# Introduction to
# CYBER 18 System

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# Block 1

# System Components

# Processor Characteristics

CYBER 18 is a versatile, adaptable computer product line with features representative of the most recent wave of commercially used computers. For this reason, understanding the mainframe of the CYBER 18 product line should provide you with a background applicable to working with other computer systems today and in the near future. In this reading, the adaptability and characteristics of the CYBER 18 microprocessor will be examined.

## Adaptability of CYBER 18 Hardware

The distinguishing feature of the CYBER 18 line is the microprocessor. The prefix "micro" does not mean that the processor itself is small; rather, it refers to the type of instructions the processor can handle. A microprocessor deals with microinstructions. Simply put, these microinstructions allow the programmer the use of suboperations not ordinarily accessible in programming. The programmer can change the capabilities of the computer by programming a desired set of suboperations. In older computers, these suboperations would have been unchangeable because they would have been built into the actual wiring of the computer.

Connected to the microprocessor in a CYBER 18 system will be a number of peripheral devices, such as a card reader, magnetic tape units, or line printers. The exact peripheral equipment used will differ in various CYBER 18 systems. The exact type of microprocessor used can also vary, depending on the actual system.

Software for the CYBER 18 line is also adaptable. Available software includes cross-assemblies with nonrelated product lines (such as CDC "CLASS"), a comprehensive set of assembly and compiler-level support software (such as FORTRAN, BASIC, PASCAL, and RPG II), and an executive software operating system called CDC MSOS-5.

The microprocessor of the CYBER 18 line can be thought of as having multilevel performance characteristics. It allows for applications that give the programmer access to the high-speed control machine language, or microlevel operations; it also permits pre-established interpretation of both newly created software instruction sets and emulations (software-level operations which cause the computer to accept certain software programs and routines and behave as if the computer were another hardware system).

The control section of the CYBER microprocessor contains the high-speed control memory (or micromemory), a microinstruction-holding register, and hardware jumps controlled by the microprogram and referred to as transforms. With a good understanding of the micromemory, microinstruction coding, and CYBER 18 transform

wiring, a qualified microlevel programmer can adapt certain CYBER 18 configurations to meet changes in or expansions of system requirements.

The following list gives an indication of current CYBER 18 system applications:

- CYBER 18-05 is a microprocessor-controlled terminal set for preprocessing data to and from peripherals and to and from computers in a terminal net.
- CYBER 18-10M is an enhanced computer emulator (emulating the CDC 1700 model) in the small- to mid-sized range; it is used to save all developed software and systems of an out-of-date product line while improving overall computer system performance.
- CYBER 18-20 is an up-to-date small- to mid-sized computer configuration that provides total software compatibility with older operating software systems, a much expanded software repertoire, and an ability to further expand as well as alter machine code interpretations through the use of microprogramming.
- CYBER 18-30 is a modular application of multiple CYBER-type computers that provides an increase in vertical (that is, operations-per-second) expansion for background-foreground-batch processing.

## Operating Characteristics of the AB113 Microprocessor

The basic processor used in the CYBER 18-20/30 systems is the AB113 microprogrammable processor. This processor uses sixteen-bit software (or macroinstruction) words, which are instructions in a source language that is equivalent to a specified sequence of clearly defined machine operations. This processor can emulate the basic instruction repertoire used with the Control Data 1700 series; it also has an enhanced, or expanded, 1700 instruction set in which instructions are executed in a time relative to the main memory cycle time of 600 nanoseconds.

Additional features of this processor include:

- An input/output-teletype (I/O-TTY) interface that permits input and output through a teletypewriter or a conversational display terminal (CDT)
- An internal transistor-to-transistor logic (TTL) level bus (a circuit over which data or power is transmitted) that is functionally compatible both with CDC 1700 A/Q equipment and A/Q direct memory access (DMA) peripheral equipment—a feature that permits users to use older equipment with a CYBER 18 system
- An operation mode permitting automatic data transfer (ADT)
- A real-time clock interrupt capability, which permits computer-programmed monitoring to occur at specific, predetermined intervals

- Sixteen levels of interrupt facilities to accommodate most system configurations, which increase input/output efficiency by allowing concurrent input, output, and computation
- A direct memory access (DMA) bus system that controls access to memory based on assigned priorities

The person operating the processor does so through a conversational display terminal and the operator panel. The operator control unit provides basic control functions, including AUTOLOAD, DEAD START, MASTER CLEAR, STOP, MANUAL INTERRUPT, and RUN. The CDT provides for the input and output of information as well as on-line monitoring of the progress of the running software.

The processor is designed to operate from a power supply of 120 vac, single phase, 60Hz input power. For other site voltage sources, a power conversion transformer must be installed.

The microprocessor used with the CYBER 18 system is a stand-alone processor that provides the user with both macro and microprogramming. The processor can be used in remote terminal applications ranging from an international computer network, such as Control Data's CYBERNET, to a small CYBER system in itself.

## Summary

It is the microprocessor that makes CYBER 18 an adaptable product line because microprogramming:

- Makes the system compatible with previously purchased equipment
- Makes the system compatible with future technological advances
- Permits computer emulations and acceptance of already developed software

The AB113 microprogrammable processor used in CYBER 18-20/30 has the following characteristics:

- Sixteen-bit macroinstruction words
- Capacity to emulate the 1700 series
- I/O-TTY interface
- TTL-level bus
- ADT
- Real-time clock interrupt
- Sixteen levels of interrupt
- Priority-oriented DMA
- 120 vac, 60Hz power supply

# Processor and Peripherals. Exercise

DIRECTIONS: Fill in the blanks or follow the directions accompanying the question.

1. The CYBER 18 processor is designed to operate on _____ vac, single phase input power.

2. The operator communicates with the processor via the _____ and _____
   _____ .

3. The basic processor utilizes _____ bit macroinstruction words.

4. In the list below, circle the letters of the two options that ARE NOT characteristics or capabilities of the CYBER 18 system:
   a. Emulates the basic 1700 instruction repertoire
   b. Has hardware transform function
   c. Has 4K MOS memory modules
   d. Can function as a peripheral controller
   e. Has memory capability of from 16K to 161K words
   f. Is a stand-alone processor
   g. Cannot recognize external interrupts

5. List four of the more common peripheral devices used with the CYBER 18:
   a. _____
   b. _____
   c. _____
   d. _____

6. The card reader can read Hollerith cards at the rate of (circle the letter of the appropriate answer):
   a. 300 cards per minute
   b. 500 cards per minute
   c. 800 cards per minute
   d. 1000 cards per minute

7. The line printer used with the CYBER 18 prints 300 lines per minute, with _____ characters per line.

8. The magnetic tape unit uses nine tracks to record information and operates in:
   a. The return to zero (RTZ) mode
   b. A phase shift mode
   c. The non-return to zero, indiscrete (NRZI) mode
   d. A frequency shift mode

ANSWERS

1.   120    2.    Conversational display terminal, operator panel    3.    16
4.    The options that are not characteristics are:  e and g    5.    List should
include: card reader, magnetic tape unit, line printer, and disk drive    6.    a
7.   136    8.    c

TABLE 1-1
Basic, Average, and Large Configurations
for the CYBER 18-10M and CYBER 18-20

| Size | CYBER 18-10M | CYBER 18-20 |
|---|---|---|
| Basic | 1 64KB memory system console (752)<br>2 operator stations (752's)<br>4.4MB cartridge disk and controller (one spindle)<br>70 lpm line printer<br><br>1X8 CLA<br>Single diskette and controller | 1 128KB memory system console (752)<br>8 operator stations (752's)<br>50MB SMD and controller (two spindles)<br>300 lpm line printer and controller, with synchronous CLA<br>1X8 CLA<br>9-track magnetic tape and controller |
| Average | 1 64KB memory system console (752)<br>2 operator stations (752's)<br>8.8MB cartridge disk and controller (one spindle)<br>300 lpm line printer<br><br>1X8 CLA<br>Single diskette and controller | 1 192KB memory system console (752)<br>12 operator stations (752's)<br>100MB SMD and controller (two spindles)<br>300 lpm line printer and controller (with synchronous CLA)<br>Two 1X8 CLA's<br>9-track magnetic tape and controller |

| Size | CYBER 18-10M | CYBER 18-20 |
|------|--------------|-------------|
| Large* | 1 128KB memory system console (752)<br>5 operator stations (752)<br>17.6MB cartridge disk and controller (two spindles)<br>300 lpm line printer and controller (with synchronous CLA)<br>1X8 CLA<br>Single diskette and controller | 1 256KB memory system console (752)<br>16 operator stations (752's)<br>200MB SMD and controller (four spindles)<br><br>600 lpm line printer and controller (with synchronous CLA)<br><br>2 9-track magnetic tapes and controller |
| | *This configuration can be expanded to take: | |
| | 8 operator stations<br>4 cartridge disk spindles (Max. 35.2MB)<br>4 magnetic tapes<br>Additional diskette drive<br>300 or 600 cpm card reader<br>600 lpm line printer | 8 SMD spindles (Max. 400MB)<br>4 magnetic tapes<br>Additional diskette drive<br>300 or 600 cpm card reader |

| | | Abbreviations Used | | |
|---|---|---|---|---|
| | CLA | Communications line adapter | Lpm<br>MB | Lines per minute<br>Megabytes |
| | KB | Kilobytes (byte = 8 bits) | SMD | Storage module drive |

## Central Processors (CPUs)

The two principal CPU models used for CYBER 18 application systems are the 18-10M and 18-20. (The 18-05 is strictly a remote batch terminal; the 18-30 is used primarily for time sharing and financial applications.) Like all CYBER 18 processors, the 10M and 20 are variants of an earlier MP17 microprogrammable CPU. The differences between the two processors consist of memory sizes and peripheral complements. These differences are summarized in table 1-2.

TABLE 1-2
Feature Comparisons
18-10M and 18-20 Central Processing Units

| Features | 18-10M | 18-20 |
|---|---|---|
| Macromemory Size | 32-128KB | 32-256KB |
| Disk Subsystems Supported | 1866-12, -14 only | 1866-12, -14 1867-10, -20 |

Both CPUs execute an enhanced instruction set from Control Data's 1700 computer series, have integral memory parity, memory protection, sixteen levels of interrupt, and a real-time clock, and both support up to nine peripheral device controllers (with a maximum of four of those devices providing direct memory access).

To the user this means a choice between two CPUs, each of which can solve varied processing loads. The 10M will typically be limited to fewer concurrent applications and smaller data bases due to constraints in its memory and peripheral capabilities. Because of field modification, however, this is not an absolute limitation. For example, the user may start with a system employing the CYBER 18-10M and later replace the processor with a CYBER 18-20 while still using the original peripheral equipment.

## Peripheral Equipment

Both the CYBER 18-10M and the CYBER 18-20 models utilize similar types of peripheral equipment. These types are reviewed here to show the elements of a typical site configuration.

### Operator Consoles

Both systems (18-10M and 18-20) normally utilize a self-contained single-station cathode ray tube (CRT) display terminal, model 752. A CRT is similar to a picture tube in a television set. Up to 24 lines of 80 characters each can be displayed at one time on the screen. If desired, a nonimpact printer can be slaved to, i.e., made to function in parallel with, the console to provide a printed copy of the operator's activity. (The console model normally used is the 1811-2; however, if the system uses 1890-1, 1890-2, or 1890-3 batch terminal controlware, the 1811-1 console display must be used.) A photograph of an 1811-1 is shown in figure 1-1.

Figure 1-1. 1811-1 Console Display

## Line Printers

There are three printers available with the CYBER 18 product line: the 70 lines-per-minute (lpm) impact printer, the 300 lpm printer, and the 600 lpm printer.

**The 70 lpm Printer** (model 1827-7). This is a desktop, 7 by 7 dot matrix, 132-column wide, impact serial printer with a print speed of approximately 220 characters per second. The printer offers a low cost, low duty alternative to higher speed printers for those interactive-oriented businesses that do not require a card reader. Because this printer is connected to the CPU by the same communication line adapter (CLA) as the interactive terminals, no card reader/line printer controller card is needed. This further reduces the configuration cost.

**The 300 lpm Printer** (models 1827-30 and 1827-31). These are standard 136-column-wide drum printers. They are connected to the CPU through line printer controllers (either model 1828-1 or 1828-2). The 1827-30 printer will be the one used in most applications. The printer's sound-damped cabinetry makes it suitable for office environments. Its heavy-duty construction will ensure maximum availability even under heavy printing loads.
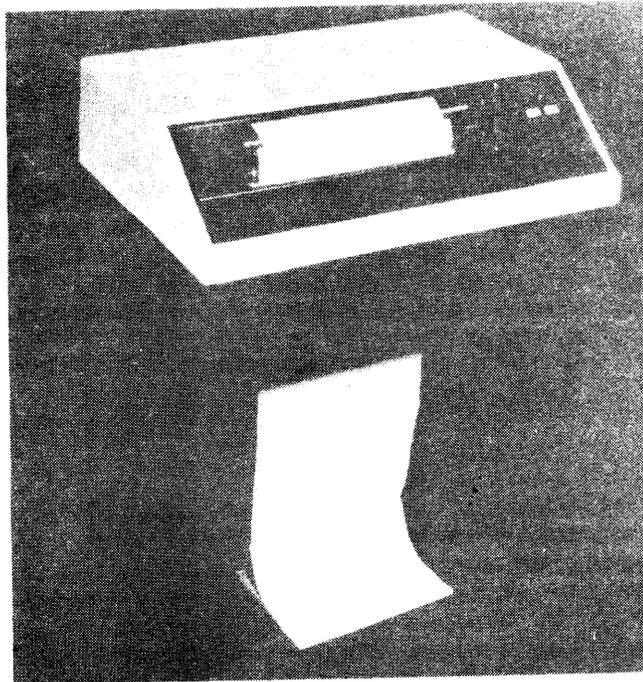
Figure 1-2. 1827-60 Line Printer

**The 600 lpm Printer** (models 1827-60 and 1827-61). These are high-speed, 132-column band printers. Like the 300 lpm printers, they can be attached to the CPU by either of the line printer controller models. To make it suitable for office environments, the 600 lpm printer has sound-damped cabinetry and an automatic motor turn-off that goes into effect when the printer has not been used for thirty seconds. The printer's 64-character band can also be replaced with a 48-character band; this change permits print speeds up to 720 lpm. Bands with different character fonts can also be substituted to meet the needs of international applications. A photograph of an 1827-60 is shown in figure 1-2.

## Disk Subsystems

On the CYBER 18, two rigid disk subsystems are available. On both the 18-10M and the 18-20, two types of smaller cartridge disk drives (4.4MB and 8.8 MB) are available. The larger storage module drives (SMD), either 25MB or 50MB capacity, are available only on the 18-20. Through combining various drives, the user can obtain on-line storage capacity ranging from 4.4MB to 400 MB.

The two cartridge disk drives (the 4.4MB 1866-12 and the 8.8MB 1866-14) are split; this means that there are two cartridges on each drive, one of which is removable while the other is fixed. Both of the cartridge disk drives are attached to the CPU by an 1833-4 controller.

Both storage module drives (the 25MB 1867-10 and the 50MB 1867-20) are single spindle and fully removable. These drives are attached to one CPU by an 1833-1 storage module drive (SMD) interface and an 1833-3 SMD controller. To access a second CPU, an 1833-2 SMD interface is also needed. A photograph of the 1867-20 is shown in figure 1-3.
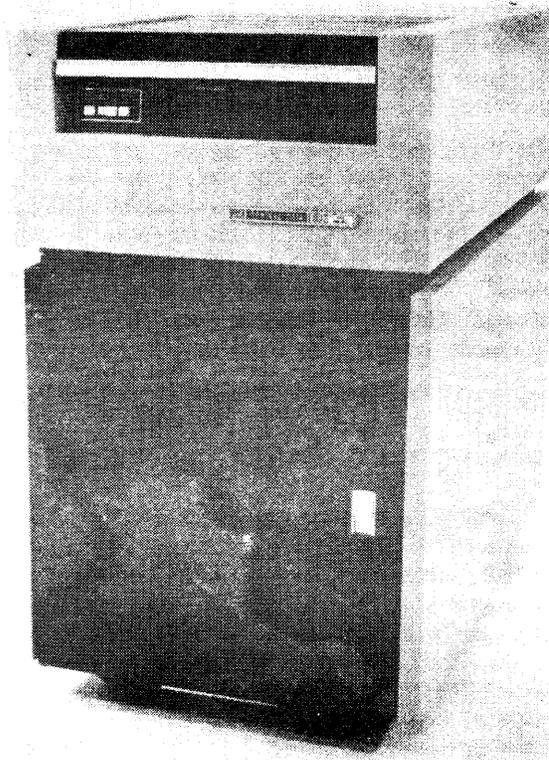


Figure 1-3. 1867-20 Storage Module Drive

A broad range of user storage requirements can be met with these two subsystems. For systems requiring less than 20MB on-line capacity, cartridge disk will offer better cost-effectiveness. Beyond 20MB, the SMD family is the better choice.

## Magnetic Tape Subsystems

1860 magnetic tape subsystems provide the CYBER 18 with reliable, low cost, and versatile tape storage. Combinations of 7- and 9-track tape transports, or drives, are possible. With the appropriate controller, up to four mixed transports can be connected to the CPU. There are two 7-track subsystems (1860-1 and 1860-2) available, each of which contains a controller, one or two transports (depending on the model), and the appropriate cabinetry and cable. There are four 9-track subsystems. Two of them (1860-3 and 1860-4) operate at 25 inches per second (ips); the models differ in whether they are a single or a double transport. The other two 9-track subsystems (1860-5 and 1860-6) operate at 50 inches per second. A photograph of the 1860-5 is shown in figure 1-4.
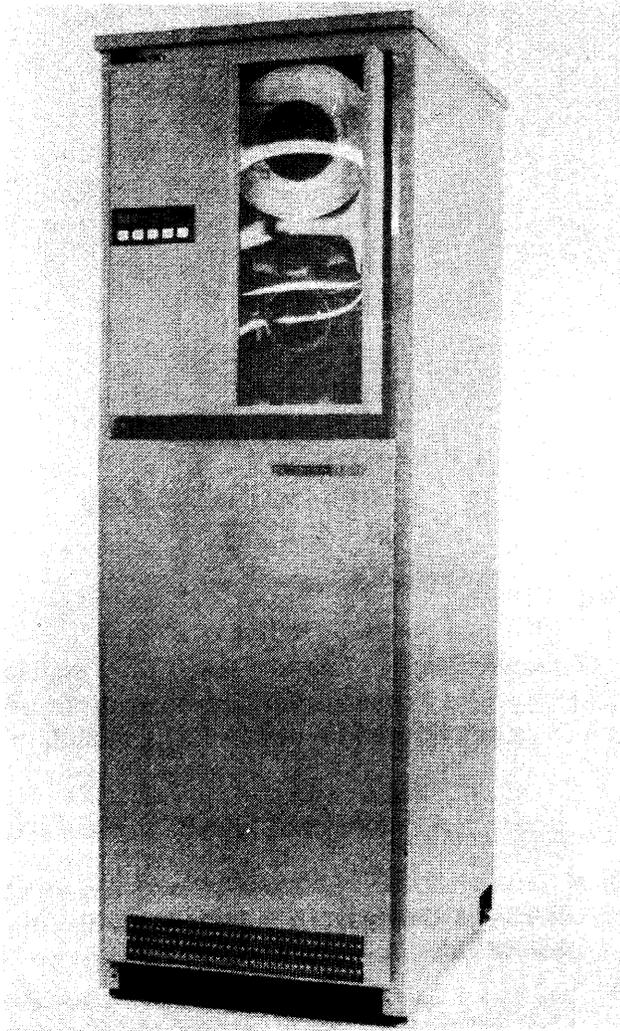


Figure 1-4. 1860-5 Magnetic Tape Subsystem

## *Flexible Disks*

The flexible disk subsystem (model 1865) provides low cost auxiliary storage for
CYBER 18 systems. This system's controller and first driver are included with the
CYBER 18-10M and 18-20 processors because the two items form the standard diag-
nostic load system for these processors. This first drive also provides the user with
280KB of removable storage. A second drive can be added to provide a total of
560KB of on-line auxiliary storage. Because this subsystem is capable of reading,
writing, and formatting in IBM 3740, it permits CYBER 18 to act as a remote data
entry station for IBM-compatible systems. A photograph of the 1865 is shown in
figure 1-5.
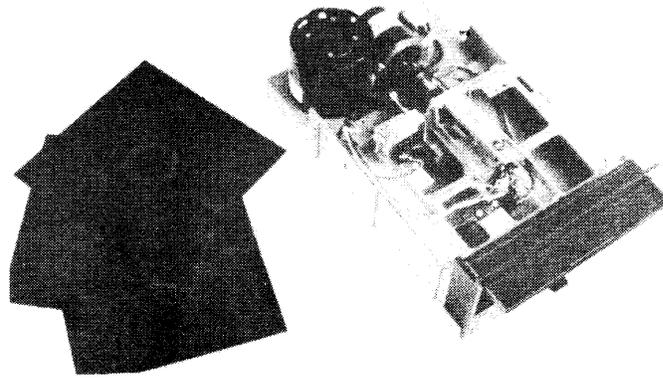
Figure 1-5. 1865 Flexible Disk Drive

## *Communications*

There are two types of communications line adapters (CLAs) available in the CYBER 18
line. The 1843-1 model provides 2 channels for communications while the 1843-2 pro-
vides 8 channels. The CLAs can be used to interface with modulating and demodulating
devices (modems) for remote communications or with such equipment as 75X terminals,
1827-5 serial printers, and card punches. When CLAs are used to interface with local
devices, the maximum cable length is 50 feet.

## Card Readers

Card media input is provided to CYBER 18 systems by the 1829-30 and 1829-60 card readers. These desktop devices read 80-column cards at 300 and 600 cards per minute, respectively. As business systems become increasingly interactive, the need for such card readers decreases. A photograph of the 1829-30 is shown in figure 1-6.
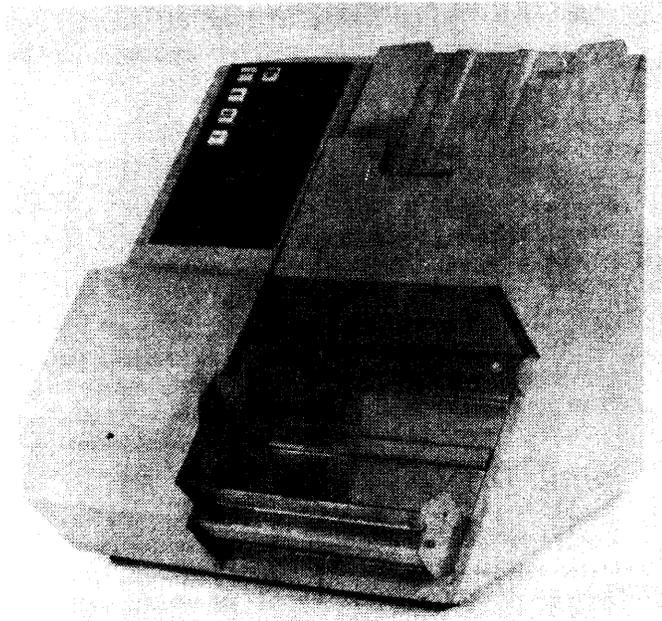


Figure 1-6. 1829-30 Card Reader

## Other Products

Various other products are available to meet special requirements. If a card punch is required, the TAB 560 is available. This 80-column punch operates at 30 to 70 cards per minute and is attached to the CPU by either of the CLAs.

If extreme data integrity is needed, a correction code array (model 1874-1) is available. This array detects and corrects all single-bit errors and detects all double-bit errors. Note, however, that the array reduces maximum memory access speed by approximately seven percent.

For users doing extensive software development, a breakpoint controller (1875-1) and a breakpoint panel (1875-2) are available. This equipment can be used in troubleshooting to help identify problems with programs in both main and micromemories.

## Summary

The block diagram in figure 1-7 will aid you in visualizing the configuration of the CYBER 18-20 system used as an example throughout this unit. There are two each of the peripheral devices, one being used on-line, the other, off-line.
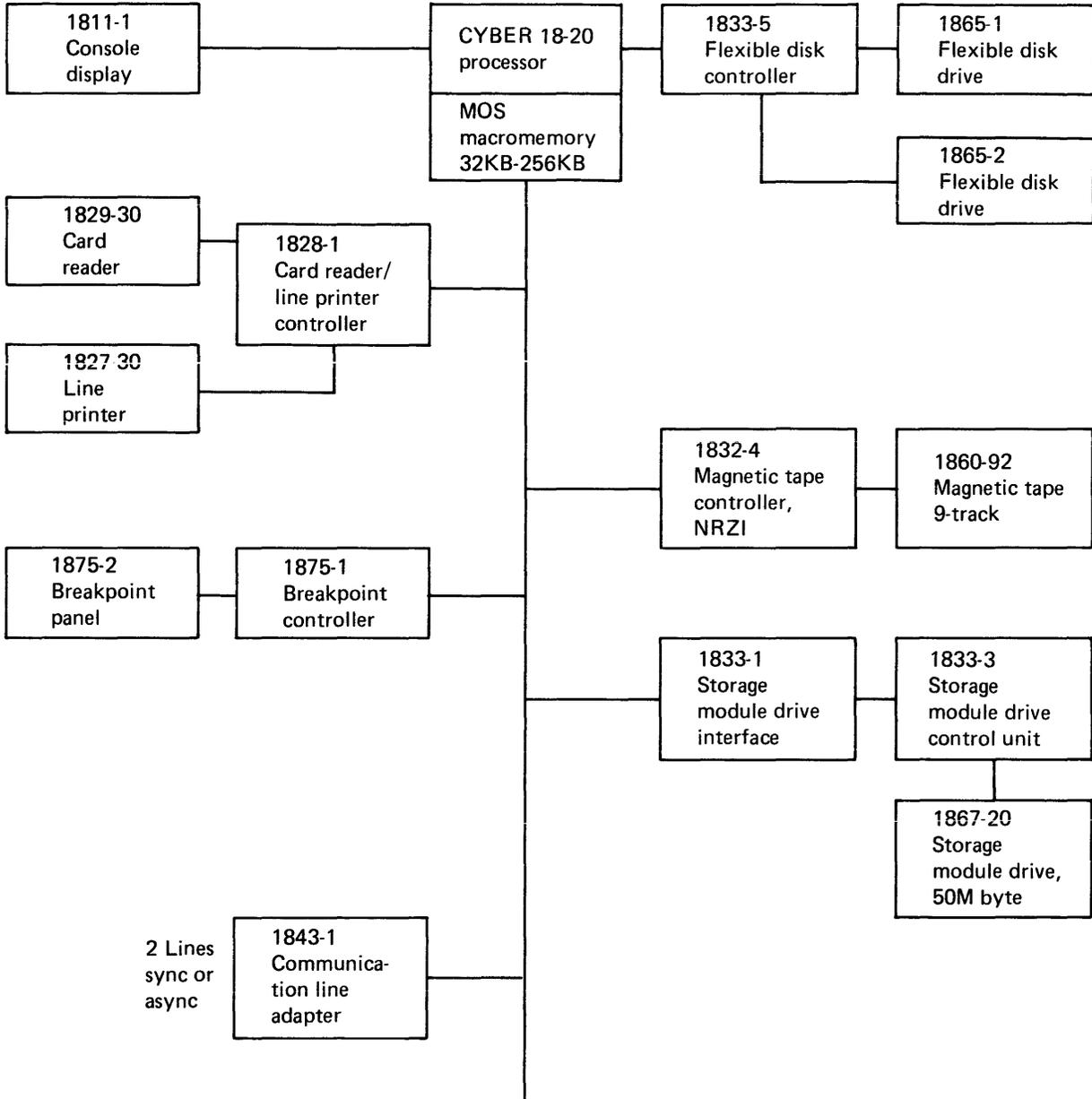
Figure 1-7. Block Diagram of CYBER 18-20 Configuration

# Block 2

# Operation

# CPU Console Operation

Typical of general business processing units, the CYBER 18-20 system has controls and indicators used in operating the CPU. These controls and indicators are found on the sloping panel at the front of the equipment frame (as shown in figure 2-1). This text lists and describes the switches and displays that deal with the processor, the modem, flexible disks, and tape cassettes.
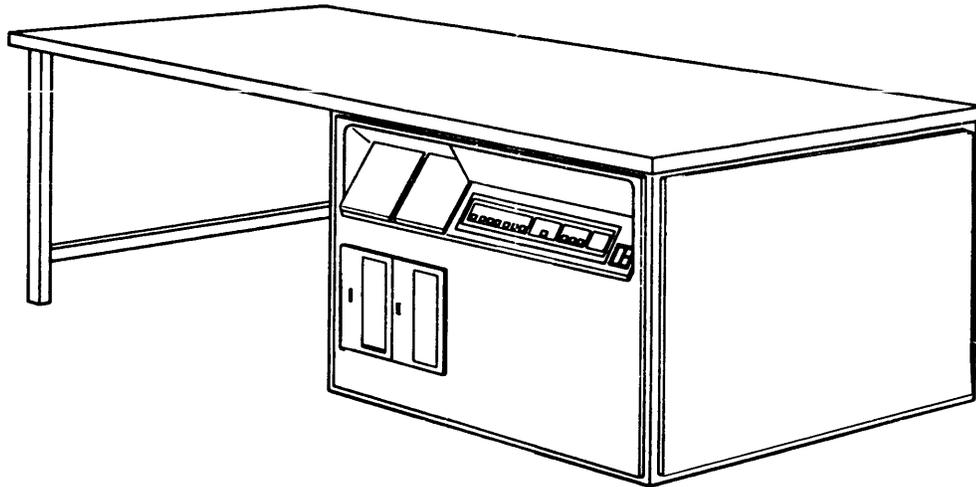
Figure 2-1. CYBER 18-20 Desk Cabinet

## Processor Switches and Indicators

The operator panel is divided into four separately labeled groups of controls (as shown in figure 2-2). Of these controls, the processor switches and indicators are probably the most important to understand, since these will be used in every computer configuration.

*MANUAL INTRPT* This switch is used to initiate an external interrupt of the CPU. It may be used during diagnostics to access the operating system monitor.

*STOP* This switch enables a microprogrammed, controlled halt of any program that may be running in the CPU.
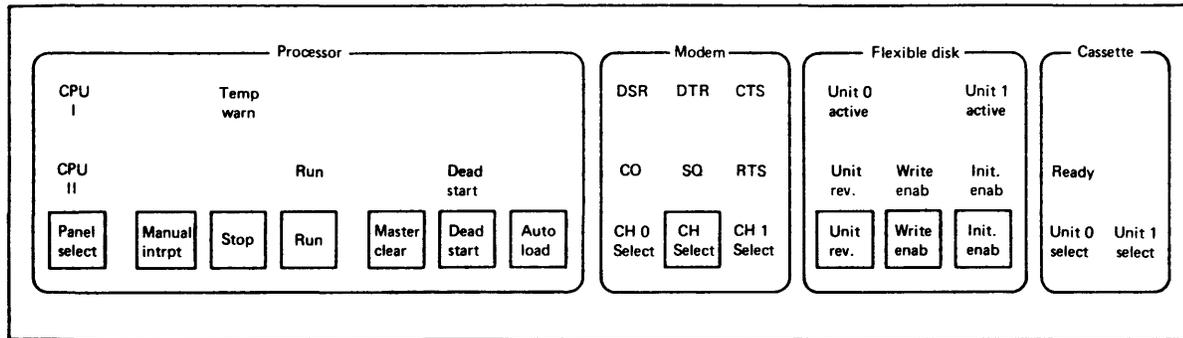
Figure 2-2. CYBER 18-20 Operator Panel

**RUN** This switch is used to initiate a run state in the CPU.

**MASTER CLEAR** This switch initiates a MASTER CLEAR to the CPU and to the input/output controllers in the CPU.

**DEAD START** This switch initiates a micromemory load from the input device, using the transform as a loader for the micromemory. Dead start logic allows read/write micromemory to be loaded from an external input device such as a card reader or magnetic tape unit.

**AUTO LOAD** This switch initiates a program load from a mass storage device, such as a program sorted on a disk that would then be loaded into memory.

**PANEL SELECT** This switch is not used on a CYBER 18-20. In a CYBER 18-30, however, where two CPUs are used, this switch permits selecting CPU I or CPU II; in other words, it connects the operator panel and the CDT to a specific CPU. In the CYBER 18-20, this switch is not needed because the CPU is connected automatically when the processor is powered up.

In addition to the switches, there are the following backlighted displays that pertain to the processor.

**CPU I and CPU II** These displays indicate, on a CYBER 18-30, which CPU is active.

**TEMP WARN** This display indicates that the temperature inside the processor is dangerously high (over 130 degrees Fahrenheit).

**RUN** This display indicates that the processor is in the run mode.

**DEAD START** This display shows that a dead start operation is in process.

2-2

# Modem Switches and Indicators

The modem switches and indicators are used only when the processor must be connected to a remote processor or peripheral device. On systems having more than one data transmission channel, the CH SELECT switch is used to select channel 0 or channel 1. The CYBER 18-20 system has only one channel, so this switch is not used.

There is also a set of backlighted displays used to monitor the operation of the modem. These displays are listed and described in table 2-1. Notice that a number of the abbreviations in this table are identical to the CDT's indicators for modem operation.

TABLE 2-1
Modem Displays

| Abbreviations | Displays | Meanings |
|---|---|---|
| DSR | Data set ready | The modem is in operation. |
| DTR | Data terminal ready | The terminal is ready to send or receive data. |
| CTS | Clear to send | The modem is ready for data. |
| CO | Carrier on | Data cannot be sent or received if display is not lighted. |
| SQ | Signal quality | The quality of the modem signal being received is satisfactory for operation if display is lighted. |
| RTS | Request to send | The channel is prepared to send data to the modem. |
| CH 0 SELECT | | The modem display lights are connected to channel 0. |
| CH 1 SELECT | | The modem display lights are connected to channel 1. |

## Flexible Disk Grouping and Cassette Grouping

Whenever flexible disk storage units are used, the third group of switches and displays, labeled "Flexible Disks," will be active. The functions of these switches and displays are listed in table 2-2.

TABLE 2-2
Flexible Disk Grouping

| Abbreviations | Meanings |
|---|---|
| UNIT REV | Two flexible disk units will normally be used, unit 0 and unit 1. This switch reverses the logical unit numbers between the two units. Unit 1 will act as if it were unit 0 and vice versa. |
| WRITE ENAB | This switch permits writing on the disk. It disables the write protect feature. |
| INIT ENAB | This switch permits writing address information on normally protected format tracks. |
| UNIT 0 ACTIVE | This display indicates that the heads are loaded and that data is being transferred by unit 0. |
| UNIT 1 ACTIVE | This display indicates that the heads are loaded and that data is being transferred by unit 1. |
| UNIT REV | This display indicates that unit numbers are reversed. If light is off, unit 0 is selected; if light is on, unit 1 is selected. |
| WRITE ENAB | This display indicates that the write enable is on. This is manually set. |
| INIT ENAB | This display indicates that the initialize enable is on. This is manually set. |

The final group, the cassette grouping, contains only backlighted displays. No switches are needed because the processor directly controls the tapes. Although the CYBER 18-20 system used as an example throughout this unit will not have tape cassettes, an explanation of the displays in the cassette grouping is given in table 2-3.

TABLE 2-3
Cassette Grouping Displays

| Abbreviations | Meanings |
|---|---|
| READY | This display indicates that the unit is ready to respond to controller-initiated operations. |
| UNIT 0 ACTIVE | This display indicates that unit 0 is selected and on-line. |
| UNIT 1 SELECT | This display indicates that unit 1 is selected and on-line. |

## Check Your Understanding

DIRECTIONS: Mark the following statements using T for true or F for false.

_____ 1. The MASTER CLEAR switch clears registers and controls in the CPU.

_____ 2. The DEAD START button is used to initiate a manual interrupt to the processor.

_____ 3. When lighted, the TEMP WARN indicates that the temperature within the cabinet is above the safe operating level.

_____ 4. The PANEL SELECT switch is used on a CYBER 18-20.


DIRECTIONS: Fill in the blanks.

5. The MASTER CLEAR switch indicates a MASTER CLEAR to the processor and the _____ within the processor unit.

6. Pressing the DEAD START switch initiates a micromemory load from an input device, using the _____ as a loader.

ANSWERS

1. T   2. F   3. T   4. F   5. Controllers   6. Transform

# CDT Operation and Controls

In the CYBER 18-20 model, the standard device used to input and output information is a conversational display terminal (CDT). The specific model used (CDC 1811-1) displays information on a cathode ray tube (CRT) that is similar to a television picture tube. In this text, the following aspects of the CDT's operation will be explained:

- The controls and indicators on the CDT and their functions
- The function of the CDT keyboard and the individual keys
- The procedure for applying power to the CDT

## CDT Controls and Indicators

The user enters, obtains, and monitors information on a CDT through a front and back panel of controls and a keyboard. The front and back panels are illustrated in figure 2-3. The keyboard will be illustrated later. One other important indicator is found on the terminal display: the cursor. Blinking about three times a second, the cursor indicates where the next character will be displayed. When a character key is pressed, that character is displayed on the screen immediately above the cursor; the cursor then advances one position to the right (as shown in figure 2-4).

## *Front Panel Controls*

There are eight rocker switches and one potentiometer found on the CDT's front panel. The purpose and location of each of these controls follows.

*POWER ON/OFF* This switch, used to apply power to the terminal, will not function unless the terminal power cord is connected to the site power outlet and the circuit breaker (CB1) is ON. If this switch is placed in the OFF position, it should not be placed back into the ON position until at least thirty seconds have passed; repowering more quickly than that can cause the circuit breaker to trip.

*FULL DUPLEX/HALF DUPLEX* This switch is important only when the terminal must transmit data to and from the CPU over long-distance data transmission lines. The switch selects whether the terminal transmits and receives serial data (one bit at a time) in a full- or a half-duplex mode. "Full duplex" means that the display terminal can send and receive information simultaneously. "Half duplex" means that the terminal can either send or receive information, but cannot do both at the same time.

Figure 2-3. Front and Rear CDT Panels

NOTE:
Except for parity and format switches, maintain all rocker switches with top depressed. Parity switch must be in even par position and the format switch must be off.



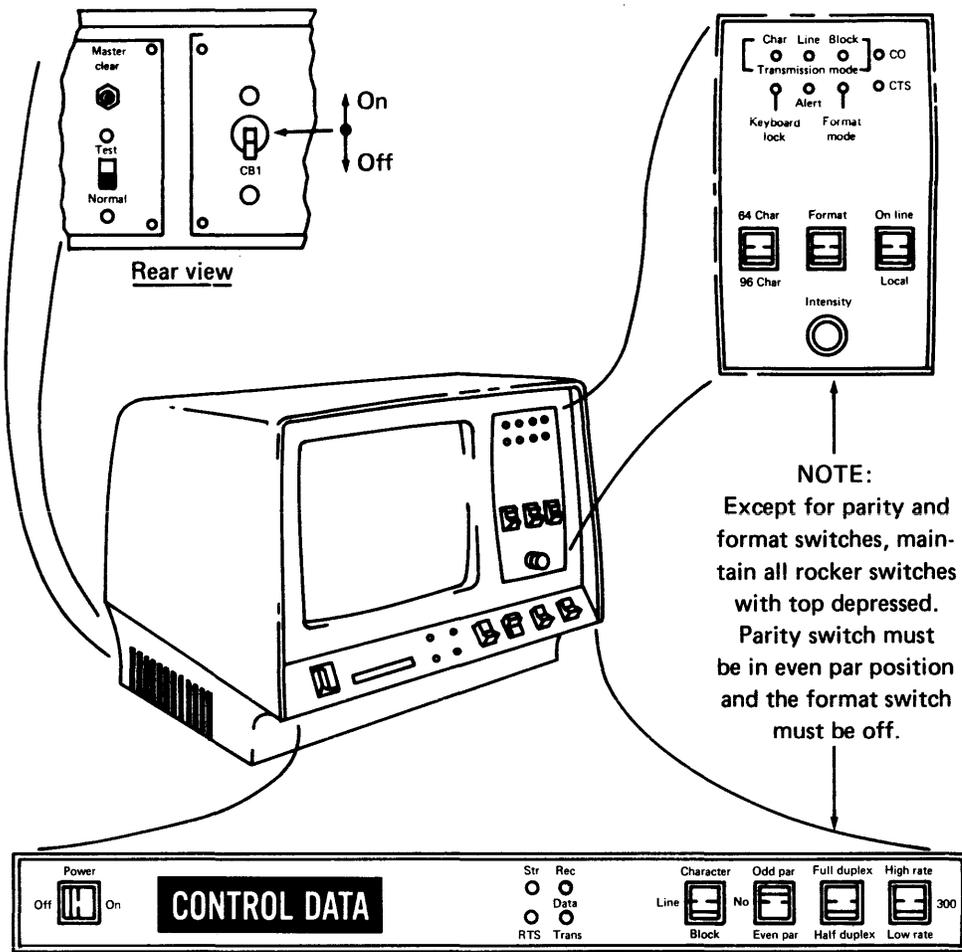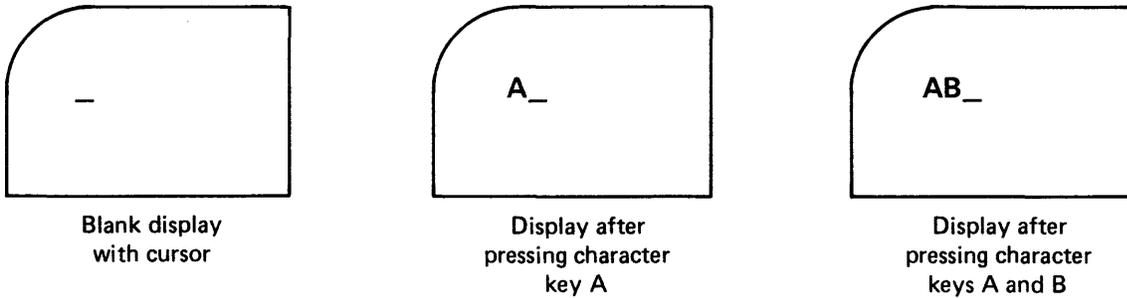| Blank display with cursor | Display after pressing character key A | Display after pressing character keys A and B |

Figure 2-4. Cursor Display

*HIGH RATE/300/LOW RATE* Again, this is a switch used in data transmission. The switch determines the speed at which data can be sent and received. During installation, the high and low rate are preset and their values are written on the terminal above and below the switch. The center position of the switch selects a transmission speed of 300 baud (the term "baud" specifies the bit rate per second). For batch terminal applications, the high and low rates are set at 9600 baud.

*CHARACTER/LINE/BLOCK* When the format key is pressed ON, the CHARACTER/LINE/BLOCK key is used to determine how keyboard data is transferred. When the key is placed in the CHARACTER mode position, keyboard data is transferred to the communications interface as the keys are pressed. A three-character internal buffer is provided to accommodate sporadic typing speeds.

When the key is in LINE mode, keyboard data is displayed and stored in the CDT memory as keys are pressed. One line of data is transferred to the communications interface when the CARRIAGE RETURN key (on the keyboard) is pressed.

When the key is in BLOCK mode, keyboard data is displayed and stored in the CDT memory as keys are pressed. Data transmission is initiated by pressing the SEND key on the keyboard. The information from the entire screen may be sent to the communications interface in this mode.

*ON LINE/LOCAL* This switch also involves data transmission. The switch must be placed in the ON LINE position to connect the terminal with the communications interface (or modem). The LOCAL position disconnects the communications interface circuit and allows information typed on the keyboard to be displayed.

*ODD PAR/NO/EVEN PAR* This switch is concerned with parity, a technique used to detect errors in data transmission. When the switch is pressed to either the ODD PAR or the EVEN PAR position, the selected parity method is generated for transmitted data, and received data is checked for the type of parity selected. When this switch is pressed to the NO position, received data is not checked for parity and the parity for transmitted data is determined by an internal switch.

*64 CHAR/96 CHAR* This switch determines the number of different characters that can be used. When placed at the 64 CHAR position, only uppercase characters are shown, but when placed at 96 CHAR, the full set of uppercase and lowercase characters can be used.

*FORMAT* When this switch is placed in the FORMAT position, it allows the CHARACTER/LINE/BLOCK switch to work. The terminal must have an edit option installed for the FORMAT position to operate. Without such an option, the terminal keyboard will be locked out whenever the switch is pressed into the FORMAT position. When the switch is pressed OFF, the keyboard is operational in all modes and the terminal operates normally.

**INTENSITY** This potentiometer control changes the video intensity of the display. The intensity can be adjusted for better readability by rotating the knob. Too high an intensity causes the display data to appear out of focus and shortens the life of the screen.

## Front Panel Indicators

The front panel of the CDT also contains a number of lights that illuminate either to indicate that the terminal is in a certain mode of operation or to warn of a problem. These indicators involve data transmission and communications interface (modem). Table 2-4 indicates the function of each of these lights.

One other indicator exists. Called the audible alarm, it sounds to indicate proximity to the end of a line when keyboard data is being entered. This alarm is located internally.

TABLE 2-4
CDT Indicators

| Abbreviations | Indicators | Meanings |
|---|---|---|
| CO | Carrier on | The communications interface is ready to receive data from an external source. |
| CTS | Clear to send | The communications interface is ready to transmit data from the terminal; if this indicator is not lit, the terminal will not transmit data. |
| RTS | Request to send | The terminal is prepared to transmit data. |
| DTR | Data terminal ready | The terminal is prepared to accept data from the communications interface. |
| REC DATA | Received data | Data is currently being received by the communications interface. |
| TRANS DATA | Transmitted data | Data is currently being transmitted by the terminal. |

TABLE 2-4 (cont'd.)

| Abbreviations | Indicators | Meanings |
|---|---|---|
| ALERT | Alert | A break in the communications line exists at the communications interface (modem) circuitry. This may be caused by loss of the receive line, noisy transmission lines, and the like. The BREAK key on the keyboard may be used to extinguish the light. |
| KEYBOARD LOCK | Keyboard lock | The keyboard is locked out, and, except for the peripheral control keys, no entries on the keyboard can be made. The BREAK key may be used to unlock the keyboard if the terminal is not being operated in the batch mode. |
| CHAR | Character mode | The terminal is operating in the CHARACTER mode of transmission. |
| LINE | Line mode | The terminal is operating in the LINE mode of transmission. |
| BLOCK | Block mode | The terminal is operating in the BLOCK mode of transmission. |
| FORMAT MODE | Format mode | The FORMAT switch has been pressed to the FORMAT position. This works only if edit option is installed. |

## Other Switches

The following information will describe other switches that are used on the CDT but are not located on the front panel.

**BATCH MODE** In the OFF position, this rocker switch selects the page mode. "Page mode" means that the information placed on the screen starts at the top left of the screen and that each line moves down, similar to a page in a book. In the ON position, the switch selects scroll mode. In scroll mode, the cursor is always on the bottom line of the display unless it is moved up by a cursor-up command. As each line is written on the screen, the entire displayed screen moves up one line to make room for another line to be added at the bottom. The top line moves off the screen.

**TEST/NORMAL** On the rear panel, there is a slide switch that selects either the test or normal operating mode of the terminal. Test mode is a special self-test feature of the display terminal. Successful completion of the test provides assurance of correct terminal operation and thereby helps eliminate the terminal as a possible source of communications problems.

**MASTER CLEAR** This is a pushbutton on the rear panel that returns the terminal to the initial condition and clears the display when pressed. This switch must be depressed whenever the TEST/NORMAL switch is varied.

**CB1** This is a circuit breaker toggle switch on the rear panel. It trips automatically if excessive power is drawn by the terminal. The normal position for the circuit breaker is up. Do not use this circuit breaker to apply power to the terminal or to remove it. The POWER ON/OFF switch on the front panel performs this function.

Note also that you should not hold the circuit breaker in the normal position if it trips immediately on resetting. To do so may cause permanent damage to the unit.

## The CDT Keyboard

The display terminal keyboard layout is similar to that of a standard typewriter, though there are some differences. (See figure 2-5.) The major difference is the many more keys found on the CDT keyboard. In addition to the data entry keys, which are very similar to typewriter keys, there are three additional sets of keys: operation keys, function keys, and transmission control keys. Furthermore, the CDT may function in one of two modes: panel or program.
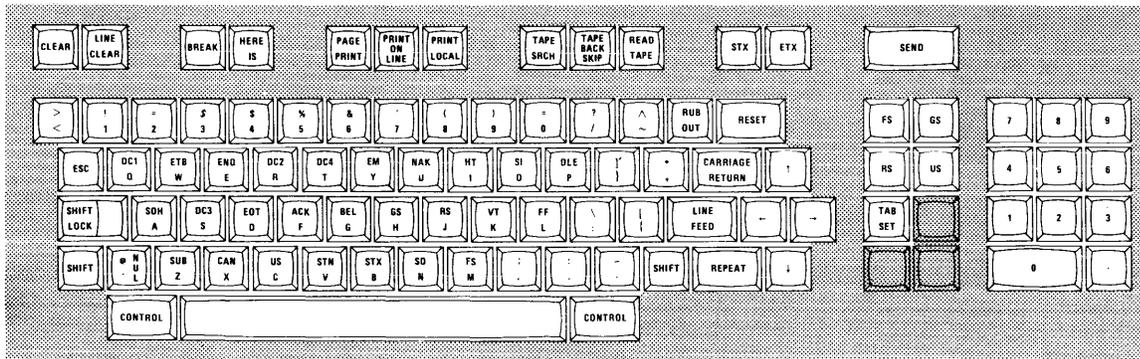


Figure 2-5. Detachable Keyboard

Much of the keyboard operates exactly like a typewriter keyboard. If a character key is depressed, the lowercase character on that key is displayed on the screen. Depressing the SHIFT key and a character key produces the uppercase display. (See figure 2-6.) When the cursor enters the seventy-third character position in any line, a tone indicates that there are eight positions left in that line. The CDT keyboard has numerical keys in the same position as a typewriter, but there is a second set of numerical keys to the right of the keyboard (similar to an adding machine layout). Both sets work interchangeably.
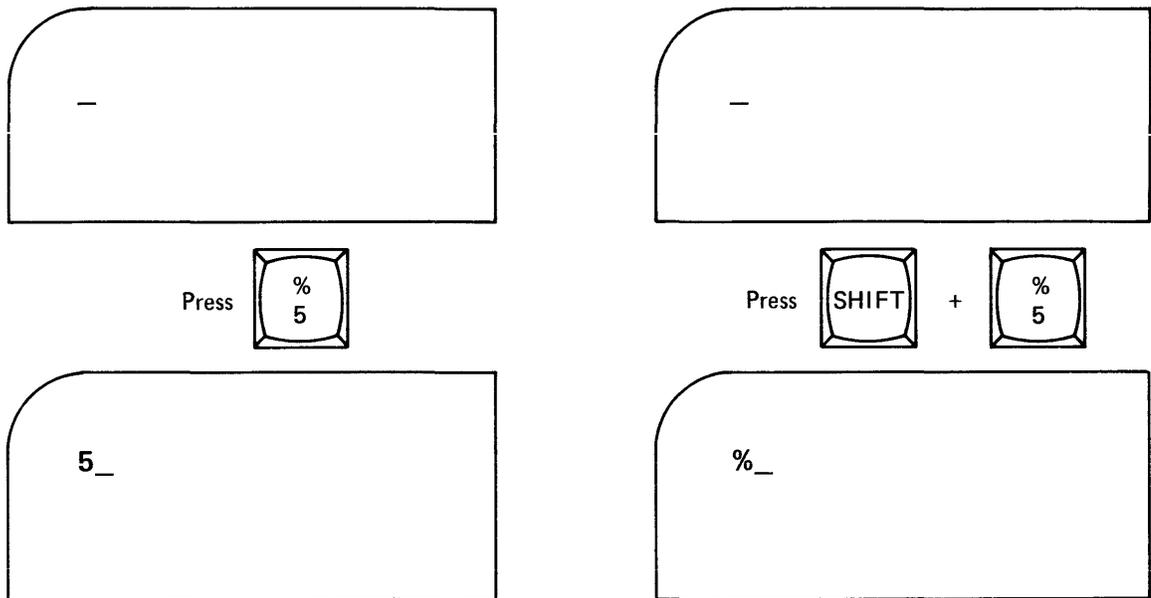


Figure 2-6. Lowercase and Uppercase Display

A CDT space bar differs slightly in function from a typewriter space bar. Depressing the CDT space bar advances the cursor one position to the right; it also erases any display above the cursor before the advance. Similarly, depressing a given character key causes the CRT to display that character above the cursor and to replace any previous display. After the character is displayed, the cursor advances one position to the right.

Depending on whether the CPU is operating as a stand-alone system or as a remote batch terminal, certain keys will be inactive or will cause signals to be generated that are not understood by the program in control of the CPU.

## *Data Entry Keys*

The data entry keys, which consist of the alphabet and numerals, operate in the same way as they do on a typewriter keyboard. Pressing a data entry key results in the appearance on the display screen of the character associated with that key.

## *Operation Keys*

The series of keys that allow the operator to format data on the display screen are called operation keys and include the following:

**CLEAR** This key erases all the data from the display screen and resets the cursor at the beginning of the first line (if the terminal is in page mode) or at the first position of the last line (if it is in scroll mode).

**LINE CLEAR** This key erases a display line from the current position of the cursor to the extreme right of the screen. This key does not change the position of the cursor.

**RESET** This key positions the cursor at the upper left corner of the display screen; it destroys no data on the display.

**CURSOR** The cursor position keys change the relative position of the cursor. One key moves the cursor up one line; another, down one line; a third moves the cursor one character position to the left; and a fourth, one character position to the right.

**SHIFT** When pressed simultaneously with another key, the SHIFT key causes the upper symbol on the other key to be registered. If a key has only one symbol, the SHIFT key will have no effect.

**SPACE** This key moves the cursor one character position to the right and then clears that position.

**CARRIAGE RETURN** This key repositions the cursor at the beginning of the line. When the terminal is on-line and in the LINE mode, hitting the CARRIAGE RETURN also causes the line just typed to be transmitted to the CPU.

**REPEAT KEY** This key causes the repeating of a symbol when both it and the key with the symbol are held down simultaneously.

## Transmission Control Keys

EXT or SEND are transmission control keys. These keys transmit messages constructed on the display screen from the keyboard to the CPU. The portion of the screen from the upper left corner up to, but not including, the current cursor position is transmitted to the central computing system.

## Function Keys

Function keys found on the CDT keyboard are assigned functions according to the configuration of the computing system. The following describes briefly some of the function keys:

**CONTROL** In some CYBER 18-05 systems, this key is used to increment the site address; in others, it clears the screen.

**BREAK** This key unlocks the keyboard and restarts the terminal.

**FS** While the CDT is in the terminal mode, this key interrupts printing or card reading and resets the cursor.

**GS** In a CYBER 18-05 system, this key might be used to select the transmission code or to refresh the terminal status.

**RS** This key, in some CYBER 18-05 systems, is used to select card punch codes.

**US** This key operates the off-line utilities such as card readers, printers, and magnetic tape transports.

**STX** In CYBER 18-05 configurations, this key is used in the selection of input or output peripherals and in error recovery.

**SO** The SO key increments site address when used with the CONTROL key.

Other function keys that can be assigned special functions include: HERE IS, PAGE PRINT, PRINT ON LINE, PRINT LOCAL, TAPE SRCH, TAPE BACK SKIP, READ TAPE, TAB, TAB SET, INSERT, DELETE, RUBOUT, and ESC.

## Modes of Operation

The 1811-1 conversational display terminal can be operated in two modes: panel or program. In the panel mode, commands affect the operation of the CYBER 18-20 CPU. In the program mode, commands affect the operation of the system software, or controlware.

Operation

The panel mode is used almost exclusively for maintenance. It allows certain registers and memory locations of the CYBER 18-20 CPU to be displayed on the CRT or to be changed or both.

## Applying Power to the CDT

The CDT plugs into a standard electrical outlet and requires no special cooling. To apply power to the CDT, use the following procedures:

1. Depress the POWER switch/indicator. (It should light.)
2. Wait thirty seconds for cursor to appear on the viewing screen.
3. Adjust intensity knob as necessary.
4. Place the CDT in local mode and depress several alphanumeric keys to check display. Place the CDT in on-line mode if this test and the next are passed satisfactorily.
5. If the cursor does not appear after checking brightness (step 3 above), push the red MASTER CLEAR button on the right side of the connector panel. If the cursor still does not register, or if key depressions for characters or cursor controls fail to register, call your instructor for assistance.

# Check Your Understanding

DIRECTIONS: Complete the following statements.

1. The switch which determines the speed at which data can be sent and received is the _____ switch.

2. In order for the CHARACTER/LINE/BLOCK switch to work, the _____ switch must be activated.

3. When the communications interface is ready to receive data, the _____ signal lights.

4. MASTER CLEAR is located on the rear/front (circle one) panel of the CDT.

5. Located on the rear panel, the toggle switch called CB1 functions as a _____.

6. The CDT keyboard has four sets of keys: data entry keys, operation keys, _____ keys, and _____ keys.

7. The key that erases all data from the display screen and resets the cursor at the beginning of the first line is called the _____ key.

8. The key that positions the cursor at the upper left corner of the display screen and destroys no data is called the _____ key.

ANSWERS

1. HIGH RATE/300/LOW RATE    2. FORMAT    3. CO    4. Rear
5. Circuit breaker    6. Function, transmission control    7. CLEAR
8. RESET

# Block 3

# Maintenance Concepts

# Problem-Solving Sequence

Each year, the computer industry introduces faster and more sophisticated equipment. Customers shorten their deadlines and increase their real-time applications and work-loads. All of this requires the customer engineer (CE) or computer technician to repair complicated equipment more quickly than ever before. In such a world, a good problem-solving method is essential.

Most successful problem-solving methods can be broken down into the four following important steps:

    I.    Recognize that a hardware problem exists.
    II.   Define the problem and gather information.
    III.  Isolate the suspected cause of the problem.
    IV.  Fix the problem and verify that the system works.

In this text, suggestions for accomplishing each of these steps are explored.

## I.  Recognizing the Problem

First, start with a positive attidude. More than one problem has remained unsolved because the person solving it became frustrated, irritated, and impatient. You must want to solve the problem and you must believe that you <u>can</u> solve it. Your mental emphasis should be on your overcoming the challenge posed by the problem. A good attitude will improve your customer relations and will lessen the likelihood of your dismissing a real problem as a product of an operator's imagination or incompetence.

Second, have respect for the opinions and observations of those reporting the problem. They work with the equipment daily and are likely to be honest and reliable in describing what they perceive as going wrong. They may not know what the cause of the problem is, but they will know what the symptoms are.

Third, verify that a problem exists. Sometimes a person sees a problem where none exists; more rarely, intermittent failures may be caused by shock or change in voltage, temperature, or humidity. Verify the problem by determining what is really happening and comparing this to what should have happened. If the system is not performing up to expectations, a problem exists.

At this point, a CE with experience might feel that the problem is likely to be a malfunction in one of a small number of components. If so, that CE might go directly to step IV and test out this analysis by replacing the suspected bad component and then checking

In isolating a problem, use the information gathered in step II to identify whether the problem is mechanical or electrical. If it is electrical, use an oscilloscope to look for a bad signal. Any signal that you cannot fully explain in terms of rise, fall, amplitude, duration, and rate of repetition may be a bad signal. Trace the bad signal back to the failing component.

If you ever run out of ideas and feel hopelessly stuck, consider these tactics:

- First, define the problem so that you do not run in circles.
- Go back to the beginning of step II, if necessary.
- If you have multiple problems, attack another problem.
- Re-examine your basic assumptions.
- Try getting a fresh approach from somebody else.
- Try completely removing yourself in order to approach the problem from a new angle.
- Try anything, including going to the restroom, going out to eat, or just putting the problem aside for a short while. Many times this will give your mind the rest needed to develop a clearer approach.

When you identify what you consider to be the likely cause of the problem, go on to step IV: fix it.

## IV. Problem Fixing and Verification of Approach

Once you have isolated the cause of the problem, repair or replace the component at fault. Then verify that this has solved the problem. Rerun the program that resulted in the symptoms of the malfunction to ensure their absence. If the problem was electrical, check with an oscilloscope to see if the bad signal is now good.

You must do more than convince yourself that the problem has been banished. You must also convince the customer. The operator must be satisfied that the system is once again functional. Have that person perform operations on the system in your presence; stay until you are told that everything is back to normal. If the problem has not been repaired, go back to the beginning of step III.

## Summary

The following is an outline of the problem-solving sequence described in this text:

I.  Recognize that a hardware problem exists.
    a.  Begin with a positive attitude.
    b.  Respect the observations of those reporting the problem.
    c.  Verify that a problem exists.

II.  Define the problem and gather information.
   a.  Observe occurrences of the problem.
   b.  Use available reference manuals when necessary.
   c.  Use diagnostic programs.
   d.  Examine your assumptions.
   e.  Describe the exact problem.
III. Isolate the suspected cause of the problem.
   a.  Limit yourself to one problem.
   b.  Conduct a detailed analysis of possible causes.
   c.  Identify the most likely cause.
   d.  If no cause is apparent, begin again at step II.
IV.  Fix the problem.
   a.  Repair or replace the suspected component.
   b.  Verify that the system functions correctly.
   c.  Have the operator verify that the system functions correctly.
   d.  If the problem is not corrected, return to step III.

# Maintenance Concepts

This text gives you a background in troubleshooting a computer device. It shows how a computer is designed with maintainability in mind and introduces you to the tools that will aid you in troubleshooting. It also compares the relative maintainability of discrete logic versus integrated circuit hardware.

## General Design Factors

Engineers and technicians who design a computer system or a peripheral device must weigh many factors in their overall design. When designing a CPU, for example, they must consider whether it will be used for business data processing, scientific applications, or industrial control. They must weigh the cost of the system versus its capabilities. And they must consider maintainability: Can the system be fixed easily and quickly by a technician? Maintainability is important because a customer wants computer equipment that will operate with very little down time. Three design factors that influence maintainability are access to hardware, diagnostic software, and troubleshooting aids.

### Access to Hardware

Hardware must be designed to provide optimum access to components and subassemblies. (See figure 3-1.) Doors and snap covers should be positioned to allow easy access. Logic assembly also affects access. A plug-in logic module is easier to remove and replace than one soldered into the logic circuits. Remember that the more inaccessible the hardware, the greater the time required to repair a fault.

### Diagnostic Software

A computer system is a complex arrangement of hardware. If a failure occurs somewhere in the system, it would be impractical to troubleshoot each part using an oscilloscope and a meter to isolate the problem. Diagnostic software isolates failures much more efficiently. Diagnostic software consists of a series of tests that individually analyze the operation of each part of the system. For example, one diagnostic test checks the printer. When executed, this test generates a series of commands from the CPU to the line printer; these commands determine if a failure exists in the line printer by simulating the tasks the printer performs during normal operation and verifying that the printer is functioning properly. Another diagnostic test is a memory test that writes data into memory and reads it back to verify that the memory section is functioning properly.

Core memory
power supply
input AC fuse

Backplane

±15/±12 VDC
power supply
(PS2)

+5 VDC
power supply
(PS1)

Power
supply
mounting
frame

Power supply
main power
circuit breaker

CB1
Circuit
breaker

CB2
Circuit
breaker

Power
distribution
box
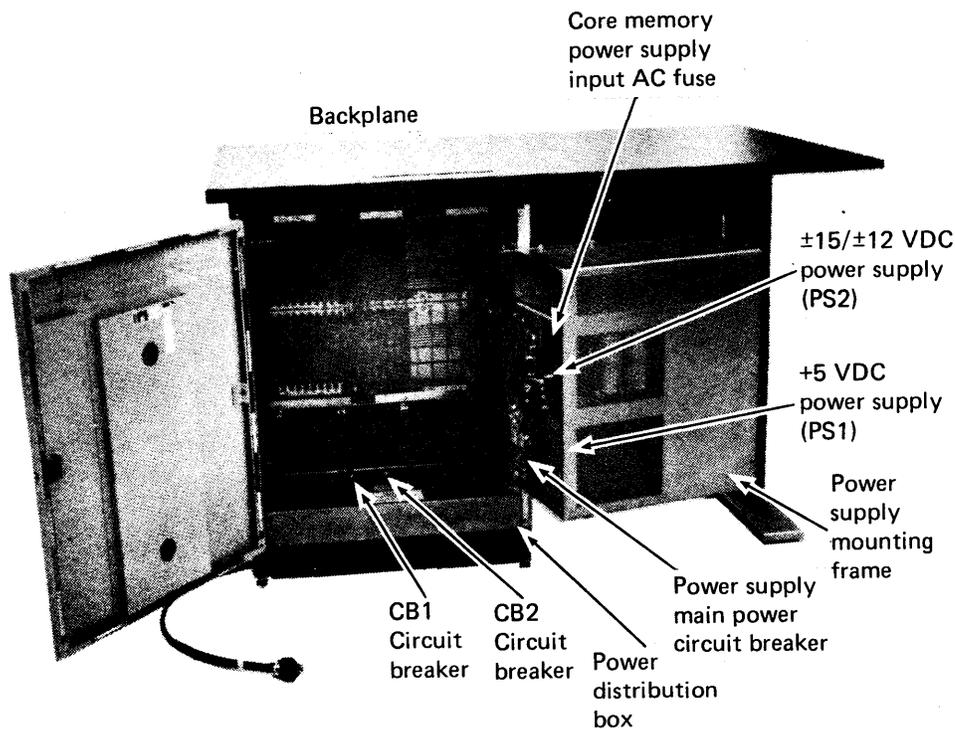
Figure 3-1. Accessibility of Hardware
in the CYBER 18-10M

## Troubleshooting Aids

In troubleshooting, technical manuals assist in isolating failures or making adjustments
in a device. Some manuals include logic diagrams, explanations of peripheral mechanics,
or proper maintenance procedures; still others explain how to program the computer or
interpret the results of the diagnostic tests. These manuals are regularly updated as
computer technology advances and are made available when the computer is installed.
Reference manuals required to troubleshoot problems and make adjustments on the
CYBER 18 system will be made available to you as needed.

## Discrete Component vs. Integrated Circuit Design

Digital computer design has evolved from the use of vacuum tube circuits to the use of
transistor logic. Transistor logic circuits are called discrete logic circuits, meaning that
discrete components such as transistors and resistors must be placed individually on
logic boards. Each board contains a limited number of discrete components. (See fig-
ure 3-2.) If too many components are placed on a given area of a board, they dissipate

excessive heat, which interferes with efficient operation. Computers with many thousands of discrete components require a large cooling system to keep the logic at required operating temperatures. Overall size is further increased because the discrete logic assemblies are themselves large. Usually, discrete logic is divided into small logic boards with, for instance, only one to eight logic functions per board. Many of these boards are required in the arithmetic section of a computer.
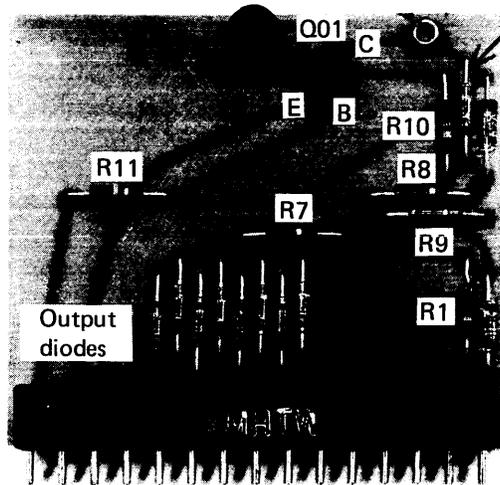


Figure 3-2. 1604 Computer Circuit Card

As a technician working with discrete components, you will need both a thorough understanding of the processor and ample time to pinpoint a failure on a specific logic board. This, in turn, will mean undesirable down time for the customer.

Integrated circuit (IC) technology, however—the latest stage in computer evolution—significantly reduces the problem of down time. It offers the advantage of placing a large amount of circuitry in a relatively small area. Whereas discrete logic construction involves individually placing separate transistors, resistors, and other components on a logic board, integrated circuit packages include all of these components in one small housing or chip. These packages generate little heat and can therefore be tightly placed on logic boards. Furthermore, they make modular construction possible. IC technology allows, for example, the entire arithmetic section of a CPU to be contained on one board. The entire CPU may require only a few such boards to perform all of its functions. Figure 3-3 shows a memory interface board.
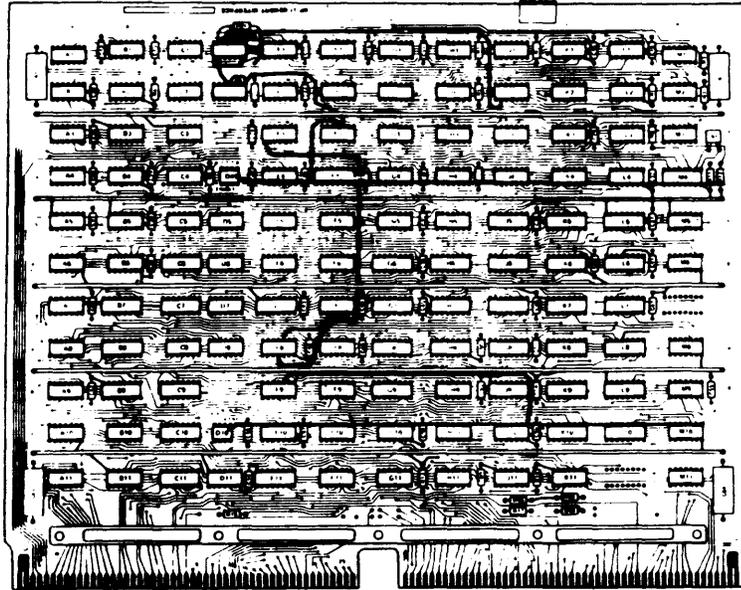
Figure 3-3. Memory Interface IC Board

A discrete logic computer requires you to isolate a failure on one of several hundred boards. A computer using integrated circuits and modular construction, however, can be repaired by replacing one of a small number of modules. Modular construction, with its benefits in maintenance, is also available in newer peripheral devices. Older peripherals required the disassembly and reassembly of mechanical parts, but newer designs allow for modular substitution of mechanical assemblies. The customer attains greater use of the computer system because problem isolation and repair require less time.

## Summary

In designing a computer, engineers and technicians keep in mind three factors affecting maintainability:

- Physical ease in accessing components
- Availability of diagnostic software to isolate system failures
- Availability of troubleshooting aids—reference manuals—in isolating problems

The growing use of integrated circuits and modular construction (as opposed to discrete components) results in speedier problem isolation and repair.

# Block 4

# Operational Diagnostic System (ODS)

# Operational Diagnostic System

One of the maintenance aids available to you as a computer technician is diagnostic software. This software consists of a series of test programs that can be used to verify the operation or isolate a failure of a computer system. Each test program analyzes the operation of a single functional block of the system, such as the card reader or CPU memory.

In this text, you will examine:

- The three types of diagnostics
- Operating procedures for running tests
- Keys and functions used in operating tests
- Level I and level II commands for tests
- The control of tests and their run parameters

## Three Types of Diagnostics

The diagnostic software used on the CYBER 18 system is called the "operational diagnostic system" (ODS). The ODS operates the CYBER 18 central processor and peripheral equipment in a way that brings to light system failures. To isolate the exact problem, appropriate hardware maintenance manuals containing diagnostic decision logic tables (DDLTs) are used.

The ODS was designed to satisfy the following goals:

- To isolate a fault at the level of a replaceable electrical subassembly or mechanical component
- To detect 100 percent of solid failures (problems that appear every time the equipment is used)
- To detect 90 percent of transient failures (problems that appear occasionally as the equipment is used)
- To assist the field service maintenance engineer in isolating and repairing 80 percent of all failures within two hours

The ODS software is composed of three types of diagnostics: loadcheck, level I test diagnostics, and level II monitor and test diagnostics.

## *Loadcheck (LODCHK)*

The loadcheck routine is a stand-alone dead start program that performs the following functions:

- Checking the microinstructions of the CYBER 18 processor by executing a selected set of macrolevel instructions
- Checking all available memory (up to 32K)
- Checking the load path to ensure that further diagnostic tests can be loaded into the CPU
- Checking the operation of the conversational display terminal (CDT)
- Loading level I programs and/or level II monitor

The loadcheck program is always the first ODS program loaded. Other tests will not load until this test has been executed successfully.

## *Level I Test Diagnostics*

Level I diagnostics are stand-alone diagnostic tests. Each test is executed independently of all others. The operator decides which test to load and execute and enters the appropriate test mnemonic on the conversational display terminal. Refer to table 4-1 for a list of the various level I tests available. This table gives a brief description of the functional block evaluated by each test.

The operator has the ability to modify certain conditions of test execution. These test conditions are called "parameters." A parameter allows the operator control over how a test is executed.

## *Level II Monitor and Test Diagnostics*

Level II tests are more complex diagnostic tests. They frequently test external devices on a CYBER 18 system. The level II monitor, rather than being an operating system, is responsible for the complete control of the ODS level II system. Once loaded into memory, the monitor:

- Provides machine-operator interface
- Loads level II diagnostic tests
- Controls parameter display and entry
- Controls error handling and error display
- Controls test execution (section selection, multiplexing, pass count control, repetition of sections and subsections, halts, and abortion of tests)
- Handles I/O messages
- Provides interrupt handling
- Offers utilities (such as code conversion)

TABLE 4-1
System Test Overview

| Equipment Tested | Test Mnemonic | Action Code ID | Prog. Diag. Level | No. of Test Sects. | Comments |
|---|---|---|---|---|---|
| Microprocessor load path | LDCHK3 LDCHK5 | — — | I | 6 | Loads level I programs or level II monitor after ensuring that instructions, memory, and load path are functional |
| Microprocessor | MPINS | 01 | I | 9 | Instruction test |
| Microprocessor | MIMEM | 02 | I | 2 | Tests optional READ/WRITE micromemory |
| Microprocessor | PAGE1 | 03 | I | 5 | Memory paging file test |
| Microprocessor | MPMOS | 04 | I | 6 | MOS memory storage and addressing tests |
| Microprocessor | MOSMA | 24 | I | 4 | MOS memory parity protect bit and bank error correction tests |
| Microprocessor | MPMEM | 05 | I | 5 | Macromemory test (core) |
| Microprocessor | MPRTC | 06 | I | 5 | Protect system and interrupt test |
| Microprocessor | MIINS | 0E | I | 8 | Tests microinstructions not used by emulator |
| CC614 Conversational display terminal (CDT) | LIAT2 | 07 | I | 9 | Comment device |
| FH301-A card reader/ line printer controller | CRECO | 08 | I | 4 | Echo test |

TABLE 4-1 (cont'd.)

| Equipment Tested | Test Mnemonic | Action Code ID | Prog. Diag. Level | No. of Test Sects. | Comments |
|---|---|---|---|---|---|
| Magnetic tape | CASEC | 0C | I | 6 | Echo test, A/Q data test |
| Cassette controller FA 104-A | CASET | 1C | II | 10 | Drive test |
| Magnetic tape cassette drive BE602-A | CASEM | 1D | II | 1 | Multiplex test |
| CYBER 18-30 Timeshare and 2552 CP/MLC | DUCPU | 0D | I | 9 | Dual CPU configurations. Test always loaded into CPUB |
| Storage module drive interface storage disk adapter 1833-1/2 | SMDDA | 20 | I | 4 | Tests DA board only; no CU/33 required |
| Storage module drive interface storage module control unit | SMDCU | 21 | I | 4 | Tests control unit only; no drive required |
| Storage module disk drive BJ701 | SMD01 SMDUT | 22 22 | I I | 11 2 | SMD drive test Utility for SMD |
| CB104 card reader | CR104 CRUT1 CRUT2 C104M | 11 16 17 18 | II II II II | 5 2 1 1 | 300 or 600 cards/ minute Multiplex test |
| CL408 line printer | LP408 L408M | 12 1A | II II | 7 1 | 300 lines/minute Multiplex test |
| Magnetic tape subsystem: BW101-A/BW301-A Magnetic tape transports, FA107-A Magnetic tape controller | LCTTA LCTTB LCTTM | 13 14 19 | II II II | 2 12 2 | Self-test NRZI, 7/9 TK, 25 IPS Multiplex test |

TABLE 4-1 (cont'd.)

| Equipment Tested | Test Mnemonic | Action Code ID | Prog. Diag. Level | No. of Test Sects. | Comments |
|---|---|---|---|---|---|
| Flexible disk controller FA730-A and flexible disk transport BR803 | FDSKA | 1F | II | 12 | 1833-5 controller 1865's (50 & 60 Hz) transports |
| | FDSKM | 38 | II | 1 | Multiplx test |
| | FDSKU | 1F | II | 1 | Utility |
| FJ441 dual channel communica-tion line adapter | CLA2A | 15 | II | 12 | Controller test |
| | CLA2M | 1B | II | 1 | Multiplex test |
| Conversa-tional display terminal (CDT) | LIAT1 | | | | |

Refer to table 4-1 for a list of the various level II tests available and an explanation of the functional area tested by each.

## Operating Procedures

Tables 4-2 and 4-3 show the general operating procedures for the ODS.

TABLE 4-2
Loading Procedures, Loadcheck, and Level I Tests

| Procedures | Methods | Comments |
|---|---|---|
| Load input device | Insert diskette into floppy disk drive unit and close cover. | Make sure notch on diskette is facing toward unit and is on bottom half of edge surface. |
| Master clear | 1. Depress clear button on CDT display keyboard.<br><br>2. Depress STOP, MASTER CLEAR buttons on CPU operator panel. | |
| Load LODCHK routines and level I tests | Depress DEAD START button on CPU operator panel. | LODCHK requires about twenty seconds to run to completion. The display will indicate the following:<br>123456<br>MPINS? |
| Select test | 1. Enter name of test desired, followed by a (CR), or<br><br>2. enter GO (CR) to run the test that has just appeared, or<br><br>3. enter NO (CR) to load the next test. | (CR) = CARRIAGE RETURN button on CDT keyboard.<br><br>If a test is found, it will be automatically loaded and executed. tstnm? should appear at the comment device after next test has been loaded. |

TABLE 4-3
Level II Loading Procedures

| Procedures | Methods | Comments |
|---|---|---|
| Load input device | Insert diskette containing LODCHK and monitor in load device and close cover. | Make sure notch on diskette is facing toward unit and is on bottom half of edge surface. |
| Master clear | 1. Depress CLEAR button on CDT display keyboard.<br><br>2. Depress STOP, MASTER CLEAR buttons on CPU operator panel. | |
| Load LODCHK routines and Level II monitor | Depress DEAD START button on CPU operator's panel. | LODCHK requires about twenty seconds to run to completion. When complete, the display will contain the following:<br>123456<br>ODS 2.0 VOL 1 |
| Manual Interrupt | Depress the CONTROL and BEL buttons simultaneously on the console keyboard, or MANUAL INTERRUPT on the CPU operator panel. | The message MI is displayed on the CRT screen. |
| Load test | 1. Type: ODS, LOAD, tstnm<br><br>2. Press CARRIAGE RETURN on the CDT keyboard. | 1. The test specified by tstnm will load and suspend. If the specified test is not found, an error message is issued. |

*Note: MANUAL INTERRUPT must be performed before entering commands.

TABLE 4-3 (cont'd.)

| Procedures | Methods | Comments |
|---|---|---|
| | | 2. When the test is loaded the following message is issued:<br>    tstnm SUSPENDED LOAD |
| | | 3. As many tests as memory allows can be loaded by repeating the load command. ODS error message II is issued if memory is exceeded. |
| Execute the test | 1. Type: ODS, GO, tstnm<br><br>2. Press CARRIAGE RETURN.<br><br>    -or-<br><br>1. Type: ODS, GO<br><br>2. Press CARRIAGE RETURN. | Starts execution of suspended test specified by tstnm.<br><br><br><br><br>Starts execution of all suspended tests. |
| Load and execute | 1. Type: ODS, LDGO, tstnm<br><br>2. Press CARRIAGE RETURN on console keyboard. | The LDGO command is used only when no parameter changes are desired. |

The normal procedure for loading LODCHK and level I tests is as follows:

## 1.  Insert Floppy Disk

Insert the flexible disk containing the ODS tests into the floppy disk loading device.
Note position of notch on diskette; insert with notch on the bottom.  Do not force disk-
ette.  Once it rests in drive, close door until it is latched securely.  (See figure 4-2.)
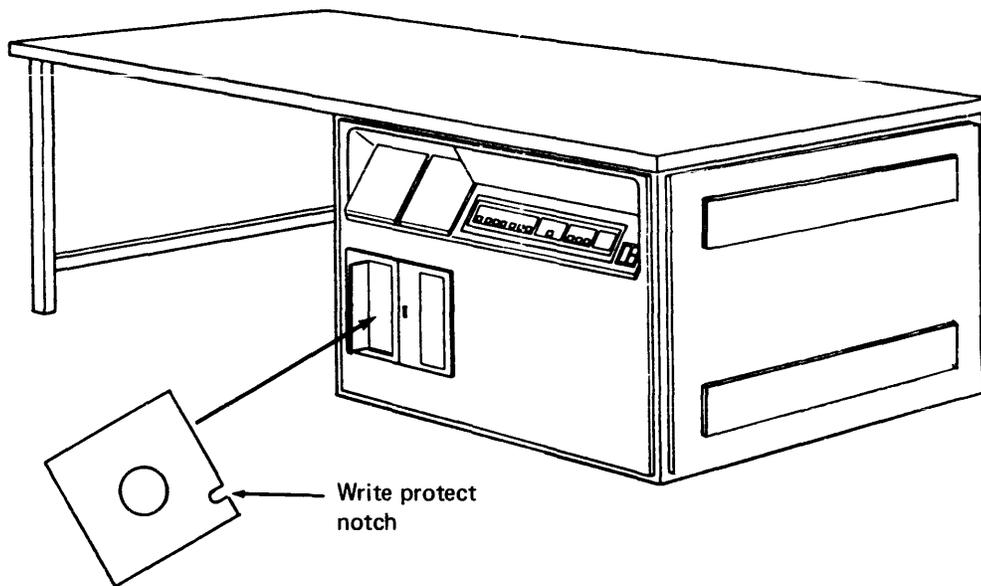
Figure 4-2  Insertion of Floppy Disk

## 2. Set Panel Controls

Clear the conversational display terminal (CDT) by depressing the CLEAR switch on the keyboard. On the CPU operator's panel, depress these switches in order: STOP, MASTER CLEAR, DEAD START. (See figure 4-3.)
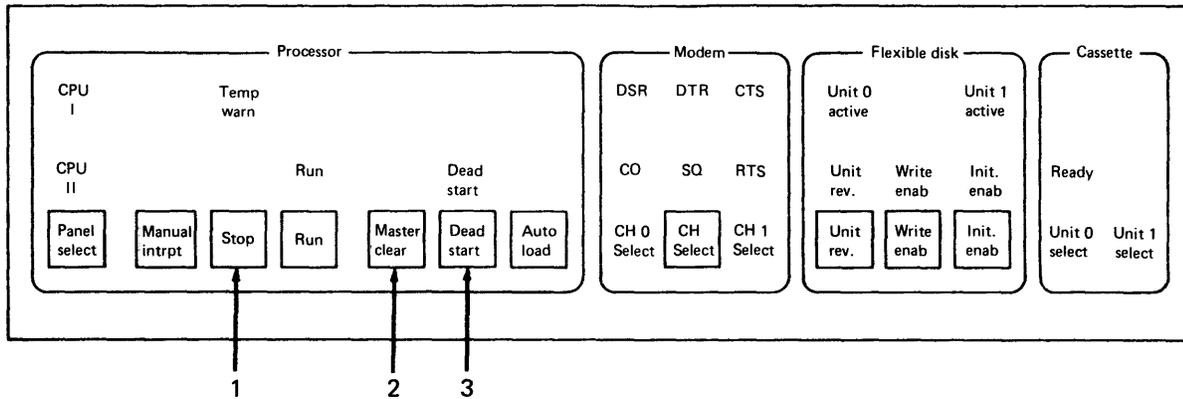


Figure 4-3. Setting Panel Controls

## 3. Run LODCHK

LODCHK will load from the diskette and be the first system diagnostic to run. About twenty seconds elapse before LODCHK is completed. This test checks all microinstructions, memory, and the load path, to ensure that other diagnostic tests can be loaded. After LODCHK has been completed, the display screen will appear as shown in figure 4-4.
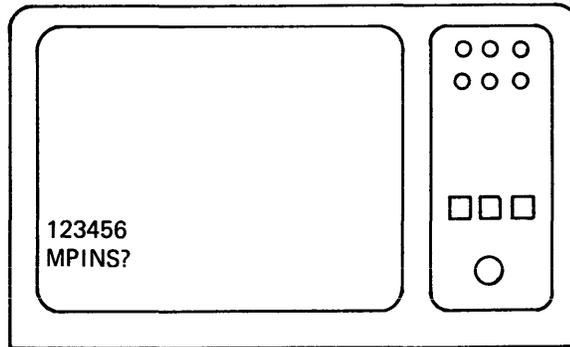
Figure 4-4. CDT Display at LODCHK Completion


## 4. Load Desired Level I Tests

It is now possible to load and execute any of the level I diagnostic tests. The display MPINS? asks whether you wish to load and execute the microprocessor instruction test. To do so, type GO on the CDT keyboard and press CARRIAGE RETURN. If you wish to load and execute another level I test, type the test's name. When CARRIAGE RETURN is depressed, the test is executed as shown in figure 4-5. Note that, after completion of an entry and depression of CARRIAGE RETURN, the display on the CDT is moved up one line. This allows the bottom of the screen to show the latest entry.


## 5. Set Operating Parameters

Each level I test operates under a set of restrictions or parameters. For example, if a macromemory test (MPMOS) is loaded and executed, the amount of memory to be tested must be considered. It is possible to test all or some of the available memory. To tailor tests to individual needs, other operating parameters of tests may also be changed. The following is an example of a macromemory test or MPMOS. It will be loaded and executed with typical displays and entries shown to give you some idea of how parameter changes are made. Let's begin with our original display and make an entry of MPMOS and CARRIAGE RETURN. (See figure 4-6.)

ODS



Operator entry

123456
MPINS?
GO (CR)

Load and
execute MPINS test

or



Operator entry

123456
MPINS?
CRECO (CR)

Load and execute
CRECO test
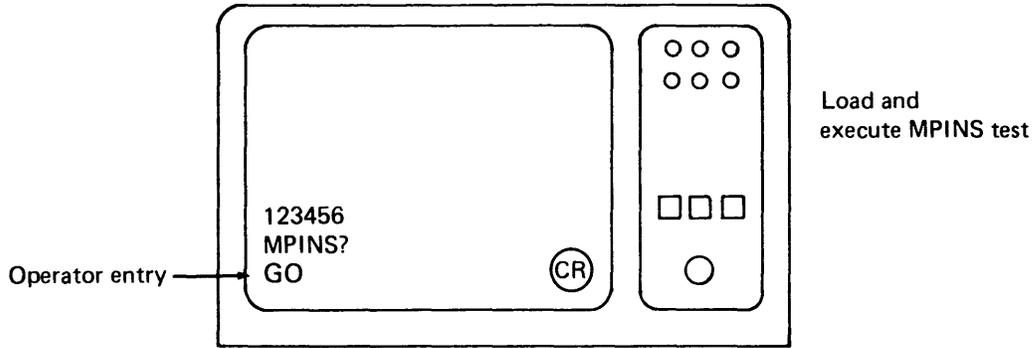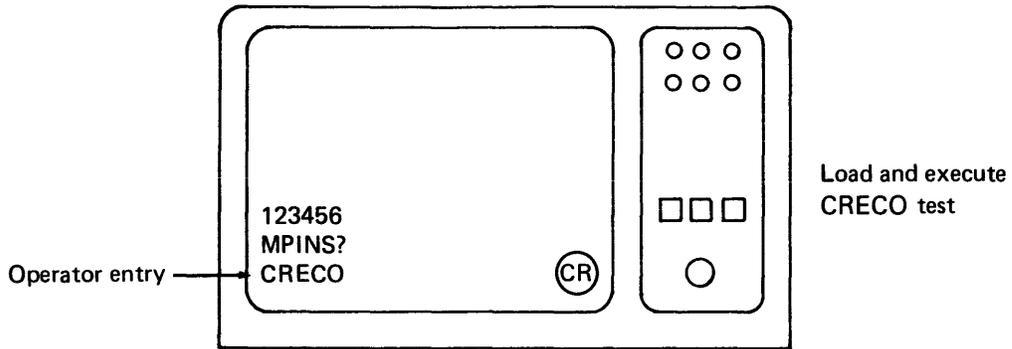
Figure 4-5. Loading Level I Tests



Operator entry

123456
MPINS?
MPMOS

Type: MPMOS (CR)
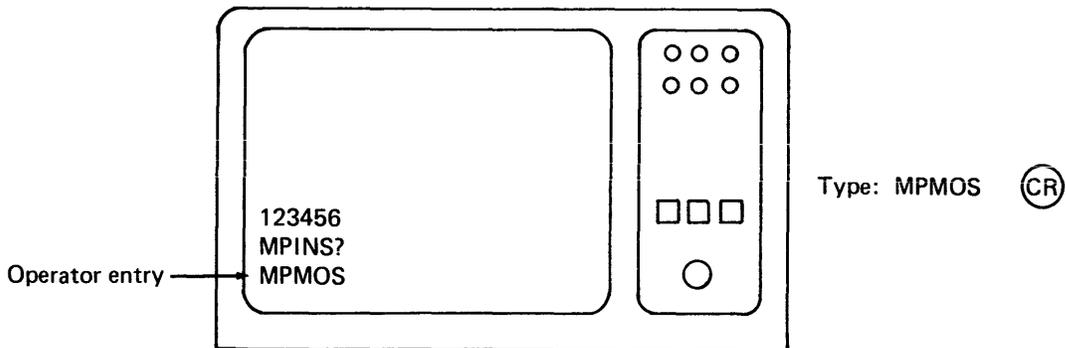
Figure 4-6. Setting Operating Parameters

Once this entry has been made, the MPMOS test loads from the diskette into processor memory. Then the following (as shown in figure 4-7) is displayed:
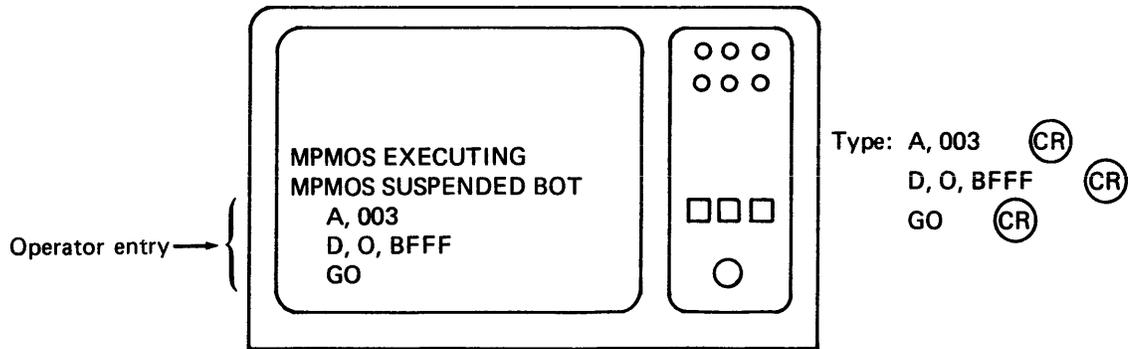


Figure 4-7. Setting Operating Parameters

The entries made in response to the display in figure 4-6 are as follows:

A, 003  (CR)

This parameter is used by the operator to specify the number of available 16K blocks of memory. "A" indicates the type of entry made, while "003" indicates that there exist three 16K blocks of memory (or 48K) to be tested.

D, O, BFFF  (CR)

This parameter is used to specify the maximum address available in memory to be tested. "D" indicates that a stop address is being specified. "O" indicates that this is a single processor rather than a dual processor. In this example, "BFFF" shows the maximum address that can be accessed in memory.

GO  (CR)

This entry indicates completion of the parameter entries and a request to resume the MPMOS test. This test will now be executed under the parameter restrictions specified.

Once the test begins execution, it will stop again and display the contents shown in figure 4-8.
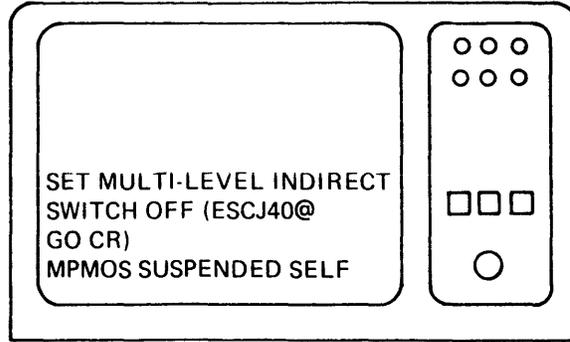
Figure 4-8. Setting Operating Parameters

A response to this display is made as indicated in figure 4-9. This entry will indicate to the test that indirect addressing of memory is not allowed.
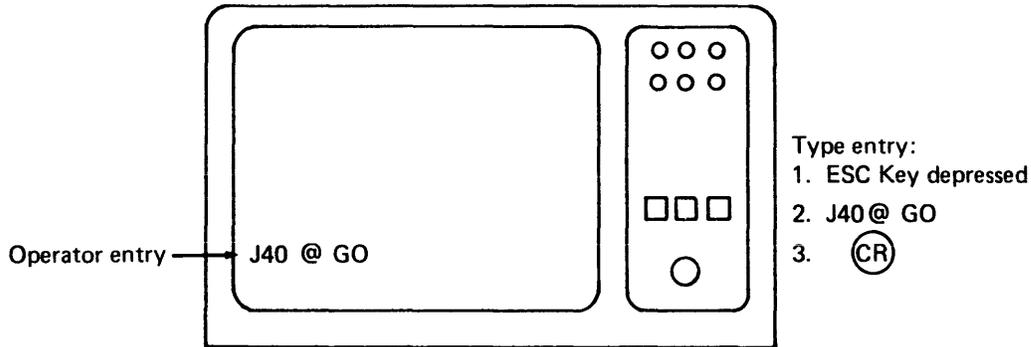


Figure 4-9. Setting Operating Parameters

## 6. Execute Test

Continuing with our example, we find that the MPMOS test will now be properly executed. As each section of the test is executed, the display so indicates. After the test has completed all sections, the contents of the display are as shown in figure 4-10.

## 7. Complete Execution

In our example, the only operation that must be accomplished to complete the execution of the MPMOS test is to set the multilevel indirect switch ON. Entry on the keyboard is made as shown in figure 4-11.

```
┌─────────────────────────────────────────────────┐
│  ┌────────────────────────────┐   ┌───────────┐  │
│  │ MPMOS SECTION 0001         │   │  O O O    │  │
│  │ MPMOS SECTION 0003         │   │  O O O    │  │
│  │ MPMOS SECTION 0004         │   │           │  │
│  │ MPMOS SECTION 0005         │   │           │  │
│  │ MPMOS SECTION 0006         │   │           │  │
│  │                            │   │           │  │
│  │ MPMOS COMPLETED 0001 PASSES│   │  □ □ □    │  │
│  │ SET MULTI-LEVEL INDIRECT   │   │           │  │
│  │ SWITCH ON (ESCJ42 @ GO CR) │   │    O      │  │
│  │ MPMOS SUSPENDED SELF       │   │           │  │
│  └────────────────────────────┘   └───────────┘  │
└─────────────────────────────────────────────────┘
```
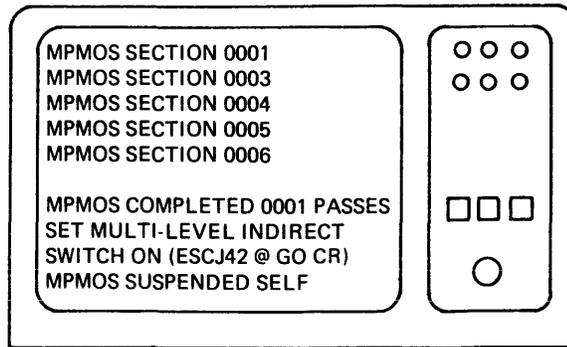
Figure 4-10. Executing the Test

```
┌─────────────────────────────────────────────────┐
│  ┌────────────────────────────┐   ┌───────────┐  │
│  │                            │   │  O O O    │  │
│  │                            │   │  O O O    │  │
│  │                            │   │           │  │
│  │                            │   │           │  │
│  │                            │   │  □ □ □    │  │
│  │                            │   │           │  │
│  │     J42@GO                 │   │    O      │  │
│  └────────────────────────────┘   └───────────┘  │
└─────────────────────────────────────────────────┘
```

Operator entry ────► J42@GO

Type entry:
1. ESC Key depressed
2. J42@GO
3. ⓒⓡ
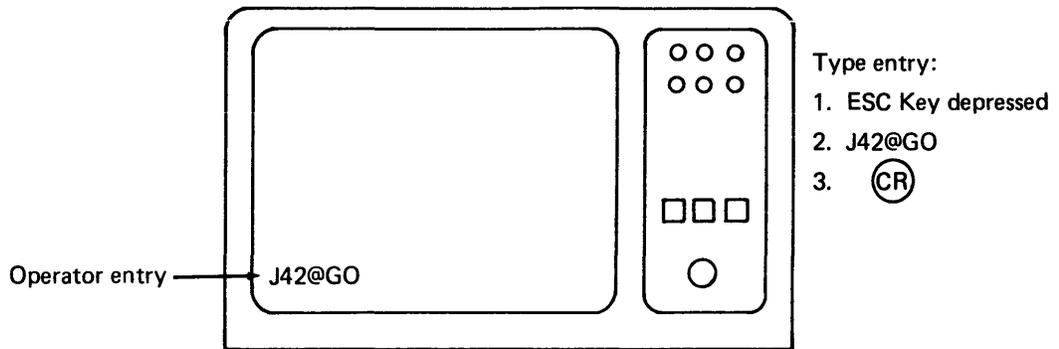
Figure 4-11. Completing Test Execution

The test now terminates, with the display containing the contents shown in figure 4-12.

```
┌─────────────────────────────────────────────────┐
│  ┌────────────────────────────┐   ┌───────────┐  │
│  │        .                   │   │  O O O    │  │
│  │                            │   │  O O O    │  │
│  │                            │   │           │  │
│  │                            │   │           │  │
│  │ MPMOS TERMINATED           │   │  □ □ □    │  │
│  │ 0000 ERRORS                │   │           │  │
│  │ MOSMA?                     │   │    O      │  │
│  └────────────────────────────┘   └───────────┘  │
└─────────────────────────────────────────────────┘
```
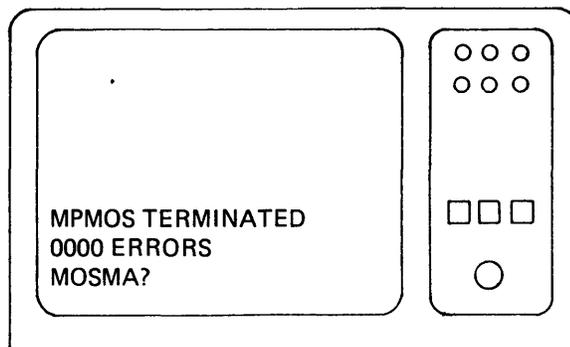
Figure 4-12. Test Completion Notation Plus Next Diagnostic in Sequence

This display informs the operator that MPMOS terminated with zero errors. The display also indicates that MOSMA may be loaded and executed next. If desired, a different level I test may be specified by going through the same procedure used to load the MPMOS test. In other words, a GO and CARRIAGE RETURN can be used to start the test named, or a new test (see table 4-1) can be started by typing its name and pressing CARRIAGE RETURN.

The operator has substantial control over the execution of diagnostic tests. They may be tailored to meet a variety of specific applications.

## Keys and Functions Used in Tests

The operator can use special keys, buttons, commands, and functions to execute, modify, and terminate tests, and to diagnose errors. For further information on error diagnosis and special functions, refer to "ODS Messages and System Malfunctions" (Section 9) in the "CYBER 18 Hardware Maintenance Manual."

The following keys or buttons on the CDT or the processor panel have specific functions for use in the ODS. All other special keys are illegal, and indeterminate actions may occur as a result of their use.

**SLASH (/)** This key is used to correct errors made when entering commands and parameters on the keyboard. It can correct any field (the portion of an entry between commas) where an error has been made, except for the ODS portion of level II commands. When an error is caught in a field, the operator simply types a slash and enters the correct field values. If an error has occurred in an earlier field, the RUBOUT/ LINE FEED and CARRIAGE RETURN must be used to cancel the complete line. For example:

> 5, 148c/1486 for level I tests.
> ODS,LAOD/LOAD,TESTA for level II tests.

**RUBOUT/LINE FEED** Ⓒ Ⓡ These keys, when followed by CARRIAGE RETURN, are used to correct whole lines or any error that cannot be handled by the slash. For example:

> ODS, LAOD, CR104 entered from the keyboard

> To correct, press RUBOUT/LINE FEED, followed by CARRIAGE RETURN, and re-enter the correct command.

> ODS, LOAD, CR104

**CARRIAGE RETURN** ⓒⓡ  This key is used to send commands to the system.

**CONTROL/BEL**  When pressed simultaneously, these keys cause a manual interrupt for level II commands.  If the interrupt is successful, the level II monitor displays an MI on the terminal or types it on the teletype.

**ESC and @**  The ESC key places the computer in panel mode, which prevents messages from being displayed.  If the computer is in panel mode, a user may think the system is busy.  If the ESC key is depressed accidentally, the condition may be rectified by pressing the @ key on the keyboard; this takes the computer out of panel mode.

**BREAK**  This key unlocks the keyboard.  If the red light labeled "alert" or the yellow light labeled "lock" is on, no keyboard entries on the CDT will be accepted.  Pressing the BREAK key will clear this condition.

## Processor Panel Buttons

**MANUAL INTRPT**  This button functions the same as the CONTROL and BEL keys, when pressed simultaneously.

**STOP**  This button halts the CPU and extinguishes the RUN light; pressing it is the same as typing HG while in panel mode.

**RUN**  Pressing this button (similar to typing IG while in panel mode) starts a system macrorun.  When the CPU is running, the RUN light is on, and when a macrohalt condition is encountered, the RUN light goes out.

**MASTER CLEAR**  This button is used for preparing the system for dead start; it halts the CPU and clears registers.

**DEAD START**  This button starts the hardware-controlled loading of the software.

## Commands Used in Tests

## Level I Commands

Level I of the ODS supports the following types of commands:

- SKIP
- GO
- NO

- tstnm
- CPAR (change parameters)
- DPAR (display parameters)

**SKIP** The SKIP switch is not a physical switch that can be toggled, but a bit that can be set by the operator in the function control register. Setting the SKIP switch during level I operation causes the system to halt at all possible system halts. The SKIP switch must be turned off before the level II monitor or a level II test is loaded.

Setting the SKIP switch can cause the following possible halts:

- At the end of a section
- At the end of a pass
- At the beginning of a test
- At the end of a subsection
- At the end of a subsection if errors occur
- At a primary error
- At an error

To set the SKIP switch, press the ESCAPE key and type in J26@. To turn the switch off, press the ESCAPE key and type in J22@.

**GO** When any level I test is suspended, the operator can cause the test to continue by entering the command: GO (CR) . When tstnm? appears on the CDT, the GO command is also used to start the loaded test.

**NO** When tstnm? appears on the CDT after a level I test is loaded, the operator may enter: NO (CR) . This causes the next test in the load device to be loaded and tstnm? to be displayed.

**tstnm** (CR) The display tstnm causes the test specified, if it exists on the load device, to be loaded and executed. When the cassette system is used, typing a name for which no test exists causes "ODS error 12" to be reported after the library is searched. In a flexible disk system, the message "Test Not In Directory" will be displayed if a non-existent test name is typed.

**CPAR** When a level I test is suspended, or when tstnm? appears on the CDT, the operator may change the test's run parameters. Run parameters, explained in detail later, control the messages and execution of the test program. They are changed by typing the index of the first word to be changed and the new data values for successive parameter locations. A CARRIAGE RETURN terminates the input string. If illegal values are entered, the parameter list is reissued. Up to thirty-six characters, including blanks, may be entered. All parameters—except the TESTID, PASCNT, and ERRCNT—can be changed or modified. The format for parameter modification is as follows:

h, qqqq, qqqq, qqqq, qqqq, qqqq, qqqq, qqqq (CR)

In this format, "h" is a one- or two-digit hexadecimal number indicating the index value of the first word of the parameter list to be changed and "qqqq" is a one- to four-digit hexadecimal number indicating the data value(s) to be stored in the parameter list. If less than four digits are input, the leading digits are defaulted to 0. The use of run parameters is explained in more detail later.

Two examples of parameter modification follow.

Example 1: If section selection word 3 has data values of 1234 and section selection word 4 has data values of 5678, and the operator wishes to modify the parameters to execute only sections 1, 3, 5, 7, and 8, he or she enters the following after the test is suspended:

    3, 1357, 8000    (CR)

Example 2: If the operator wishes to change run parameters that are not in contiguous locations, two separate entries can be made or, if quicker, the parameter words in between can be repeated. For instance, if the control word (run parameter 1) has hexadecimal value 80 and the operator wants to change it to 2080 and also change the section selection words as in example 1, the changes can be entered in one of two ways. First, the operator can make two separate entries:

    1, 2080    (CR)
    3, 1357, 8000    (CR)

Or, second, the operator can change the parameters by including the existing value of run parameter 2 (assume a value of 0002), thus making only one entry:

    1, 2080, 2, 1357, 8000    (CR)

If the parameter entry is valid, no message is issued. Further, if the section selection parameter words (3 through 6) are selected, the test is restarted. Otherwise, the test resumes execution from the point of suspension.

**DPAR** When a test is suspended, any input by the operator other than a GO or an illegal input causes the test parameters to be displayed or typed out. Typically, the user can cause parameters to be displayed by typing CARRIAGE RETURN. For the format of the parameter display, see figure 4-13.

In addition, parameters can be displayed by entering CARRIAGE RETURN after tstnm? has appeared on the CDT.

When a test is suspended at its beginning, at the end of a section, or at the end of a pass, it can be restarted by setting the P-register to 0000. Restarting can also be accomplished by changing the section selection words in the test's run parameter list.

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | | | | | |

       No CDT—use maintenance panel (level 1 only)*

      Halt at end of section

     Halt at end of pass

    Halt at beginning of test

   Halt at end of subsection

  Halt at end of subsection if an error

 Halt on primary error

Halt on error (primary or secondary)

Repeat subsection

Repeat section

Repeat test

Suppress secondary diagnostic error messages

Suppress all diagnostic error messages

Suppress diagnostic error messages except action codes (primary or secondary)

Suppress all information messages

*If this bit is set, no attempt is made to read or write from the system comment device. When the system needs to write a message to the operator, the system macrohalts and the operator should inspect the A register to determine the message number.

Figure 4-13. Format of Control Word

## Level II Commands

The operator can use two general commands that affect specific level II ODS commands. The first involves setting the SKIP switch, which causes the system to suspend automatically each test at every point where a stop can be set by a control word.

It is important that the operator not leave the SKIP switch set while loading a test into the machine.

The second general command involves interrupting the system. When the operator enters a manual interrupt (by striking simultaneously the CONTROL and BEL keys), the system responds with MI and awaits a command. A slight delay may occur before MI is typed out. If there has been no response after about five seconds, the operator should try again. Once the system has responded with an MI message, all the diagnostics in execution have stopped and will not continue until the input is completed.

The complete formats for all specific level II commands follow. It is absolutely necessary to enter the ODS portion of the command starting at column 1 with no embedded blanks following it. If the ODS portion of the command is entered incorrectly, the system responds with the following message: MI INPUT ERROR. In order to correct the error, the operator must perform a manual interrupt and re-enter the command correctly.

**Load**   This command is used to load a new diagnostic test into the system. (See also LDGO.) The format for this command is (tstnm being the name of the test to be loaded):

   ODS, LOAD, tstnm   (CR)

If the specified test is already in the system, an executive error message is generated. If the test can be found, the system issues the following message:

   LU, yy FAILED xx ssss

The operator must respond to this with

   CU   (CR)

When a test is found, it is loaded and immediately suspended, and this message is issued (tsnm being the test name):

   tstnm SUSPENDED LOAD

**DPAR**   Once a test has been loaded into the machine, an operator may need to look at the parameters currently being used by the test. The DPAR (display parameters) command is used for that purpose. The format is (tstnm being the test name):

   ODS, DPAR, tstnm   (CR)

If the specified test is not currently in the machine, an executive error message is generated. If the test is found, the parameters are displayed or typed out.

**CPAR**   If the operator wants to change the parameters for a specific test, then the CPAR (change parameters) command is used. The format for this is:

   ODS, CPAR, tstnm, x, yyyy, yyyy, yyyy, ...   (CR)

In this format, tstnm is the test name, x is the number of the first parameter to be changed, 1 is the control word, $15_{16}$ is the last word in the parameter list, and y is the data value to be put into the parameter list starting at entry x. There can be from one to four data values entered.

All numbers are entered in hexadecimal and only the first four characters are used. The system issues an error message if the specified test is currently running. If the CPAR request is accepted by the system, there is no response. If the section selection words are changed, the test is restarted when a GO function is entered. A maximum of thirty-six characters may be input before a CARRIAGE RETURN.

**DCW** If the operator wants to display only the control word, then the DCW (display control word) command is used. The format for this command is:

ODS, DCW, tstnm    (CR)

In this format, tstnm is the name of the test or the word MASTER (for the master control word). Figure 4-13 illustrates the control word bit interpretation.

If the system cannot find the specified test, an error is generated. When the control word is displayed, it comes out in the following form:

tstnm CONTROL WORD = xxxx

In this format, tstnm is the name of the test and xxxx is the hexadecimal value of the specified control word.

**CCW** If the operator wants to change only the control word, then the CCW (change control word) command is used. The format for CCW is:

ODS, CCW, tstnm, xxxx    (CR)

In this format, tstnm is the name of the test or the word MASTER (for the master control word) and xxxx is the new control word value to be entered.

If the system cannot find the specified test, or if the new control word value is illegal, an error is generated. If the test name is found and the control word value is valid, there will be no reaction from the system. This command can be used to modify a test's control word while the test is running.

**GO** Whenever a test has been suspended for any reason, it is necessary to tell the system to start the test running again. The GO command does this. Its formats are:

ODS, GO, tstnm    (CR)    (for one test) or
ODS, GO    (CR)    (for all tests currently in the CPU)

In the first format, tstnm is the name of the test that the operator wants to start or continue executing. In the second format, in which no name is specified, all suspended tests in the system are started.

If the specified test is not in the system (first format), or if there are no suspended tests in the system (second format), an error message is generated.

**RSTR** To restart a diagnostic test from the beginning, the RSTR (restart) command is used. The formats for RSTR are:

> ODS, RSTR, tstnm   (CR)
> ODS, RSTR   (CR)

In the first format, tstnm is the name of the test that the operator wants to restart. If no name is specified, as in the second format, then all the tests in the system are restarted.

If the specified test is not in the system (first format), or if there are no tests in the system (second format), an error is generated. When a test is restarted, both the termination and initialization sections are run unless the test's initialization section has not yet been run.

**ABRT** If the operator wishes to stop the execution of a diagnostic and remove it from the system, the ABRT (abort) command is used. The formats of ABRT are:

> ODS, ABRT, tstnm   (CR)
> ODS, ABRT   (CR)

In the first format, tstnm is the name of the test to be aborted. If no name is specified, as in the second format, all of the tests in the system are aborted.

If the specified test is not found (first format) or if there are no tests in the system, (second format), an error is generated.

**LDGO** The LDGO command combines the operation of the LOAD command and the GO command; but with the LDGO command, the test is immediately started (not immediately suspended). The format and error detection are identical to those of the LOAD command. The LDGO command is used whenever the preset parameters of the diagnostic test are acceptable to the operator. It can be very helpful in speeding up operations. The format of LDGO is:

> ODS, LDGO, tstnm   (CR)

In this format, tstnm is the name of the test.

*LIST*  The LIST command is used to list the contents of the test directory on the CDT. This command will list the directory of any ODS flexible disk inserted into the unit 0 drive. This command is only used for the flexible disk system.

# Control of Tests and Run Parameters

As you now realize, you can exercise substantial control over the diagnostic tests. An operator may select sections to be executed in any order; request halts at various logical points during test execution; and request that subsections, sections, and even an entire test be repeated. In addition to controlling the logical flow of the diagnostic test, the operator may alter a number of parameters specific to a particular diagnostic test. The following are the types of changes the operator of the ODS can perform.

*Run Parameter Control*  Test control is realized through individual sets of run parameters. Each test has a stored control word contained within a maximum of twenty-four and a minimum of twelve words of run parameters. The test's run parameters control the execution and messages of the test program. The first twelve words of the parameter list contain standard parameters used by each test. The remaining twelve words contain optional parameters used for special functions.

Each test's run parameters may be displayed and, with the exception of TESTID, PASCNT, and ERRCNT entries, may be modified while the test is suspended. The test control word, however, is modified with the CCW command, even if the test is in execution (in level II only).

Figure 4-14 illustrates the run parameter list format. A description of each word and its bits is given in table 4-4.

*Section Selection*  Each diagnostic test consists of a number of operator-selectable sections. The parameter list of a test contains four section selection words. Each four-bit hexadecimal digit represents a section. Up to fifteen sections (1 through $F_{16}$) may be selected. A zero terminates section selection. The test initialization and termination sections are nonselectable. The initialization section executes whenever a test has to start the device being tested. All selected sections are executed the number of times specified. Sections may be executed in any order.

A test-terminating section, if one exists, is then executed by the monitor at the completion of all specified passes for that test. The termination section performs the necessary clean-up and housekeeping tasks that may be required at the completion of a test (but not at the completion of each pass).

After a test section is completed, it is reported to the monitor. The monitor either transfers control to the next selection section, if any, or to the same section, if the repeat-section flag in the control word is set.
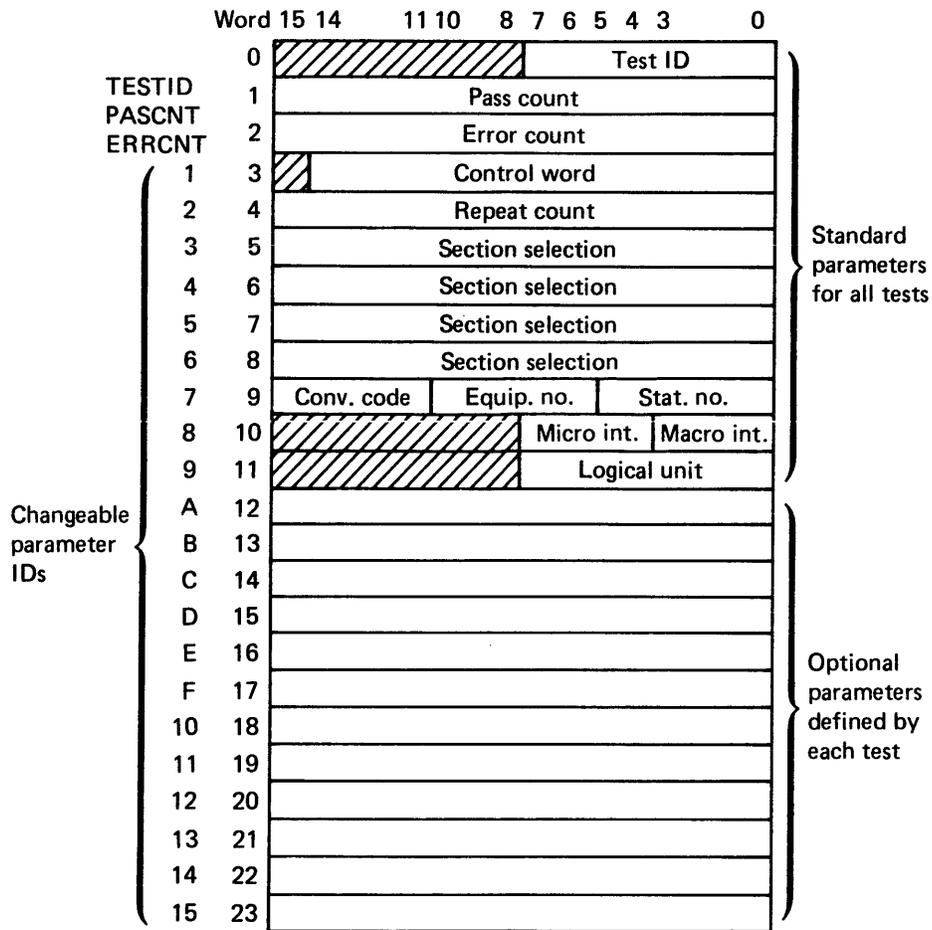
Figure 4-14. Run Parameter List

**Test Repetition** When the last selected section of a test reports to the monitor that it is completed, one pass is considered complete for that test. The monitor then increments the test pass count. If the pass count has reached the specified repetition count for the test, the test is terminated, unless the repeat-test flag in the test control word is set. In this case, the pass count is allowed to exceed the specified repetition count. When a test is repeating, the initialization and termination sections are not executed.

**Section Repetition** Each diagnostic test is composed of a number of repeatable sections. Each section calls a monitor subroutine to control its repetition according to the repeat-section bit in the test control word. In addition, the subroutine determines whether or not the test is to be suspended at the end of the section.

TABLE 4-4
Run Parameter Descriptions

| Run Param-<br>eter ID | Bits | Descriptions |
|---|---|---|
| TESTID | 15 through 8 | Reserved for system expansion. |
| | 7 through 0 | Two hexadecimal digits designating the test identification code. The digits are the leftmost digits of any action code issued by the diagnostic tests. |
| PASCNT | 15 through 0 | Four hexadecimal digits designating the number of passes (times the test has executed). The pass count is incremented by one every time a pass is completed. It is reset to zero whenever a test is restarted. |
| ERRCNT | 15 through 0 | Four hexadecimal digits designating the detected error count of the test executing. The error count is reset to zero whenever a test is restarted. |
| 01 | 15 through 0 | See figure 4-13 for a bit-by-bit description of the control word. |
| 02 | 15 through 0 | Four hexadecimal digits designating the number of times a test is to be repeated. When the pass count equals the test repeat count, the test is terminated. If the repeat-test bit is set (bit 10 of the control word), the repeat count is overridden. The maximum value is 7FFF. |

TABLE 4-4 (cont'd.)

| Run Param-<br>eter ID | Bits | Descriptions |
|---|---|---|
| 03-06 | 15 through 0 | Each hexadecimal digit in the four words going from left to right selects a test section to be executed. These four words describe to the ODS executor the order in which the diagnostic sections are to be run. Each hexadecimal digit is the section number of a section of the diagnostic the operator wishes to execute. Diagnostic test sections execute in the order in which they are selected by the section selection words, reading from left to right, starting with the first selection word. The ODS monitor continues to execute the test sections until all selected sections have been executed or a zero byte is extracted from the selection words. If a section selection is changed by the operator after the test has begun execution, the test is restarted. |
| 07 | 15 through 11 | Converter code of peripheral—zero if not applicable. |
| | 10 through 7 | Equipment number of peripheral. |
| | 6 through 0 | Station number—zero if not applicable. |
| | 15 through 8 | Reserved for system expansion; should be zero. |
| | 7 through 4 | Microinterrupt line number of peripheral—zero if not applicable. |
| | 3 through 0 | Macrointerrupt line number of peripheral—zero if not applicable. |

TABLE 4-4 (cont'd.)

| Run Param-<br>eter ID | Bits | Descriptions |
|---|---|---|
| A-15 | 15 through 8 | Reserved for system expansion, should be zero. |
| | 7 through 0 | Logical unit number—zero if not applicable. |
| | — | Optional run parameters defined by each test. Refer to test descriptions for parameter definitions. |

**Subsection Repetition** Each diagnostic test section is composed of a number of repeatable but nonselectable subsections. Each subsection calls a monitor function to control its repetition according to the repeat-subsection bit in the test control word. In addition, this function determines whether or not the test is to be suspended if an error has been detected in that subsection.

**Multiplexing** Multiplexing, a level II operation only, is the mechanism of transferring control to the various tests in memory so that the processor's time is divided among those tests. This division is accomplished by specifying that a diagnostic test relinquish control to the monitor as soon as it initiates an I/O request. The monitor then schedules the next test in memory that is ready to be scheduled. Because of this scheme, no test is allowed to waste processor time by looping (waiting for I/O completion) while other tests are waiting to initiate their I/O. This scheme approximates an operating system as much as possible. No other mode of multiplexing is employed by the ODS.

**Aborting of Tests** A level I test is aborted by setting the section select parameter word 3 to 0000. The test will then terminate. An alternate method of aborting the execution of a test is to master clear the processor.

When it becomes necessary to abort a level II running test without halting the processor or the system, the following command may be entered after a manual interrupt:

ODS, ABRT, tstnm   (CR)

In this command, tstnm is the name of the test to be aborted.

This command causes the specified test to be halted at the end of either the subsection or section currently being executed, and it causes the termination section (if one exists) to be executed. If the test name is omitted, every executing test is terminated. In order to restart an aborted test, the test must be reloaded.

**Restarting a Test**  To restart a level I test, the P register must be reset to 0 (ESC HG J11G K0000G I@). This can be done by pressing MASTER CLEAR and then the RUN button. However, restrictions for individual tests must be observed.

When a level II test is restarted by the ODS, RSTR, tstnm command, execution is suspended at the end of the next subsection or section, whichever comes first. The termination section (if it exists) is executed, and then the initialization section is executed. The selected test sections are then executed as directed by the section selection words in the test parameter list.

**Master Control Word**  In addition to the control exercised through the parameter list and the SKIP switch, the system supports a master control word. The master control word—a level II operation only—has the same format as the test control word (see figure 4-13). Setting bits in the master control word affects all tests in the system, whereas setting bits in the test control word affects only that test. Whenever the system needs to look at the control word, it does an inclusive OR of the master control word and the test control word.

Figure 4-13 illustrates the test control word of the run parameter list. Table 4-5 contains a description of each of the bits and their functions.

**Parameter Display and Entry**  The method of parameter display is based on setting bit 0 of the control word; 0 is set for program mode display and 1 is set for panel interface mode.

For level I tests, the run parameters may be displayed by pressing the CARRIAGE RETURN key on the consolte keyboard or changed any time the test is suspended. Figure 4-15 shows the format of the parameter display.

**TABLE 4-5**
Descriptions of Control Word Bits and Their Functions

| Bits | Descriptions |
|------|--------------|
| 15 | Zero. |
| 14 | Suppress all informative messages. |
| 13 | Suppress diagnostic error messages except action code. If this bit is set, only the action code portion of an error message is output. |
| 12 | Suppress all diagnostic error messages. If this bit is set, no diagnostic error messages are output to the CDT. |
| 11 | Suppress secondary diagnostic error messages. |
| 10 | Repeat test. If this bit is set, the test is repeated and the pass count is incremented until the bit is cleared. |
| 9 | Repeat section. If this bit is set, the active section is repeated until the bit is cleared. |
| 8 | Repeat subsection. If this bit is set, the system repeats the active subsection of a test section until the bit is cleared. |
| 7 | Halt on error. If this bit is set, the test is suspended when a diagnostic error is detected. |
| 6 | Halt at primary error. If this bit is set, the test is suspended only after a primary error. |
| 5 | Halt at end of a subsection if there is an error. If this bit is set, the test is suspended at the end of the subsection that detected the error. |
| 4 | Halt at end of subsection. If this bit is set, the test is suspended at the end of each subsection execution. |
| 3 | Halt at beginning of test flag. If this bit is set, the test is suspended at the beginning of the test and outputs an information message. |

TABLE 4-5 (cont'd.)

| Bits | Descriptions |
|------|--------------|
| 2 | Halt at end of pass. If this bit is set, the test is suspended when it completes a pass. |
| 1 | Halt at end of section flag. If this bit is set, the test is suspended at the end of a section. |
| 0 | No CDT (level I only). If this bit is set, the system does not use a CDT. |

```
tstnm RUN PARAMETERS
TEST ID  PASCNT   ERRCNT    0001   0002   0003   0004   0005
xxxx     xxxx     xxxx      xxxx   xxxx   xxxx   xxxx   xxxx
0006     0007     0008      0009   000A   000B   000C   000D
xxxx     xxxx     xxxx      xxxx   xxxx   xxxx   xxxx   xxxx
000E     000F     0010      0011   0012   0013   0014   0015
xxxx     xxxx     xxxx      xxxx   xxxx   xxxx   xxxx   xxxx
Where:   tstnm        is the test name
         xxxx         is the hexadecimal value of a parameter
         0001         is the control word
         0002         is the repeat count
         0003-0006    is the section selection
         0007         is the equipment code
         0008         is the interrupt lines
         0009         is the logical unit
         000A-0015    are defined by each test if used
```

Figure 4-15. Parameter Display

If the "no CDT" bit is set in either the test control word or the master control word, control is never passed to the run parameter display software, and, as a result, the machine does a halt with the run parameter message number in the A-register. Inspection and modification of a test's run parameters are possible when the machine halts with a suspension message number in the A-register; at this time, the Q-register contains the address of the test's run parameters.

## Summary

The operational diagnostic system (ODS) is used to operate the CYBER 18 CPU in a way that indicates failures in the equipment. There are three types of diagnostics: loadcheck, level I test diagnostics, and level II test diagnostics.

The basic operation procedures for the ODS are:

1.  Insert floppy disk.
2.  Clear CDT; depress STOP, MASTER CLEAR, DEAD START.
3.  Run LODCHK.
4.  Load desired level I or level II tests.
5.  Set operating parameters.
6.  Run test.
7.  Terminate test.

In operating the ODS, you will use the following special keys, buttons, controls, and functions to diagnose errors: /, RUBOUT/LINE FEED, CARRIAGE RETURN, CONTROL/BEL, ESC, BREAK, MANUAL INTRPT, STOP, RUN, MASTER CLEAR, and DEAD START.

The following are level II commands: SKIP, MANUAL INTRPT, LOAD, DPAR, CPAR, DCW, CCW, GO, RSTR, ABRT, LDGO, and LIST.

The operator has control over how the tests are run, including control over run parameters, section selection, and test, section, or even subsection repetition. Tests can be aborted or restarted, and with level II tests, multiplexing is possible.

# Diagnostic Decision Logic Tables

By themselves, operational diagnostic system (ODS) tests are unlikely to help you solve all the problems you will face as a computer technician. They are to be used in conjunction with reference manuals that aid in isolating problems and interpreting diagnostic tests. (See figure 4-15.) Such manuals for CYBER 18 systems contain troubleshooting aids called diagnostic decision logic tables (DDLTs). This text describes the use of these tables.

A separate set of tables exists for each functional block or peripheral device that is part of the computer system. Each table, or DDLT, provides a step-by-step procedure to detect, isolate, and correct equipment malfunctions. Together with the ODS, the DDLTs provide a powerful set of tools to maintain the CYBER 18 system.
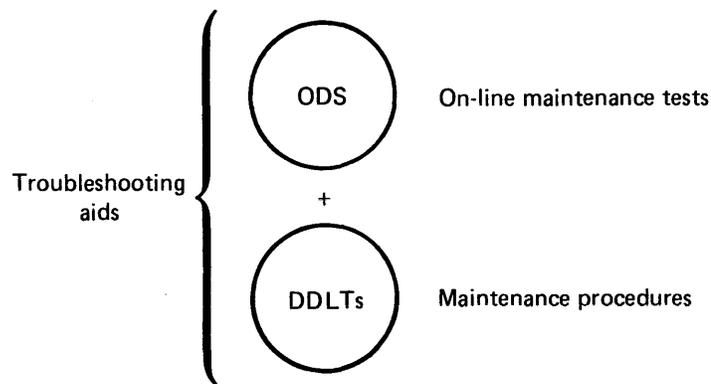


Figure 4-15. CYBER 18 Maintenance Aids

## Description of DDLTs

The DDLTs identify and isolate equipment malfunctions at the level of replaceable subassemblies. They analyze a situation into specific conditions and then direct you to perform the actions that will correct the situation. The most probable repair action is listed first. The table is arranged in five sections: "Assumptions," "Conditions," "Responses," "Actions," and "Sequence of actions." (See the DDLT example in figure 4-16.)

## Assumptions and Conditions

The upper section of the DDLT contains the prerequisites for the specific tests to be performed. The DDLT is valid only if all assumptions are correct. The center-left section contains the conditions or the tests to be made, in the form of questions that can be answered yes or no.

## Responses

The center-right section of the DDLT contains the responses to the questions asked in the "Conditions" section. Note that the condition, or question, can be answered with a yes (Y) or a no (N). The example chosen for figure 4-16 has ten unique situations, numbered from 1 to 10, left to right. The shaded area in the example shows the conditions that define situation 9: the POWER ON indicator does not illuminate; no other indicators illuminate when the READ CHECK indicator/switch is pressed. To use the table, the first condition should be examined for a yes or no response. The applicable response directs the operator to the next condition in the column and so on until all conditions in that column have been analyzed. Column 1 identifies an everything-is-normal situation for the tests made; therefore, the "Actions" section in the lower left of the table directs you to sheet 2 of this table without wasting further examination time with sheet 1.

## Actions

The lower left quadrant lists actions that will correct a situation.

## Sequence of Actions

The lower right section lists the sequence in which the listed actions should take place to correct a situation. Each succeeding action should be performed only if the previous action failed to correct the condition under test. The numbering of actions reflects the probability that the action will correct the problem, with the most likely listed first. An X indicates that the action listed must be performed but that the sequence of actions is unimportant.

Both "Actions" and "Conditions" may refer to specific procedures to follow (for example, when checking and adjusting power supply voltages). To answer any questions that are related to the procedure you must exit from the table, perform the procedure, and return to the same point in the table. If the fault persists, you continue testing. Similarly, if you exit to another table or sheet of the same table without finding the fault and if the action that called for the exit is not the last action in the sequence, you must return to the original DDLT exit point and continue testing from that point.

## Example of DDLT Use

Figure 4-17 shows an example of a DDLT table, one page of the line printer diagnostic tables. In the "Responses" section, the responses to certain existing conditions are circled. What action is called for by the condition indicated?

By evaluating the conditions present, you should have determined that action number 7, "Check the ribbon," should be performed. The procedure for checking the ribbon is shown in the parentheses and is found in the hardware maintenance manual on the pages indicated.

If the first action in the sequence fails to correct the problem, the next action should be attempted: action number 8, "Check that ribbon is threaded properly."

The DDLTs also explain exactly how the various ODS tests are to be loaded and executed by the CYBER 18. An example is shown in figure 4-18. Notice that the figure gives a step-by-step procedure. A card reader or cassette is assumed as the load device and the procedure shows everything you must do to load and execute the test. The "Conditions" section of this table shows what takes place during execution of the test and indicates possible faults. In case of a test fault, you are directed to action codes that will correct the failure.

Figure 4-19 is a flowchart showing the normal sequence used during CYBER 18 troubleshooting. If you suspect a specific peripheral device of a failure, first run the CPU tests, then proceed to test the suspected device. Refer to figure 4-19 during your lab to locate the table in the DDLTs that applies to the specific device you are trouble-shooting. Before you attempt any laboratory assignment that requires diagnostic tests, have available the hardware maintenance manual containing the DDLTs; they are needed for any on-line testing.

## Summary

When troubleshooting problems on the CYBER 18 system, the technician should use the diagnostic decision logic tables (DDLTs). These tables have five parts: "Assumptions," "Conditions," "Responses," "Actions," and "Sequence of Actions." The technician takes actions based on the responses applicable to the particular situation.

ODS

Power On

ASSUMPTIONS:

1. If card reader is load device, go to sheet 2 of this table.

2. Card reader power cord is connected to ac outlet.

3. Power is on (procedure D1).

4. Ensure card reader is not ready by pressing RESET.

| CONDITIONS: | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Is POWER ON indicator on card reader illuminated? | Y | | | | | | N | | | | Responses |
| 2. | Press READ CHECK switch/indicator. Do all other indicators illuminate? | Y | | | | N | | Y | N | | | |
| 3. | Do any indicators illuminate? | | | | | Y | N | | Y | N | | |
| 4. | Press and release RESET switch/indicator. Does RESET indicator illuminate? | Y | | | N | | | | | ③ | | |
| 5. | When RESET switch/indicator is pressed, do stacker springs and/or card drum turn? | Y | | N | | | | | | | | |
| 6. | Did motor power come up and then drop within 10 to 30 seconds after releasing RESET switch/indicator? | Y | N | | | | | | | | | |
| ACTIONS: | | | | | | | | | | | | |
| 1. | Go to sheet 2 of this table. | X | | | | | | | | | | |
| 2. | Check that toggle switch S1 (rear panel) is up. | | | | | | | | | 1 | | |
| 3. | Check that removable power cord is connected securely to card reader. | | | | | | | | | 2 | | |
| 4. | Check fuses (rear panel) and ac power. | | | | | | | | | 3 | | Sequence of actions |
| 5. | Check switch board and associated cabling (procedure D9). Replace if required (procedure D10). | | | | 3 | 2 | 2 | 2 | | 4 | | |
| 6. | Check +17-volt power supply (procedure D6). | | | | | | | | 1 | | | |
| 7. | Check for +17 vdc between ground and control board connector P2, pins 2 and 3, and between ground and switch board connector, pins 2 and 3 (two pins joined by foil). | | | | | | | | 2 | | | |
| 8. | Check cable between control board and switch board. | | | | | | | | 3 | | | |
| 9. | Replace lamp in failing indicator (procedure D9). | | | | | | | 1 | | | | |

Note: Arrows and circled numbers indicate sequential flow of analysis procedure.

Figure 4-16. Example of a DDLT

4-36

| Print Quality | | | | | | | | | | | Sheet 3 of 7 |
|---|---|---|---|---|---|---|---|---|---|---|---|

**ASSUMPTIONS:**

1. STOP indicator on line printer is pressed.

2. Test print switch (logic chassis location 4A27) on line printer is pressed.

3. Test print switch is pressed a second time (15 seconds after it was pressed first).

| CONDITIONS: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. Does the customer complain of ribbon malfunction? | N | | | | | | | | | Y |
| 2. Did line printer continuously print 136 columns of Es? | Y | | | | | N | | | | |
| 3. Was anything printed? | | | | | | N | Y | | | |
| 4. Were lines overprinted? | N | | | | | | Y | N | | |
| 5. Were more than 16 contiguous columns of Es missing? | | | | | | | | N | Y | |
| 6. Does ribbon move during printing cycle? | Y | | | | N | | | | | |
| 7. Is print density of Es even? | Y | | | N | | | | | | |
| 8. Do top and bottom of Es appear? | Y | | N | | | | | | | |
| 9. Did line printer print six or eight lines of Es per inch as expected? | Y | N | | | | | | | | |

| ACTIONS: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. Go to sheet 4 of this table and run line printer diagnostic. | X | | | | | | | | | |
| 2. Replace format register and decoder 4A19 (procedure F23). | | 1 | | | | 15 | 4 | | | |
| 3. Replace status and paper motion board 4A18 (procedure F23). | | 2 | | | | 14 | 5 | 8 | 8 | |
| 4. Check line density switch and associated wiring (procedure F45). | | 3 | | | | | | | | |
| 5. Adjust character phasing control (top of control panel). | | | 1 | | | | | | | |
| 6. Adjust flight time (procedure F32). | | | 2 | | | | | | | |
| 7. Check ribbon (procedure F3, steps 6 through 10). | | | | 1 | | | | | 1 | 1 |
| 8. Check that ribbon is threaded properly (procedure F7). | | | | 2 | 2 | | | | 2 | 2 |
| 9. Check and adjust ribbon tracking (procedure F21). | | | | 3 | | | | | 3 | 4 |
| 10. Check that ribbon or spool is not binding. | | | | | 1 | 13 | | | | 3 |

Figure 4-17. Line Printer DDLT

| | Sheet 1 of 1 |
|---|---|

**ASSUMPTIONS:**

1. For the remaining testing in tables 6-4 through 6-103, all tests must be loaded from the same load device that loadcheck is loaded from. This requires a full set of diagnostics on either cards or cassette. Restart the DDLTs using the load device on which all the diagnostics exist on a single medium (table 6-3, sheet 1).

2. If the load device is a cassette, go to assumption 3. If the load device is a card reader:

   MPINS card deck is inserted.
   RESET button is pressed.
   RUN button is pressed.
   Go to assumption 3.

3. After xxxxx? is displayed, the following is entered at the keyboard (if xxxxx is not displayed, go to table 6-100):

   MPINS is typed in.
   CARRIAGE RETURN is pressed.

   NOTE: xxxxx = test name

4. Observe the CDT display for the following conditions.

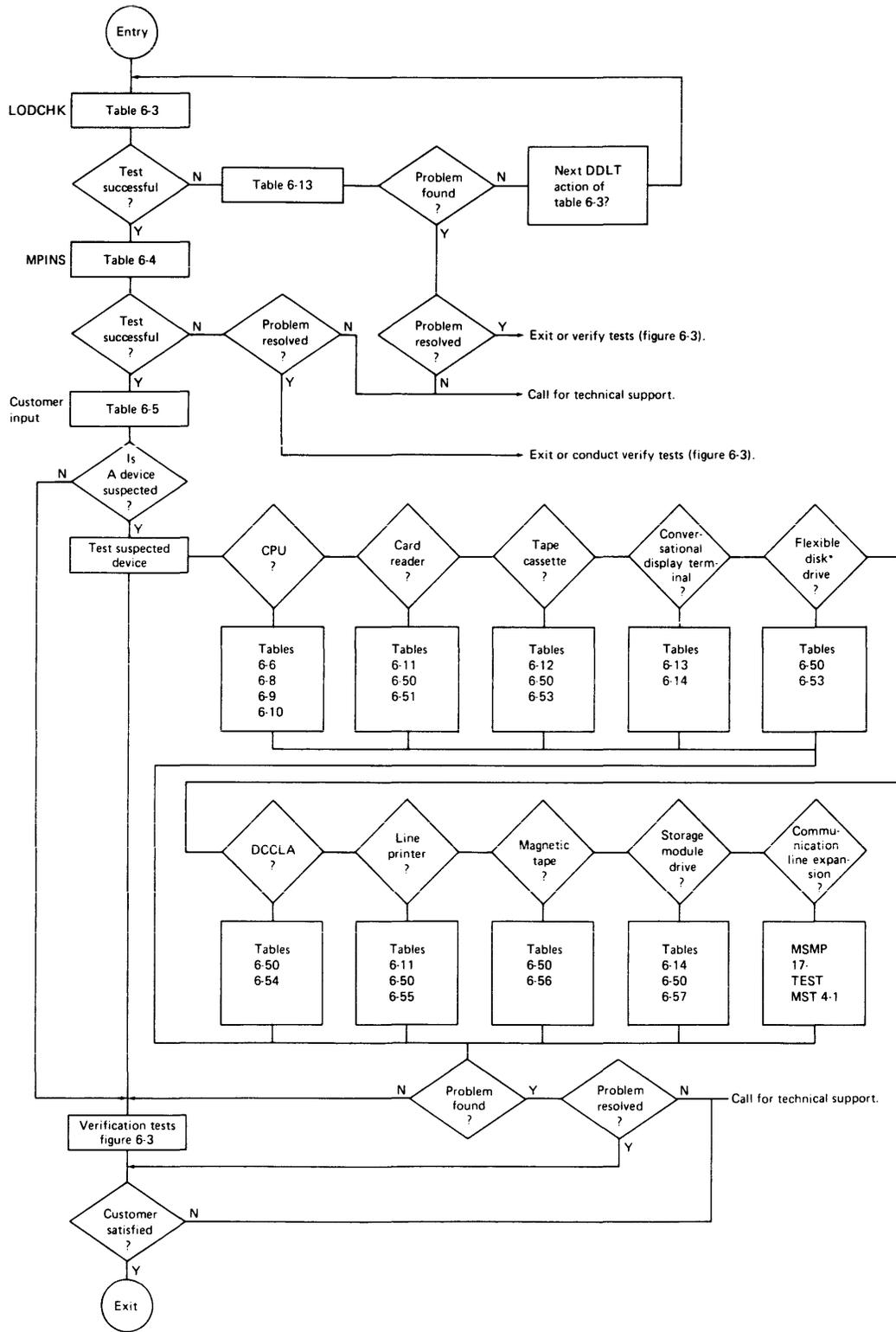| CONDITIONS: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Is MPINS EXECUTING displayed? | Y | | | | | | | | | N | |
| 2. Is RUN indicator illuminated? | | | | | | | | | | N | Y |
| 3. Is MPINS TERMINATED displayed after approximately 10 seconds? | Y | N | | | | | | | | | |
| 4. Are any of the following action codes displayed? | | | | | | | | | | | |
|     xx11 or xx12 or xx13 or xx14 | | Y | | | | | N | | | | |
|     xx11 or xx21 | | Y | N | | | Y | N | | | | |
|     xx12 or xx22 | | | Y | N | | | Y | N | | | |
|     xx13 or xx23 | | | | Y | N | | | Y | N | | |
| **ACTIONS:** | | | | | | | | | | | |
| 1. Go to table 6-5. | X | | | | | | | | | | |
| 2. Go to table 6-101. | | | | | | | | | | | X |
| 3. Replace operators panel (procedures A20 and A21). | | | | | | | | | | 1 | |
| 4. Replace transform, slot R. | | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | | |
| 5. Replace ALU, slot M. | | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | | |
| 6. Replace control 1, slot P. | | 5 | 5 | 3 | 3 | 5 | 5 | 3 | 3 | | |
| 7. Replace control 2, slot N. | | 4 | 4 | 5 | 4 | 4 | 4 | 5 | 4 | | |
| 8. Replace SMI, slot L. | | 3 | 6 | 4 | 5 | 3 | 6 | 4 | 5 | | |

Figure 4-18.  Command DDLT

Figure 4-19. System Troubleshooting Flowchart

# ODS Lab

This laboratory exercise calls for verifying the operation of a peripheral device using the operational diagnostic system (ODS). It will familiarize you with diagnostic system operation. The ODS test associated with the peripheral device—in this case, the line printer—must be loaded and executed. It is assumed that the CYBER 18-20 system is powered-up and in a ready state. If the system is powered-up and in a ready state, skip over the following steps and start with the printer test. If the system is not powered-up and ready, follow the directions for system initialization before starting the printer test procedure. To complete this lab, you should have available the ODS level II diskette. Follow the procedure outlined here. It is suggested that you read through the procedure once before starting the lab to become familiar with the operation. Some operator actions are required during the test.

System Initialization. The CYBER 18-20 system must have power turned on and switches preset before running the ODS tests. Check the following switches before running the tests.

Check for proper equipment set up:

ON TERMINAL:

| Switch | Position |
|---|---|
| POWER ON/OFF | ON |
| 64/96 CHAR | 64 CHAR (up) |
| FORMAT | DOWN |
| ON-LINE/LOCAL | ON-LINE (up) |
| CHARACTER/BLOCK | CHARACTER (up) |
| ODD PAR/EVEN PAR | EVEN PAR (down) |
| FULL DUPLEX/HALF DUPLEX | FULL DUPLEX (up) |
| HIGH RATE/LOW RATE | LOW RATE (down) |

ON CYBER 18-20 CONTROL PANEL:
      POWER ON/OFF                ON

ON BREAKPOINT PANEL:
      REMOTE/LOCAL                REMOTE

ON CARD READER:
      POWER ON/OFF:               ON

ON PRINTER:
      POWER ON                    ON
      START                       ON

ON DISK CONTROLLER:
     POWER ON/OFF                    ON

ON STORAGE MODULE DRIVE:
     POWER ON/OFF*                  ON
     START                            ON
     PROTECT                     OFF

*NOTE: Before starting the SMD, you must ensure that your system has the proper channel selected on the SMD and on the CYBER 18 operator's panel. After starting the SMD, wait for the ready light before proceeding.

Printer Test

1. <u>Line Printer Ready</u>. The line printer must be powered-up and ready before it can be tested. First, depress the POWER ON switch and then, approximately ten seconds later, the START switch. Both these indicators should light.

2. <u>Load Diskette</u>. Insert the diskette containing the monitor and level II tests into the floppy disk loading device and close the cover.

3. <u>Master Clear</u>. Clear the conversational display terminal by depressing the CLEAR switch on the keyboard. On the CPU operator's panel, depress the STOP and MASTER CLEAR switches.

4. <u>DEAD START</u>. Depress the DEAD START switch.

5. <u>CDT Display</u>. Twenty seconds after DEAD START is pressed, the CDT will display:

     123456
     ODS 2.0 VOLI

6. <u>Operator Entry</u>. Press the CONTROL and BEL keys simultaneously (this causes manual interrupt).

7. <u>CDT Reply</u>. The previous entry will cause the following to be displayed:

     **MI**

8. <u>Operator Entry</u>. Type in ODS, LDGO, LP408 press CARRIAGE RETURN.

9. <u>Operator Actions</u>. The line printer test begins execution. However, two operators actions are required. The display will show the following:

<div align="center">PRESS STOP ON LINE PRINTER WITHIN 30 SECONDS</div>

    a.    Go to the line printer and depress the STOP switch. When this is done, the following will be displayed:

<div align="center">PRESS START ON LINE PRINTER WITHIN 30 SECONDS</div>

    b.    Respond within thirty seconds by depressing the START switch on the printer's operator panel. The line printer test will run to completion from this point without further operator actions.

10. <u>Test Sections</u>. The line printer test (LP408) consists of seven sections that perform the following functions:

    a.    <u>Section 1</u>. Line printer controller test: checks printer-ready condition as operator manually switches printer from ready to not ready and vice versa.

    b.    <u>Section 2</u>. Line printer memory test: checks data transfers to the line printer and the decoding of that data for hammer selection and firing.

    c.    <u>Section 3</u>. Paper motion control: performs such paper motion functions as page eject, single spacing, double spacing, etc.

    d.    <u>Section 4</u>. Sliding pattern: checks all possible characters at all possible print positions.

    e.    <u>Section 5</u>. Printing speed: prints data at highest possible speed using alternate data characters.

    f.    <u>Section 6</u>. Specific character printing: allows the operator to specify a desired character for printing, provided that a certain parameter has been set.

    g.    <u>Section 7</u>. Operator troubleshooting: allows the operator to use an oscilloscope to check data paths in the line printer by supplying output to the printer.

11. <u>Test Completion</u>. After the printer test has run to completion, the CDT screen will display the following:

    LP408 COMPLETED 0001 PASSES
    LP408 TERMINATED 0000 ERRORS

12. <u>Other Options.</u> You may wish to repeat this test or to call in another type of test for a different peripheral device.

    a.    <u>To repeat test</u>: type ODS, RSTR, and tstnm (test name).

        ⒸⓇ

    b.    <u>To load and execute new test</u>: 1.) Depress simultaneously CONTROL and BEL. 2.) Type ODS, LDGO, and tstnm (test name).   ⒸⓇ

    c.    <u>To abort test</u>: type ODS, ABRT, tstnm (test name).   ⒸⓇ

    d.    <u>Parameter changes</u>: These will be explained when you perform the individual labs involving the ODS diagnostic system and parameter changes become necessary.

Upon completion of this lab, return the equipment to its original condition.

PROGRESS CHECK

1.  The CYBER 18 processor uses _____ instruction words.

    a.  8-bit
    b.  16-bit
    c.  32-bit
    d.  60-bit

2.  Which of the following CYBER 18 system components has the capability of emulating 1700-type instructions, and controls the access to memory?

    a.  A/O channel
    b.  Processor
    c.  I/O channel
    d.  Storage module drive

3.  Block 6 represents a device that uses the principles of magnetism to store and recall information; it can transfer data at high speed and generally has direct access to memory.  What is block 6?

    a.  Line printer
    b.  Storage module drive (SMD)
    c.  Magnetic tape
    d.  Optical character recognition unit (OCR)
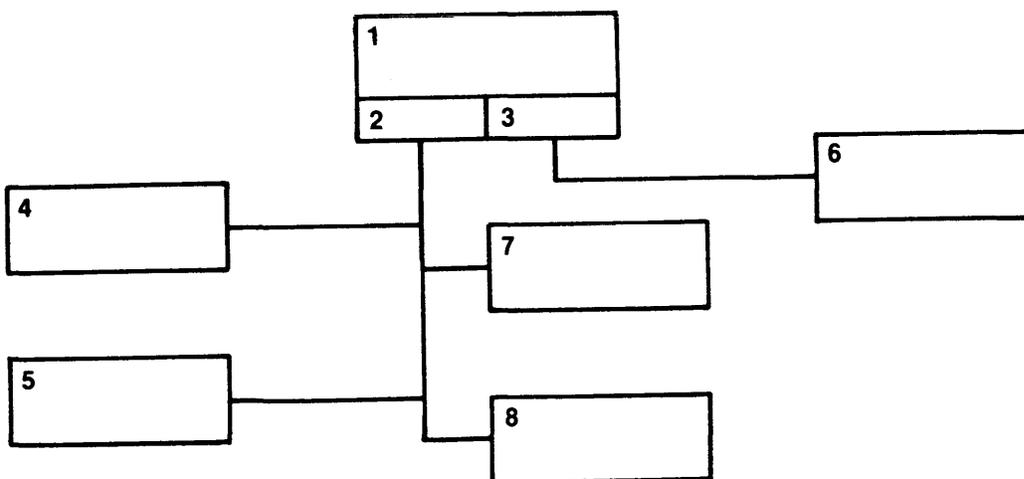
PROGRESS CHECK

4. Block 1 is a multilevel unit capable of emulating 1700 instructions; it handles arithmetic operations and controls the access to the MOS memory.  What is block 1?

    a. CDT
    b. CYBER 18-20 processor
    c. Card reader
    d. A/Q channel

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                        ┌─────────────┐
                        │ 1           │
                        │             │
                        ├──────┬──────┤
                        │ 2    │ 3    │
                        └──────┴──────┘          ┌─────────────┐
┌─────────────┐                │                │ 6           │
│ 4           │                │                │             │
│             │────────────────┤                │             │
│             │           ┌────┴────────┐        └─────────────┘
└─────────────┘           │ 7           │
                          │             │
                          │             │
┌─────────────┐           └─────────────┘
│ 5           │                │
│             │────────────────┤  ┌─────────────┐
│             │                └──│ 8           │
└─────────────┘                   │             │
                                  └─────────────┘
```
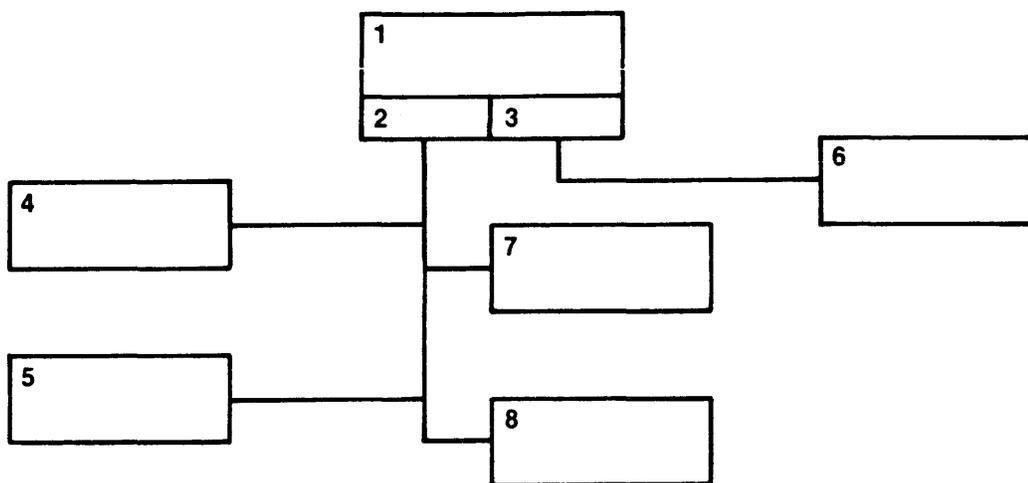
5. What is the key or switch on the CYBER 18-20 CDT panel that controls the mode of communication with the interface device (modem)?

    a. FULL/HALF DUPLEX
    b. MASTER CLEAR
    c. CB1
    d. ODD/EVEN PAR

6. Which group of CDT keyboard keys unlocks the keyboard, selects the transmission code, and interrupts printing or card reading?

    a. One, data entry
    b. Two, operating
    c. Three, transmission control
    d. Four, function

7. Which control on the CYBER 18 control panel causes an input/output controller to be cleared?

    a. MANUAL INTRPT
    b. DEAD START
    c. MASTER CLEAR
    d. AUTOLOAD

8. Which operator control on the CYBER 18 control panel allows information being typed to be displayed on the screen?

    a. FORMAT
    b. 64-CHAR
    c. HIGH RATE/LOW RATE
    d. ON-LINE/LOCAL

9. An operator reports a card reader failure to the technician, who knows that this card reader model is difficult to operate. The technician should _____.

    a. determine whether a hardware problem exists
    b. define the problem
    c. isolate the problem
    d. fix the problem

10. Assume that a card reader fails to read any card with a punch in row 12. A technician determines that only three logic modules and one photo diode control the reading of row 12. The technician is _____.

    a. recognizing that a problem exists
    b. defining the problem
    c. isolating the problem
    d. fixing the problem

11. If a computer's logic consists mostly of integrated circuit components, it _____.

    a. requires a large cooling system
    b. is often more difficult to repair than a discrete component computer
    c. requires fewer logic modules than a discrete component computer
    d. is usually more expensive than an equivalent discrete component computer

12. Which of the following characterizes the value of good diagnostic software?

    a. Quickness of problem isolation
    b. Ease of mounting software
    c. High degree of skill required
    d. Easier access to hardware

13. Which section of the diagnostic decision logic tables (DDLTs) questions the technician on equipment performance?

    a. Assumptions
    b. Conditions
    c. Responses
    d. Sequence of action

14. When using the ODS system on the CYBER 18, how do you know which DDLT to consult?

    a. Cross-reference in the ODS
    b. System troubleshooting flowchart
    c. Index
    d. Operating system flowchart

15. When loading the operational diagnostic system on the CYBER 18, _____ .

    a. LODCHK must be the first ODS program loaded and executed
    b. level I tests will be the first tests loaded and executed
    c. the floppy disk drive will be used as the load device
    d. all peripheral devices must be powered up and ready

16. What three tests does the ODS consist of when running on the CYBER 18?

    a. LODCHK, MPINS, monitor
    b. LODCHK, level I tests, MPINS
    c. LODCHK, level I tests, level II tests
    d. Level I tests, monitor, level II tests

PROGRESS CHECK
ANSWERS


1. Correct Answer: b
   Resource:        Text  Introduction to CYBER 18, page 1-3

2. Correct Answer: b
   Resource:        Text  Introduction to CYBER 18, pages 1-8
                          and 1-9

3. Correct Answer: b
   Resource:        Text  Introduction to CYBER 18, pages 1-12
                          and 1-17

4. Correct Answer: b
   Resource:        Text  Introduction to CYBER 18, page 1-8
                          and 9,17

5. Correct Answer: a
   Resource:        Text  Introduction to CYBER 18, page 2-7

6. Correct Answer: d
   Resource:        Text  Introduction to CYBER 18, page 2-15

7. Correct Answer: c
   Resource:        Text  Introduction to CYBER 18, page 2-2

8. Correct Answer: d
   Resource:        Video "A Look At the CYBER 18 System"

9. Correct Answer: a
   Resource:        Text  Introduction to CYBER 18, page 3-1

10. Correct Answer: c
    Resource:       Text  Introduction to CYBER 18, page 3-2
                          and 3-3

11. Correct Answer: c
    Resource:       Text  Introduction to CYBER 18, page 3-8

12. Correct Answer: a
    Resource:       Text  Introduction to CYBER 18, page 3-5

13. Correct Answer: b
    Resource:       Text  Introduction to CYBER 18, pages 4-34
                          and 4-36

PROGRESS CHECK
ANSWERS


14. Correct Answer: b
    Resource:        Text  <u>Introduction to CYBER 18</u>, pages 4-35
                           and 4-39

15. Correct Answer: a
    Resource:        Text  <u>Introduction to CYBER 18</u>, page 4-2

16. Correct Answer: c
    Resource:        Text  <u>Introduction to CYBER 18</u>, page 4-1