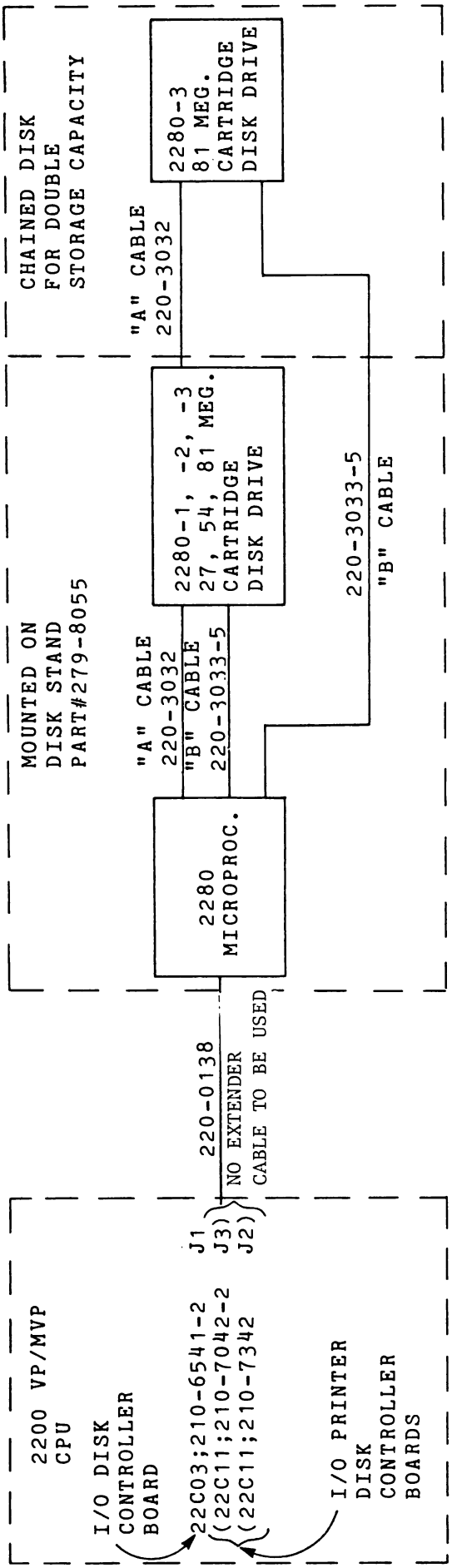


FIGURE 2 - CABLING ARRANGEMENT
FOR 2280 SINGLE AND CHAINED DISK DRIVES

After performing the installation procedure, apply power to the CPU, microprocessor and disk drive. When the door lock solenoid picks, open the cartridge door and insert a CDC 1204 disk cartridge; close the door and press the START switch. The READY light should blink during the start up period until the drive is up to speed. The READY light will remain lit once the drive is ready for operation.

DIAGNOSTICS

A new diagnostic diskette is now available for testing the 2280 drive WL #701-2555 (2280 Field Service Utilities). An additional feature on this diskette is a 2280 Head Alignment Utility which when used with a mini-alignment kit (WLI #726-5611) eliminates the need for a for a CDC Field Test Unit (FTU) TB216. The following is a description of the diagnostic diskette and its operation.

To operate the diagnostics, enter the following:

SELECT DISK (ADDRESS OF DISK WHICH CONTAINS DIAGNOSTICS)(EXECUTE)

LOAD DCT "START" and (EXECUTE)

RUN (EXECUTE)

The following menu should appear on the screen:

```
SF '0---DISK ACCESS TEST
SF '1---RANDOM VERIFY TEST
SF '2---MULTI-SECTOR TEST
SF '3---COPY TEST
SF '4---READ AND WRITE ON ONE SECTOR
SF '5---READ ONE SECTOR
SF '6---RANDOM READ AFTER WRITE (ALL SURFACES)
SF '7---RANDOM READ/WRITE TEST (ONE SURFACE)
SF '8---PHOENIX HEAD ALIGNMENT

:____STOP
```

The following prompts pertain to all the tests except 4,5,8. These tests will be explained later. Depress the appropriate special function key to select the desired test. The following will then appear:

```
        DISK UNIT DIAGNOSTIC SET-UP

WHICH DISK IS TO BE TESTED? 1 4

1.  2270-1                      2.  2270A-1
3.  2270-2                      4.  2270A-2
5.  2270-3                      6.  2270A-3
7.  2230-1                      8.  2230-2 or 2260B/C-1/4
9.  2230-3 or 2260B/C-1/2       10. 2260B/C
11. 2260B/C-2                   12. 2280-1
13. 2280-2                      14. 2280-2
15. Twin 2280-3                 16. 2nd 2280-3
```

Select the type of drive to be tested by entering one of the numbers (1 through 16) and key EXECUTE.

The following will appear:

DISK MODEL: (TYPE OF DISK SELECTED)

HAVE ALL SURFACES BEEN FORMATTED (Y or N)? Y

SURFACE NO.	PLATTER ADDRESS	START SECTOR	END SECTOR
1.	(ADDRESS)	0	52607
2.	(SELECTED)	0	52607
3.		0	52607
4.		0	52607
5.		0	52607
6.		0	52607

Enter Y or N then EXECUTE. The following will appear:

DISK MODEL: (Type of Disk Selected)

WHICH SURFACE IS TO BE CHANGED (CR IF NONE)? ___ ___

At this time if any surface is not to be tested, the surface number (1 through 6) should be entered, then EXECUTE. If all surfaces are to be tested then only EXECUTE should be entered. To eliminate one or more surfaces from being tested, perform the following:

Enter the first surface number not to be tested, then key EXECUTE. The following will appear on the screen:

DISK MODEL: (Type of Drive Selected)

IS THIS SURFACE TO BE TESTED (Y or N)? Y

Enter N then EXECUTE. The Start and End sector numbers should not appear on the screen for the surface(s) not to tested. Continue this procedure until all surfaces not to be tested have been entered.

Tests 4,5,8 differ slightly from the format of the other tests. Following is a brief explanation of each:

SF 4: Test 4 performs continuous reads and writes of a selected sector. If Test 4 is selected, the following will appear on the screen.

STOP, DATA WILL BE CLOBBERED! CONTINUE?

Key CONTINUE, EXECUTE and the following will appear:

DISK ADDRESS / 3 2 0

Enter the address of the desired surface and the following display appears.

SECTOR ADDRESS

Key in the desired sector address and EXECUTE. The test should begin. The data pattern used is displayed on the left side of the screen and the number of accesses on the right. Key HALT to stop the test.

SF 5: This test is used to read one sector and display the data on the screen. This test can also be used to read the alternate sector map which is not normally available to the user. To run this test, select the disk and sector addresses as described in SF 4. After the data read from the sector is displayed, there are five options available.

SF 0: This SF key is used to select another surface.

SF 1: This SF key is used to select another sector on the same surface.

SF 2: This key will read the next sequential sector of the selected surface.

SF 3: This SF key converts the data read from sector 52608 (alternate sector map) to indicate which sectors have been alternately assigned during formatting.

SF 19: After the data is read from a sector, the data can be changed and written back onto a sector through use of this key.

TEST DESCRIPTION

SF 0: This test performs 20 passes of random seeks then performs sequential writes and reads. After this, random read/writes are performed. This test runs continuously and will destroy data on the surfaces selected for testing.

SF 1: This test performs random verifies and runs continuously. This test does not destroy data.

SF 2: This test performs multi-sector writes with a pattern determined by the diagnostic. This test will destroy data and runs continuously.

SF 3: This test copies the data found in randomly selected sectors to other randomly selected sectors. This test will destroy data and runs continuously.

SF 4: This test writes and reads on one sector continuously and will destroy data.

SF 5: This test will read one sector and display the data read. This test can be used to determine alternate sector assignments. This can be done by reading sector 52608 and then depressing SF'3. This test does not destroy data.

SF 6: This test performs random writes/reads on selected surfaces.

SF 7: This test uses only one surface. It starts out with a verify of the selected surface, then performs 100 maximum seeks. After this, the test performs random writes/reads of single sectors.

SF 8: This option is used in conjunction with the mini alignment kit to replace the CDC field test unit by positioning the R/W heads over the alignment tracks.

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