SENTRY

SENTRY VII

Users Manual

FAIRCHILD
SYSTEMS TECHNOLOGY
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

SENTRY VII
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PREFACE

This manual represents the initial release of the Sentry VII User's Reference Manual.

The intent of this manual is to allow the user to get a general overview of the entire Sentry VII system including the FST-2 computer as well as getting an in depth knowledge of the Disc and Tester Operating systems, and finally a working knowledge of the peripherals that comprise the Sentry VII hardware systems.

Section 3 gives an alphabetical listing of both the DOPSY and TOPSY operating systems. It also discusses the disc allocations of the two operating system monitors and talks about memory management. Section 4 discusses both the standard and optional peripherals used by the Sentry system. Each peripheral gives pertinent maintenance information needed by an operator such as peripheral specifications, power up/down procedures, loading/unloading, and the controls and indicators for each peripheral.

A set of appendices are included to give quick reference information for such things as character set, FACTOR statements, system loading and recovery procedures, and utility routines available.

This manual has been designed to assist the user in running his system and his test programs, it however, cannot provide all the information that every user may require, so the following is a list of manuals that may be used for further information:

Manual	Publication Number
FACTOR Programming Language Reference Manual	67095738
FST-2 Computer Reference Manual	67095701
Sentry Utility Reference Manual	67095661
Performance Board Reference Manual	67095668
Assembly Language Programming Under TOPSY	67095720

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SECTION 1

SYSTEM OVERVIEW

This section provides an overview of the Fairchild Systems Technology Sentry VII Test System. System applications, configurations, hardware components, and software are discussed within this section.

1.1 GENERAL DESCRIPTION

The Sentry Test System is a computer - controlled high-speed universal test system. It is designed to operate in a multitude of environments and is capable of testing any digital device regardless of technology or scale of integration. The Sentry can perform high-speed functional and precision DC parametric tests, of any digital assembly or device. It can also perform in-depth engineering evaluation and device characterization, and provide production yield improvement, pilot production, final test, and quality assurance testing of devices such as:

- Microprocessors
- Advanced digital systems and networks
- Digital assemblies and subassemblies
- Wafers or discrete packages
- MOS, CMOS, VMOS, PMOS, NMOS, SOS, or bipolar integrated arrays
- Packaged solid-state elements and single circuits
- Self-timing devices
- RAM/ROM memories

Under program control, the Sentry Test System automatically performs functional and parametric tests on devices with up to 60 pins at up to a 10MHz rate. Independently-programmable timing generators that have 160-picosecond delay and width resolutions provide a multi-phase clocking capability within each test period. There are time measurement algorithms available for all AC measurements. The Sentry also provides high-speed parametric testing for continuity, stress, breakdown, leakage, and power consumption testing. All device test data can be recorded for further processing.

The Sentry VII Test System is controlled by the FST-2 general-purpose computer. The sequence of operation is dependent upon programmed instructions and statements resident in the computer memory and in the associated disc memory. System and diagnostic programs are supplied by Fairchild. Device test programs are prepared from device test specifications by the user or, if desired, by Fairchild.

Device test programs are written in FACTOR (Fairchild Algorithmic Compiler Tester ORiented), which is an English-like procedural programming language developed by Fairchild Systems Technology.

1.1.1 Test System Capabilities

The Sentry VII is a general-purpose test system capable of providing maximum throughput at a minimum cost. The test system performs functional tests up to rates of 10 MHz, DC parametric tests at rates up to 875 tests per pin/per second, and makes AC measurements using program algorithms. When operated in external sync mode, functional testing is performed at a rate determined by the device-under-test (DUT).

When testing a given device, the Sentry Test System applies a series of inputs that can be varied (by programming) from +6 volts to -30 volts (+6 to -16 volts when using the 10 MHz test station). Similarly, the system detects output voltages from the DUT varying from +6 to -27 volts (+6 to -16 volts when using a 10MHz test station). In addition to perform DC parametric tests, the precision measurement unit (PMU) can force a voltage (0 to +10.28 volts and 0 to -102 volts) on any pin of the device-under-test and measure the resulting current or conversely, force the current (0 to 102 mA) and measure the resulting voltage.

The flexibility of the Sentry Test System stems from the use of slave processors and programmable subassemblies. Functional tests, for example, are performed by inputting data to the device-under-test at a programmed rate and comparing its outputs with the expected values. Both the inputs and the expected values are stored in a local memory that is associated with the test station. This local memory consists of a specialized microcontroller containing bipolar random access memories (2048 words), control registers, and instruction set. In like manner, the variable power supplies are digitally programmable with high resolution. Once the test system has been programmed to test a given device, the system repeatedly steps through the program sequences, stopping only when a failure is detected or at the completion of the test run.

These test stations include true universal capability for all active test pins.

1.1.2 Test Stations

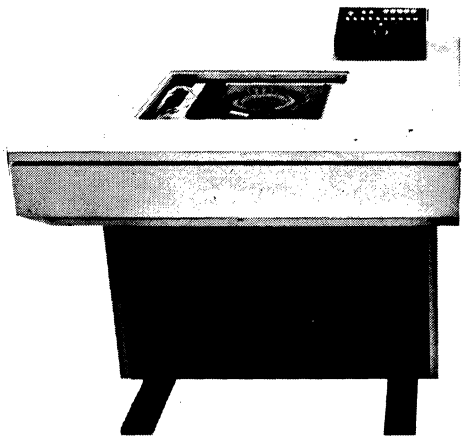
Three types of test stations are available, as shown in Figure 1-1. The test stations are:

- the manual device insertion test station
- the wafer probe test station
- the automatic device insertion test station.

Interface logic is available to allow use of various environmental test chambers. The test stations can be configured by the user to facilitate almost any application. Some examples of varying test station capabilities are the 30-pin and 60-pin test heads now available and a test station which operates at varying clock rates (up to 10MHz). Custom test stations can quickly be produced to reflect changing user requirements.

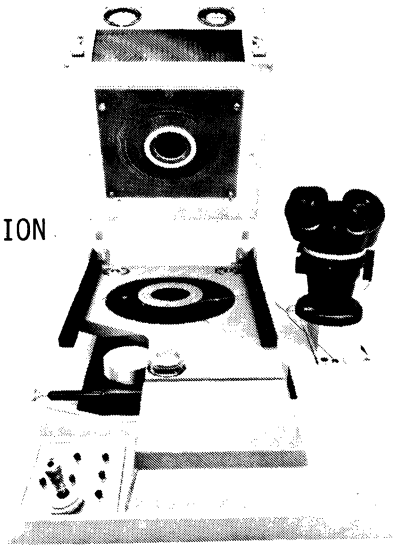
1.1.3 Types of Tests

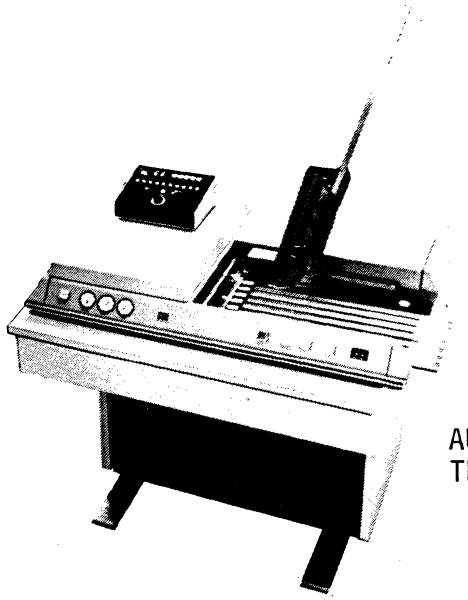
Test functions include digital logic, pulse DC parameter and stress testing. There are two basic types of tests: 1) functional tests that determine whether the DUT properly performs the intended logic operations, and 2) precision DC parametric tests that ascertain whether component parameters meet device test specifications. The system also has an external sync capability to allow testing of self-timing devices.



MANUAL DEVICE INSERTION
TEST STATION

WAFER PROBE TEST STATION





AUTOMATIC DEVICE HANDLER
TEST STATION

Figure 1-1 Test Stations

Functional tests are performed by forcing programmed logic levels (logical 1's and 0's) on all DUT input pins and comparing DUT outputs with the expected output logic levels. In functional testing, all DUT input pins are driven simultaneously and all DUT output pins are monitored simultaneously after a programmed interval of time. Simultaneously here means all pins must be at their programmed functional state somewhere within the test period. However, the actual time a pin is strobed to be at a certain state is a function of its associated timing generator.

DC parametric tests allow a voltage or current to be measured at any DUT pin while forcing a current or voltage. The Sentry can force or sense voltages or currents that are positive or negative. This allows device parameters such as voltage levels of an output pin, input leakage current, continuity, stress, breakdown and power consumption to be measured under a desired load. The functional testing capability of the Sentry is generally used in conjunction with parametric testing in order to force the DUT into the desired state.

1.1.4 Testing Capacity

The Sentry Test System provides functional testing at a rate up to 10 million tests per second and parametric testing of approximately 875 tests per pin/per second. The maximum number of tests that can be performed on a particular DUT is virtually unlimited as subroutines or loops are used when programming the local memory off the high-speed controller.

Local memory is not part of the FST-2 computer memory. It is, however, a specialized microprocessor which consists of bipolar random access memories, control registers, and instruction set. One local memory channel is assigned to each DUT pin. By using random access memories (RAM's) for local memory the FST-2 computer can update the functional patterns in local memory while testing is going on at the programmed rate. Tests are performed at the programmed rate by sending data to the DUT and comparing its outputs with expected values. These inputs and expected output values are stored in local memory. Each test pin under software control can be assigned as an input, clock, output, (output comparator), bias, load, or input/output pin.

Under software control the local memory can be segmented into major and minor loops with separate start and stop addresses and loop counts. This allows the generation of long test patterns with a minimum of software.

1.1.5 Registers

Twelve registers within the high-speed controller (called Long registers) allow control of each DUT pin while testing at the programmed rate.

Two pairs of Mask (M) and I/O definition (D) registers allow switching of DUT pin I/O definitions and "care"/"don't care" conditions while testing at the programmed rate. The S-register controls this selection of up to four pair of input reference voltage supplies (Data/Clock) used by the functional test driver for each tester pin of the DUT. The ST(strobe) register selects one of two possible strobe lines for each test pin. The RZ register controls data driver mode definitions (Return-to-Zero/Non-Return-to-Zero) to the system. The C register stores go/no-go result for logging of test failures.

An INVERT register provides a means of inverting the functional data for any pin, thus allowing testing of the complement of a data pattern. Three timing generator registers (TGAØ/TGA1/TGA2) provide the selection of timing generators TG1 through TG6 for each tester pin. A utility relay resister (R register) controls the utility relays, one relay per tester pin. The twelfth long register is the F register. Writing data to the F register address results in loading the data into the local memory.

1.2 SYSTEM HARDWARE DESCRIPTION

The Sentry VII Test System is a fully automated tester, operated via computer programming. Test and utility software is first entered into memory using either punched cards or magnetic tape, then executed on command from individual test stations. Test results are displayed on the CRT of the video keyboard terminal and/or printed on the system line printer.

1.2.1 Functional Equipment Groups

Functionally, the test system can be divided into four equipment groups. They are peripherals, computer/mainframe, high-speed controller logic, and pin electronics. (See Figure 1-2.)

The peripherals consist of a video keyboard terminal, a card reader, a magnetic tape unit, and a disc unit. A medium speed line printer is available as an option to the test system.

The computer/mainframe consists of a Fairchild FST-2 computer, an I/O module which provides the interface between the computer and some of the peripherals (disc, magnetic tape and card reader), and two modules which provide the interface between the computer and controller logic.

The high-speed controller consists of six modules located in a common cabinet within the computer mainframe. The modules contain digital and analog interface logic, high-speed control registers, local memory and local memory control logic, the precision measurement unit, eight timing generators, and other related logic that enables and implements the controller functions.

The pin electronics are circuit cards located in the test station. These cards are placed directly under the device to be tested, positioned as spokes of a wheel to provide a uniform and minimum lead length from the cards to the device to be tested.

1.2.2 Equipment Configurations

The test system configuration for the Sentry VII is depicted in Figure 1-3. The major units as shown are described functionally in Section 4. When alternate peripherals may be used, both units are described.

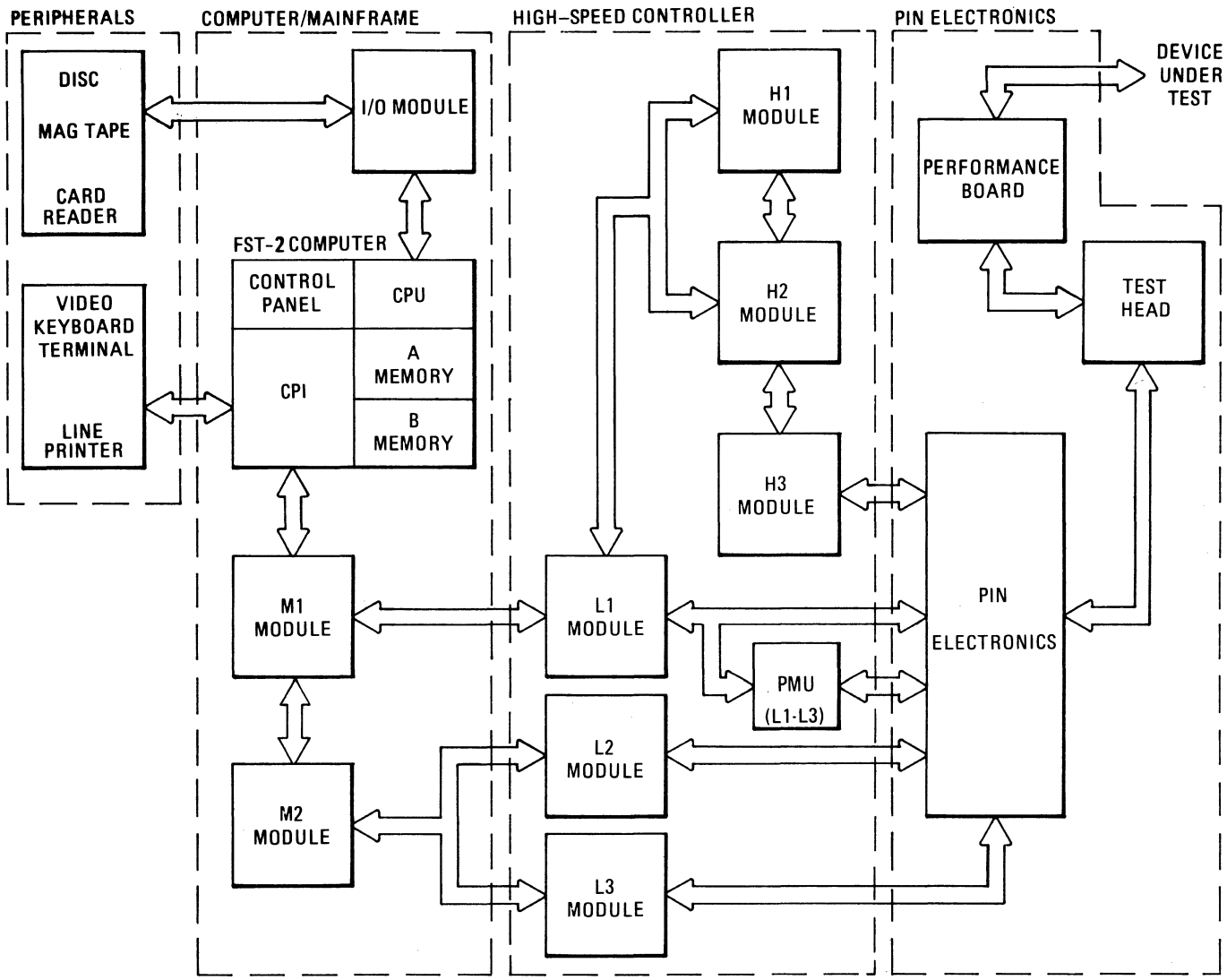


Figure 1-2 Sentry Test System Functional Block Diagram

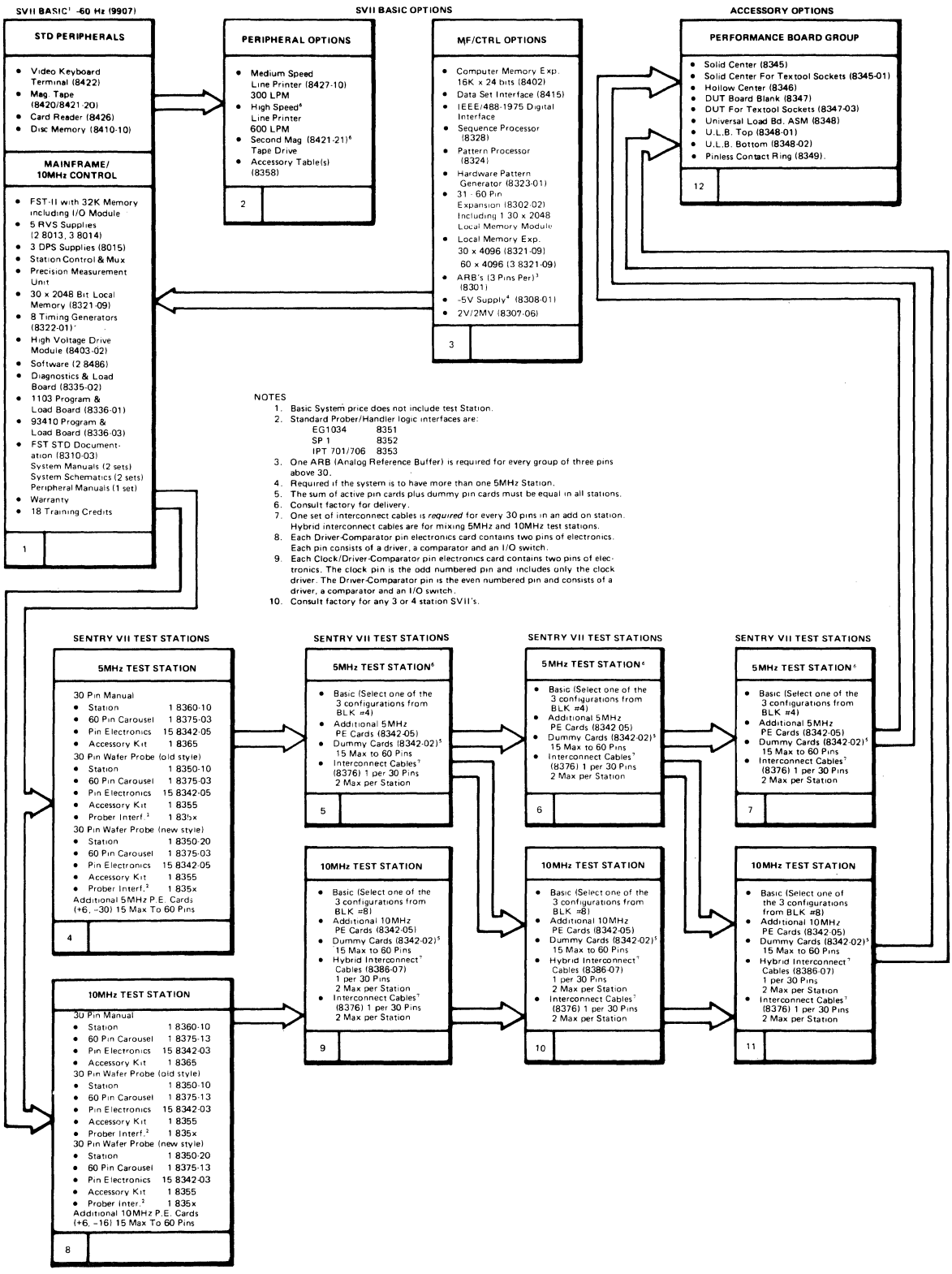


Figure 1-3 System Configuration

1.3 SYSTEM SOFTWARE

Using Sentry software, it is possible to load the system, perform various tests on a device, and obtain go/no-go results, and perform diagnostics. Test results may be printed out, recorded on the disc memory or on magnetic tape, or displayed on a video keyboard terminal or a combination of these, depending on the peripheral equipment selected for use.

Software programs are supplied by Fairchild on magnetic tape. Device test programs are written from device test specifications, by the user, or if desired, by Fairchild.

1.3.1 Operating Systems

The Sentry VII uses two operating systems. The operating systems must be resident in the disc memory before actual device testing can be performed. The two operating systems are:

The Disc Operating System (DOPSY)
The Tester Operating System (TOPSY)

DOPSY is a non real-time, batch operating disc system that facilitates job control, loading, core allocation and input/output functions. DOPSY is an operating sysem that consists of an assembler, compiler, diagnostics, file system, system loader and extensive library routines that operate under the control of a DOPSY Monitor. The majority of the facilities used by DOPSY for maintaining the disc and file processing are available to the user via an operator command language. (Refer to Section 3.3.1 for a complete description of the DOPSY operator commands and their useage.) The primary function of DOPSY is to allow the user to prepare FACTOR test programs (i.e., creating machine executable formatted files) for executions by TOPSY.

TOPSY causes execution of the device test program, supplements the hardware capabilities, and is designed to aid the user's interactions with the test system via an operators command language. TOPSY is an operating system comprised of a command processor, arithmetic statement processor, interpreter, datalogger and manual analysis that operate under the control of the TOPSY monitor. The TOPSY Monitor analyzes the user test plan, statement by statement and calls the necessary routines for execution of program instructions (called non-interpretative execution) or initiates the Direct Memory Access (DMA) Mode for the system (called interpretative execution). (Refer to Section 3.4.7 for a complete description of TOPSY commands and useage.)

An extensive diagnostic package is provided that includes programs to completely check out all test system components and peripherals.

1.3.2 System Modularity

The modularity of the system architecture allows operating system expansion without changing the resident executive software. The test programs are automatically relocated and packed in memory and disc as they are entered or deleted. Both the DOPSY and TOPSY routines automatically flag illegal calls by use of error messages. The automatic test program packing is a result of the dynamic memory allocation capability. As test programs are entered into the memory, they are automatically packed in memory address sequence. When a test program is removed from the memory, the following test programs are automatically moved within the memory to fill the vacant memory space. All vacant memory space is therefore, always in the adjacent memory addresses and not scattered throughout the memory. This provides test program protection as no test program or executive module can be removed or overlayed with a second program.

The extensive number of software routines available combined with the ability to transfer data to and from an 18 mega-bit disc, give the Sentry an unparalleled ability within the device characterization and data analysis field. This would include plots of mathematical functions, parametric distributions, three dimensional distributions (commonly referred to as composite SCHMOO's) and matrixes with various X and Y parameters.

1.3.3 Test Programming Language

The test programming language of the Sentry is English-like statements similar to Fortran or Algol-60. The language is called FACTOR (Fairchild Algorithmic Compiler - Tester ORiented). FACTOR provides two basic types of statements:

1) arithmetic and logical control statements, such as those which normally comprise procedural languages
2) test control statements which set up and execute functional/parameter tests.

FACTOR automatically informs the user of errors in syntax, entry of statement length, etc. (For complete list of FACTOR statements refer to Appendix D. For additional information refer to the FACTOR Programming Language Reference Manual, manual part number 67095738.)

1.4 FUNCTIONAL DESCRIPTION

All test stations can initiate a test program by issuing a start request. A test program for the addressed test station is requested via the keyboard. When a given test station is activated, the appropriate test program is loaded into memory from the disc, and then executed. At the end of the test, the software pointer automatically starts scanning all stations for another start request.

The pointer stops at the next start request received. If the next start request is from a station that just completed a test, the test program is already resident in memory. If the next start request is from a different test station, loading of the new program from the disc is executed and the new station is given control.

1.4.1 Operating Modes

There are two basic modes of operation for the Sentry system:

1) Automatic
2) Manual

In the automatice test mode, pressing the test station control/display unit START button at an on-line test station (refer to Section 4.5 for a description of the test station control and indicators) causes a complete test plan program to be executed. Testing is halted when an end-of-test (EOT) is reached, or when a pause condition is encountered. Pressing the START button after an EOT restarts the program. Pressing the START button after a pause condition executes the next sequential statement. This mode is primarily used in the production environment where there is minimum operator intervention.

In the manual test mode, only one test statement is executed each time the START pushbutton is pressed. Start requests can also be generated at a rate of three per second by holding the START ADV button down. This mode is useful in program development, and debugging. Only one test station at a time can be in the manual test mode.

A station that is in the manual mode and part way through a test programm may be changed to the automatic mode at any time. When a start request is issued, the remainder of that test program is executed automatically.

An overall simplified functional block diagram of the circuits associated with one tester pin is shown in Figure 1-4. The overall functions of the major units of the system are presented in the following paragraphs. The descriptions deal with hardware information and introduce yet undefined terms and concepts and are thus presented for information purposes. For a more detailed description and understanding refer to the FST-2 Computer Reference Manual, manual part number 67095701 and the Sentry VII Hardware Reference Manual.

1.4.2 I/O Module Functions

The I/O module provides a common peripheral interface (CPI) for the discs, tape drivers and the card reader. Common peripheral interface for the video keyboard terminal and line printer is provided directly by the FST-2 computer central processing unit (CPU).

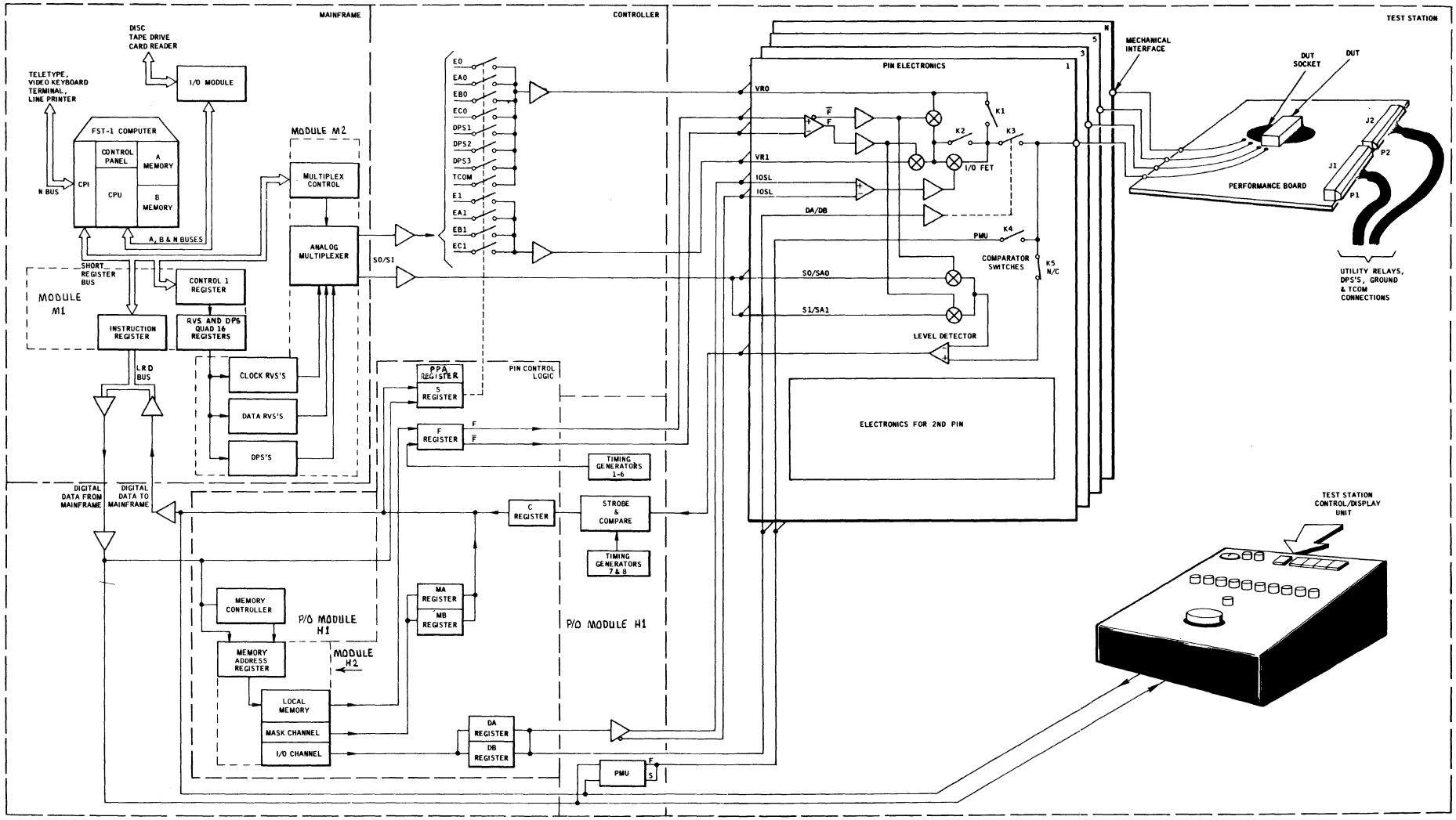


Figure 1-4 One Tester Pin Circuit Functional Block Diagram

1.4.3 FST-2 Computer

The FST-2 computer controls the peripherals, and also acts upon the device test and system programs. This unit is described completely in the FST-2 Computer Reference Manual and a brief overview is given in Section 2 of this manual.

1.4.4 Digital Control Module M1

Digital Data from Mainframe. DMA read/write instructions and other data are transferred to and from the mainframe in struction (I) register via the tester CPI, and the short register bus (SRB). The I-register is thus a digital data buffer between the FST-2 computer and the controller pin control logic and the PMU. This register contains long register addresses, pin and rank addresses and read/write instructions. The controller pin control logic, and thus all controller long registers, are loaded with I-register instructions via the long register bus (LRB), mainframe line drivers, and controller line receivers.

Digital Data to Mainframe. Fail data is strobed and compared in a fail memory (C-register) in the controller. At the conclusion of collecting each fail pattern, the data in the C-register is read into the mainframe I-register via controller line drivers, mainframe line receivers and the LRB. The contents of the I-register is then read into the FST-2 computer via the SRB and the tester CPI.

1.4.5 Analog Reference/Multiplex Module M2

The M2 module supplies RVS and DPS outputs to the controller modules under control of the M1 module registers. The Control 1 register decodes addresses contained in SPU instructions and loads the instruction data into the appropriate RVS/quad-16 registers. Each quad-16 register controls two programmable power supply pairs. The registers establish the range (high or low), polarity, and voltage magnitude of thier respective supplies. The functional test logic level voltages generated by the reference voltage supplies (RVS's) and device power supplies (DPS's) are multiplexed by an analog multiplexer, which allows the use of multiple test stations. This multiplexer is controlled by the FST-2 computer. These multiplexed analog outputs are routed to controller modules L2 and L3.

The RVS's provide the logic 1 and 0 levels to the pin electronics drivers and comparators. Data RVS's are E0, E1, EB0 and EB1. Clock RVS's are EA0, EA1, EC0 and EC1. Comparator RVS's are S0, S1, SA0, SA1.

The DPS's are used as VCC, VBB, VEE and bias supplies. The DPS's are connected directly to the performance boards, or may be switched under program control by the controller pin control logic.

1.4.6 Local Memory

Local memory stores functional F-data and can operate in one of six modes (as described below). Memory channels can be expanded to 2 or 4 times the test pattern depth by chaining (chaining, however, is not allowed if SPM is used) of 2 or 4 pin/memory channels.

1.4.6.1 NORMAL TEST EXECUTION

Testing proceeds by reading sequentially all controller memory words from a start address S to a last address L (figure 1-5). It may loop back from L to address zero (major loop) and may traverse this loop N times. The test sequence may also include a minor loop between addresses J and K which is traversed M times. Addresses S, J, K, L and counts M, N are programmable. Maximum count is 4096. The minor loop may be completely inside or completely outside the major loop as shown. If the controller memory address reaches the last memory word (address 256, 512 or 1024) and if address L is not the last memory word, it automatically goes back to address zero (wrap-around).

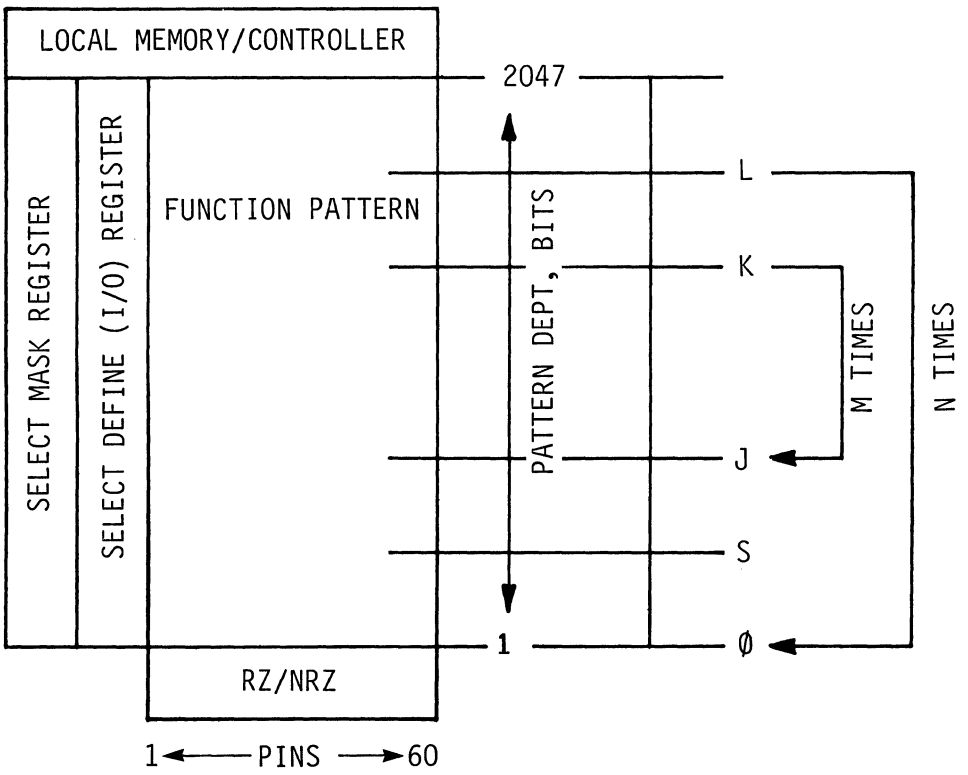


Figure 1-5 Local Memory Control and Execution

The tester leaves normal test mode and becomes idle under two conditions:

1) Address L is reached and major loop counter N is zero. This signals successful completion of a test;
2) A test pattern fails and its address is larger than the address contained in an ignore fail register. This signals failure of a test; the failing test pattern number can be read out of the controller memory address register and the failure pattern can be read out of the C (fail data) register.

1.4.6.2 CONTINUOUS LOOP MODE

This mode is identical to normal test execution except that testing stays continuously in the minor loop. The loop counters are not decremented. While in the continuous minor loop, the FST-2 computer can read or write words into the controller memory. This mode is terminated under program control.

1.4.6.3 MOMENTARY MODE

This mode is used in conjunction with the continuous loop mode so that when the minor loop end K is encountered, the jump of J is inhibited; instead address K + 1 is executed and the momentary mode is terminated (normal mode is resumed). Note the major loop end, L, should not equal K.

1.4.6.4 MATCH MODE

In this mode testing is continuously in the minor loop as long as each test generates a failure. Once the first pass (match) is ecountered the test sequence leaves the match mode and branches to address zero. A match mode failure occurs if the match mode timer runs out before a pass occurs.

1.4.6.5 SYNC MODE

When the sync mode bit is true, an external sync pulse for a specified local memory address is generated when the data in that word is executed. In this mode, functional failures up to and including the sync address are inhibited.

1.4.6.6 EXTERNAL CLOCK MODE

In this mode the controller is synchronized to an external signal that triggers the start of a test period pulse (T) for each test period.

1.4.7 Local Memory Under The Sequence Processor Module (SPM)

The Sequence Processor Module (SPM) allows dynamic alterations of local memory via programming instructions. These alterations are accomplished while testing is in progress (referred to as on the fly). SPM allows the user the facility of condensing local memory size, thus avoiding paging and at the same time eliminating time consuming test overhead.

1.4.8 Pin Control Logic

Mainframe I register instructions are routed from the controller line receivers to the pin control logic. Instructions are applied directly to the S-register and PMU, and to the controller local memory via a local memory controller and an address register. The local memory I/O channel is used to enable and set either the parallel DA or DB register. The local memory mask channel is used to enable and set either the parallel MA or MB register.

1.4.9 Timing Generators

Eight timing generators provide test synchronization and timing for single or multiphase clock devices, comparator strobes and data timing. Each timing generator is completely programmable. If no generator is programmed for data timing, the start of a test period pulse is used for data timing. Timing generators 7 and 8 are comparator strobes. One of two strobe patterns may be selected for each pin. The strobe patterns have programmable width and delay. Also, the strobes may be ORed together to create a composite double strobe pattern.

1.4.10 Precision Measurement Unit (PMU)

The precision measurement unit (PMU) is an instrument which, under program control, can be connected to an individual tester pin of the DUT for the purpose of making a quantative voltage or current measurement at that point. This is useful during DC parametric testing. This type of testing is essential for specifying semiconductor parameters such as saturation voltage, input leakage, etc. For DC parametric testing, relay K5 is open and the PMU force and sense lines are connected to the DUT via relay K4.

The PMU is capable of applying (referred as forcing) a precise program-specified voltage or current to any desired tester pin of the DUT. When a voltage is forced the PMU measures simultaneously (via a high speed comparator) a current or when a current is forced the PMU measures the voltage. The use of the PMU voltage clamp offers the user full protection from over-voltage due to programming errors or voltage complaince problems. The system software provides an analog to digital conversion for datalogging.

The PMU can also be used to make a variety of internal measurements within the test system itself such as measuring test head analog reference voltages and functional test voltages, as voltages at certain test points located on printed circuit cards within the system. This is done automatically during system self-check under the control of diagnostic programs. Thus the PMU is also a trouble-shooting aid at the user's disposal for purposes of system maintenance.

1.4.11 Pin Electronics and Test Head

Pin electronics cards are located in the test station test head. These cards are placed radially in the spokes of a wheel pattern to provide a uniform and minimum lead length from the cards to the DUT. Each card contains two identical circuits for servicing 2 DUT pins, and up to 30 pin electronics cards can be used to service up to 60 pins. Each pin electronics circuit functions in any one of four possible modes under complete program control:

- data mode
- clock mode
- sense mode
- power supply mode

1.4.11.1 DATA MODE

With DA or DB true, the corresponding relay (K3) closes, connecting the pin as an input to the DUT. In this mode, either reference level VR0 or VR1, as selected by the F register, is applied as the input logic level to the DUT pin via an apporpriate field effect transistor (FET) switch, which is in series with the I/O FET switch. The FET switches are driven by gate drivers, which translate the line receiver data to the necesary voltage levels.

The use of FET switches permits switching of an I/O pin from one state to the other within 50 nanoseconds for a 5MHz test head and 30 nanoseconds for a 10MHz. The S-register is programmed to select which power supply reference pair, and thus which programmed level, is used for the VR0 and VR1 references.

1.4.11.2 CLOCK MODE

In the clock mode, the functions of the DA/DB register, and relay K3 are the same as described for the data mode. However, when a pin is connected as a clock pin by the statement CONN CLK, relay K2 closes, shorting out the I/O FET switch. This reduces the impedance, and increases peak current by approximately 50 percent. This current is necessary for charging large clock line device capacitances. A clock pin is always an input pin. In the clock mode, EA0/EA1 or EC0/EC1 may be connected to the input pin, as programmed by the S and F registers.

1.4.11.3 SENSE MODE

With a 0 bit written into both the DA and DB registers, the corresponding K3 relay is open, and the corresponding pin is programmed as a sense (output) pin. DUT outputs are connected to a level detector circuit via relay K5, which is normally closed unless the PMU is connected for DC parametric testing.

The second input to the level detector is derived from an RVS which is driven by gate drivers that translate the line receiver data ($F/\bar{F}$) into the proper voltage levels. The power supply is programmed to provide an accurate logical 1 or 0 level. The output of the DUT is applied to the level detector and compared to the programmed level of the power supply (S0, S1). The F register is utilized to specify whether a logical 1 or 0 level is expected on the output pin. When set to a logical 1, a bit in the F register specifies an expected logical 1 level output from the corresponding DUT pin, and S1 is selected. When set to a logical 0, that bit specifies an expected logical 0 from the DUT pin, and S0 is selected. The output of the level detector is applied to decision making logic and is strobbed into the C register, which is the fail memory register.

Pins programmed as "don't care" pins in the M register (i.e., with a 0) are not strobed into the C register; only pins programmed as "care" pins (i.e., with a 1) are written into the fail memory.

1.4.11.4 POWER SUPPLY MODE

In this mode, the input pin is connected to any DPS or to tester common (TCOM). When a pin is programmed as a power supply pin, the corresponding K1 relay is closed. Closing relay K3 connects the DUT pin as an input as previously described. Closing the K1 relay provides a low impedance back from the RVS buffer amlifers to the DUT.

1.4.12 Performance Boards

The performance board provides the interface between the test head and the DUT. Several performance board models are available for wafer probing applications and manual device insertion applications; the one actually used is determined by the application. All performance boards demand certain interface wiring installed by the user; specifically, the connection of the tester pins to be used in the program with the device pins -- not necessarily on a one-to-one basis. The performance board allows optional wiring dependent upon the requirements established by the user. For example, it may be desired to have passive or active loads on certain device/tester pins. If the loads are to remain on the pin(s) throughout the program execution, they may be wired directly. If the loads are to be connected/disconnected/reconnected at invervals throughout the program, they should be connected through optional programmable utility relays which the performance board is designed to accommodate.

1.4.13 DUT Connection

Typically, in the manual device insertion test head configuration, a device test socket is attached to the center of the performance board. In this configuration, the device to be tested is simply inserted in the socket, and device testing can be started. In the wafter probe configuration, the performance board interfaces to the wafer through a fuzz button ring to the probe ring on the wafer prober itself.

1.4.14 Pattern Processor Module (PPM)

The Pattern Procesor Module (PPM) allows pattern testing of memory matrices, DC parametric testing, and functional testing from local memory all in one test sequence.

Testing is accomplished by microprograms maintained as programming modules in system storage. Each module is essentially a self-contained program structure for a specific purpose. Because of its modularity the same microprogram may be called from several FACTOR programs.

From a hardware view, data patterns are generated directly by one of 16 different hardwired data equations without requiring any software intervention. This increases throughout, requires no memory overhead, and generation is conducted at test rate.

1.4.15 4880 Bus Interface Coupler

The Model 4880 IEEE 488 Bus Interface Coupler allows the user to add 488 Bus compatibility to any ASCII instruments and control them by the Sentry VII. Devices connected to the bus may be talkers, listeners, talker/listener, or controllers.

Communication with the bus is controlled by a FACTOR test program or by the operator from the VKT keyboard while under control of the TOPSY monitor. ASCII data may be passed to and from the instruments. In addition, numeric values may be passed to the instruments from a FACTOR test program as variables and the data read back from the instrument may be converted to a variable so that the test program may operate on forcing values or measurements.

SECTION 2

FST-2

This section provides a general description of the FST-2 computer. Only general information is included here; for more detailed information refer to the FST-2 System Description Reference Manual. Information covering controls and indicators is discussed in Section 4.

The computer consists of three basic subsystems as follows:

1) Central Processing Unit (CPU)
2) Memory System, as well as a memory interface
3) Common Peripheral Interface (CPI)

The basic FST-2 system configuration is presented in Figure 2-1. The Central Processing Unit memory system, memory inteface, and common peripheral interface are discussed in the corresponding sections below.

2.1 CENTRAL PROCESSING UNIT (CPU)

The Central Processing Unit (CPU) executes the instructions contained in the program, performs arithmetic operations, and processes interrupt requests from the peripherals. Data is transferred between the CPU and peripherals via a bi-directional accumulator bus.

2.2 MEMORY SYSTEM

The memory system provided with the FST-2 is a random access storage unit. It uses dynamic MOS semiconductor RAMs as storage elements.

The memory is modular in 16K words by 25 bits. Its minimum size is 16K words. Its maximum size is (192 x 1024) 196K words. The storage elements are mounted on up to 24 identical memory boards. Each memory board contains 8K words by 25 bits, two memory boards make up a module.

The memory is divided into an A memory and a B memory. (See Figure 2-1) The A memory contains all even words, the B memory all odd words. Each 16K module consists of one A memory board and one B memory board.

Both A and B memories are independent and can be accessed simultaneously. For example, memory A could execute a CPU instruction fetch while memory B executed a DMA transfer to or from a peripheral.

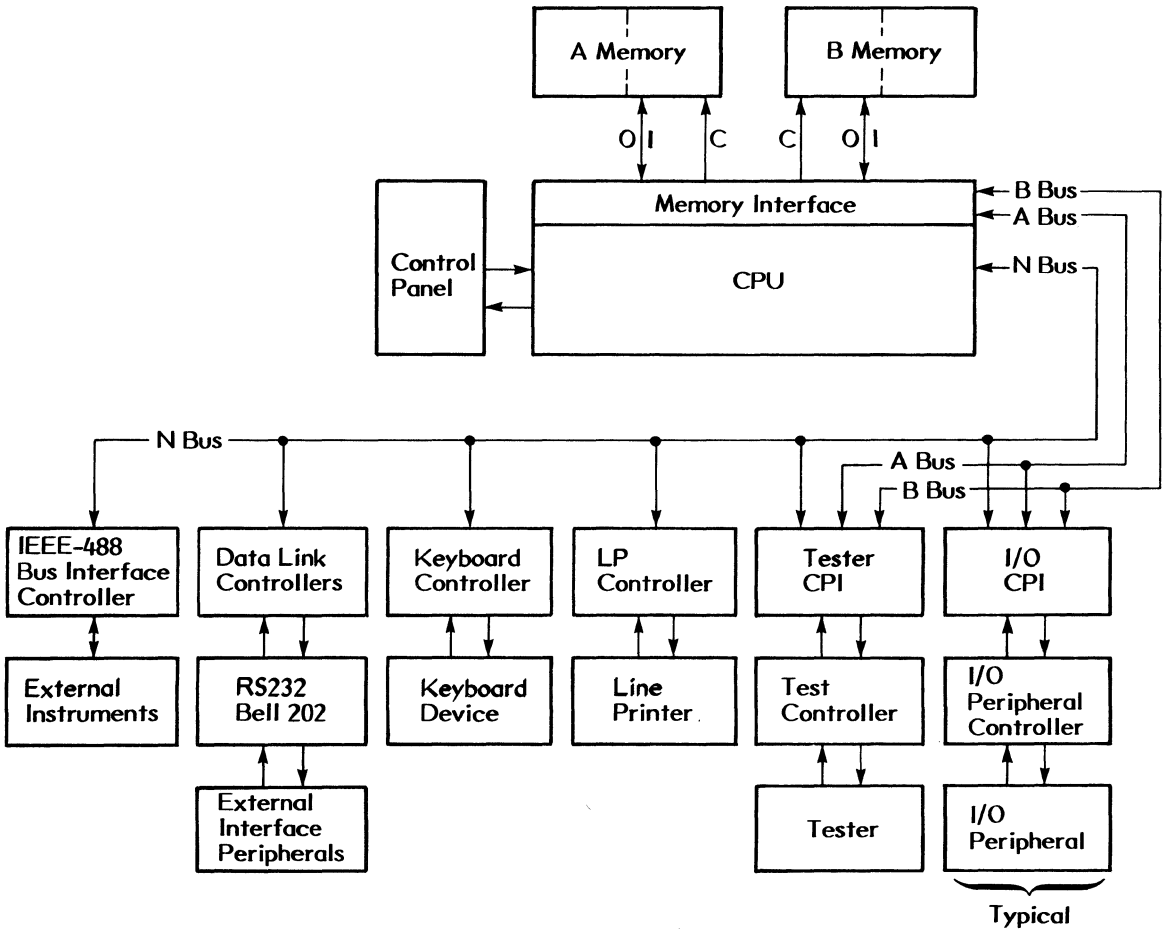


Figure 2-1 Basic FST-2 System Configuration

2.2.1 Memory Interface

The memory interface contains the necessary control circuitry to provide and regulate access to the memory, both by the CPU and by selected peripherals. Each peripheral (except the keyboard device, Data Link Controller, IEEE-488 Bus Controller, and line printer) can interact with the FST-2. Interaction can be between the peripheral and the CPU via the bi-directional N (accumulator) bus, where the CPU controls operations within the peripheral by transmitting Select Peripheral Unit (SPU) instructions, or interaction can be between the peripheral and memory (through the memory interface) via the bi-directional A bus (memory A bus) and/or B bus (memory B bus). This occurs without any explicit involvement of the CPU, and is called DMA (Direct Memory Access) mode.

A typical example of such a DMA operation is the reading of a series (block) of 24 bit data words from A or B memory into the peripheral. In such a case, certain control information, such as the initial memory address location and number of words, is needed prior to starting DMA mode. This information is sent from the CPU to the CPI in the form of SPU instructions, via the N bus.

Figure 2-1 shows one I/O peripheral as a typical case. In practice, there are three I/0 devices which are commonly used in Sentry test systems. They are:

- magnetic tape unit
- disc
- card reader

2.3 COMMON PERIPHERAL INTERFACE (CPI)

The Common Peripheral Interface is designed to provide a standard interface between the FST-2 Central Processing/Memory and each of the several Peripheral Control Units that can operate in DMA mode.

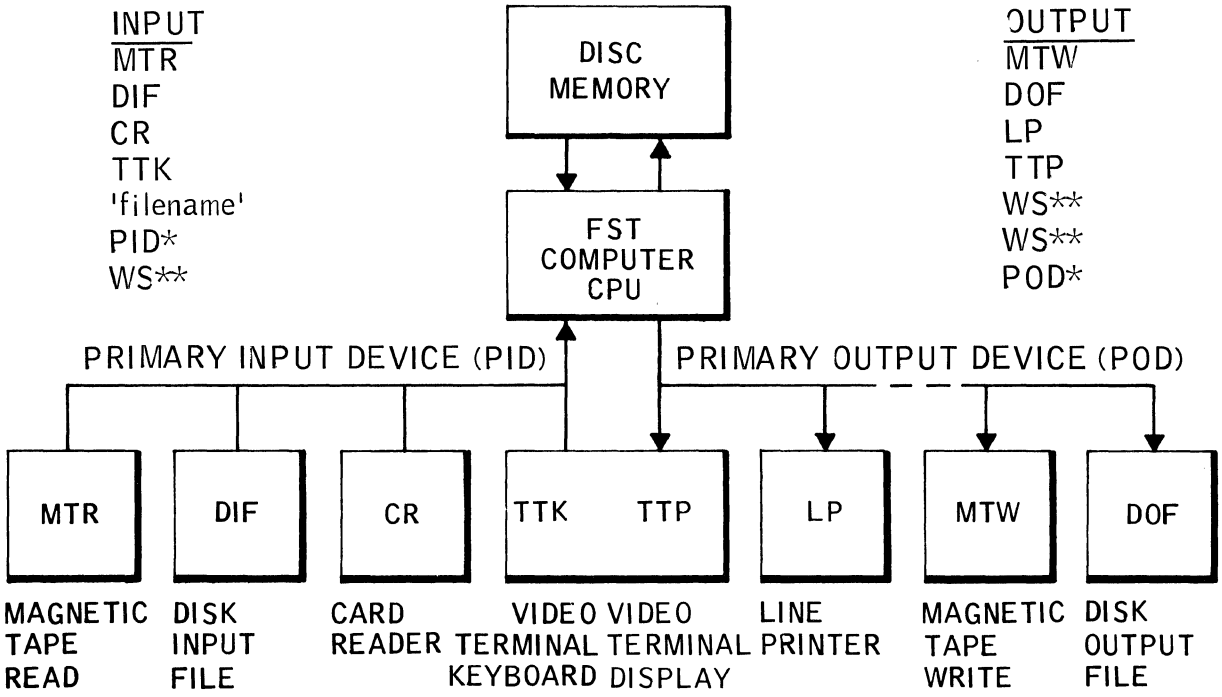
The CPI has three main functions:

1. Direct memory access
   a. it resolves memory access priority
   b. stores and advances the memory address
   c. gates address and data to and from the memory buses.
2. SPU instruction actions
   a. it determines device selection
   b. partially decodes the command
   c. gates status bits to the accumulator bus
   d. executes logic initialization command (enable, disable interrupt, interrupt complete) and the "arm interrupt" command
   e. gates data to and from the accumulator bus.
3. Interrupt actions
   a. it resolves interrupt priority
   b. gates the wired-in interrupt address to the accumulator bus except in the tester CPI where a variable interrupt address is gated by the tester
   c. stores the fact that an interrupt is in process.

SECTION 3

OPERATOR'S COMMAND LANGUAGE

The operator's command language is supported by two programming systems, DOPSY and TOPSY. These systems are written in assembly language, and operate under the control of a respective monitor. This section describes the system information flow and the two programming systems. Figure 3-1 shows an information flow diagram for the system, and defines mnemonics for the various peripherals. These mnemonics are used when an operator selects an input/output device, and are used throughout this manual.



*DEFAULT IF NONE SPECIFIED
**WORKING STORAGE (WS) IS ALSO CONSIDERED AN I/O FUNCTION

Figure 3-1 System Information Flow

3.1 COMMAND SYNTAX, FORMAT AND RECORDS

3.1.1 Command Syntax

Many TOPSY/DOPSY system commands have numerous possible forms. Syntax notation provides a convenient method of identifying all options precisely and succinctly. Special syntactical characters are used to identify alternative forms of the commands. These characters are not entered as part of the command; they simply define the command structure.

3.1.1.1 CONSTANT PARAMETERS

Any word shown in upper case in the general form is a constant parameter and is always entered exactly as shown. The general form of a command required to transfer control to the TOPSY monitor is as shown below, (the // is optional)

Example: // TOPSY
This statement has no options.

3.1.1.2 VARIABLE PARAMETERS

Any word shown in lower case in the general form is a variable parameter; the word used indicates what kind of information is required. The limits on the value of the variable depend on the statement in which it is used.

Example: // JOB 'jobname'

The word 'jobname' indicates a particular jobname that must be entered within the single quotes and not the seven characters that comprise the word jobname. // JOB ' ←←←← ' is a legal statement.

3.1.1.3 REQUIRED PARAMETERS

Brackets are used to enclose a set of parameters where one, and only one, of the parameters in the set must be used. The parameters in the set are separated by the slash character.

Example: OPEN [DIF/DOF] 'filename'
Either DIF or DOF must be specified.

3.1.1.4 OPTIONAL PARAMETERS

Parentheses are used to enclose a set of optional parameters where, at most, one of the parameters in the set may be used. A slash is used to separate parameters in the set. An underlined parameter identifies the default case if only that parameter is omitted.

Examples: // CREATE 'filename' (OVLY)
The OVLY is optional in this command.

...(STRING/OBJ/DATA(integer))
If a file type is specified either STRING/OBJ or DATA can be used. If the file type is not specified a STRING file is assumed.

3.1.2 Command Format

Command entry to the system is free format except that the name of the command or the key word must be entered first. The order of parameters, unless specifically mentioned, is random.

Commands may be optionally preceded by either a // or /. to denote a command entry. The // (DOPSY commands) or /. (TOPSY commands) are used in this manual to identify a command, but is not a required part of the command format. The // or /. format may be desired when creating a command file on disc, mag tape, or cards to identify a command or to use the SKIP command feature under DOPSY.

Under DOPSY execution, the // format may be used to ignore certain commands if the TTK is not the input device. If // is entered in column one and two, the third column must be blank or equal to the last accept-command character given to the system. The accept-command character is supplied on the NOTE ANSW command. (See Note Command)

Column	1 2 3 4	
DOPSY:	* / / command-name	operand parameters
	* / . command-name	operand parameters
	* Command-name	operand parameters
TOPSY:	: / . command-name	operand parameters
	: / / command-name	operand parameters
	: Command-name	operand parameters

The remainder of the command record contains the command name, followed by the operand parameters. The command name is terminated with the first special character (anything other than a letter or digit is ignored by the system). The operand parameters must be separated from each other by a special character,

3.1.2.1 NOISE WORDS

There are certain reserve names that are used by a command to specify options: STRING, TTP, LP, CLEAR and MAP are a few examples. Words, or names, other than reserved names recognized by the command may be inserted freely to improve read-ability. Some examples of this are shown below. The underlined terms are the commands and parameters; other words, characters, etc. are considered noise and are ignored.

// DUMP ONTO LP LOCATIONS 200B TO 1500B

// CREATE A STRING FILE NAMED 'FILE1' FROM WS

// RENAME FILE 'TEST3' AS 'TEST4'

// EXEC LOAD FROM CR AND 'PRIG1' AT 500B. CLEAR AND MAP

// CREATE A DATA FILE NAMED 'SAMPLE1'. RECORD SIZE IS 15

// ASSIGN 100 SECTORS TO FILE 'DATALG'

3.1.3 Command Records

Commands recognized by the DOPSY/TOPSY monitors are provided by the selected input device. When entering commands from the keyboard, limited editing facilities are provided. The character produced by pressing the control-B is a backspace and deletion of a single character, and that produced by pressing the control-L is a line deletion. The former is indicated by echoing a backarrow for each occurrence, while the latter is indicated by a carriage return, line feed and an asterisk (DOPSY), a colon (TOPSY), or a dash (ANALYSIS).

3.1.3.1 OPERAND PARAMETER TYPES AND LIMITATIONS

The types of parameters that may occur in an operand are listed in Table 3-1. Table 3-2 lists the operand parameter limitations.

TABLE 3-1 OPERAND PARAMETER TYPES

Type	Description
string	A sequence of characters, other than a single quote, enclosed in single quotes. These are used to reference files, job numbers, etc. Only the first six characters are retained. Example: 'FILE.1' 'CER*' 'ABIGSTRING'
name	A sequence of letters, including a dollar sign ($) or digits: the first character must be a letter. Like strings, only the first six characters are retained. Example: TTK CREATE TEST34
'filename'	The term 'filename' refers to a named file within the current job. The single quotes are required.
integer	A sequence of digits which, if terminated by the letter B, is assumed to be octal, otherwise, decimal. Only the low order 24 bits are retained. Example: 1500B 40B 77777777B
special characters	These are generally ignored but must be present to separate the parameters. Characters other than letters or digits are special characters. Example: , : + space
floating point numbers	A floating point number is a sequence of digits and special characters in any of the following forms: +xxx decimal integer +xxxB octal integer +xx. +xx.xx decimal numbers +.xx +xx.E+xx +xxx decimal numbers with exponent +.xxE+xx where x is a digit, 0-9 y is a digit, 0-7 + may be omitted, and E + xx = 10+xx

TABLE 3-2 OPERAND PARAMETER LIMITATIONS

Form	Limits
Decimal Integer	-8388608≤ n ≤ 8388607
Octal Integer	-37777777B≤ n ≤ 37777777B
Decimal Number	The integer is formed by ignoring the decimal point and any leading zeros. It must be a legal decimal integer. The actual number must be within the legal decimal number limits, including exponent.
Decimal Number With Exponent	n = 0 or 2.7105E-20≤ n ≤ 9.2228E18
Examples:	29 16B 2840.7 -14.3E-5

3.1.4 System File Organization

The kinds of files that the system processes are:

STRING
DATA
OBJECT
COREIMAGE.

The records that comprise these files are characterized by record length:

fixed
varying

and record contents

characters
words

STRING files are composed of variable length records. A source file such as a FACTOR program would be stored on the disc as a STRING file. Any string of up to 80 characters can comprise a record of a STRING file. If the contents of a STRING file were to be printed on the line printer, the printout would be an exact reproduction of the original strings written on the disc. If a FACTOR STRING file were to be compiled, the resulting object code would exist on the disc (in working storage) as a temporary file. Before the object code could be executed it would have to be reformatted as a DATA file. A DATA file consists of specially formatted object code (18 words per record) required by the tester for execution.

OBJECT files and the COREIMAGE files are of interest only to assembly language and system programmers. (For more detailed information on assembly language refer to the Assembly Language Under TOPSY reference manual, manual part number 67095720.)

Table 3-3 shows a quick reference chart of the Fairchild file conventions used.

TABLE 3-3 FILE REFERENCE CHART

File Type	Description	Listing Designator	Filename Special Character	Description
SOURCE or STRING	FACTOR or assembly language files that have not been compiled or assembled. If assembled, file becomes an OBJECT file. If compiled file becomes DATA file.	S	*	File is unassembled or uncompiled and stored on disc
COREIMAGE	Files having a one to one correspondence to executable CPU (FST-1, FST-2) instructions and are located in absolute address locations.	C	$	File is only callable from DOPSY
			:	File is only call able from TOPSY
OBJECT	Same type of file as COREIMAGE plus relocatable information.	O	=	Primary convention for indicating an OBJECT file .
	OBJECT files are not executable and are only assembly language programs that have been assembled.		$	OBJECT file is callable from another program.
DATA	Test plans generated by the compiler.	D	N/A	
	DATA files may also be FACTOR program generated files (i.e. FACTOR WRITE statements)			
ALL	Only applicable when OVLY parameter used	N/A	&	When CREATE... OVLY is used and not enough space exists for new file a file is deleted and the new file is designated by an ampersand

Example

1. Using a FACTOR program:

//CREATE '*ABC' TTK	Allows creation of a test program source file.
.	
.	
. (FACTOR statements)	
.	
//	Indicates end of source input and returns control to DOPSY.
// COMPILE '*ABC' OBJ	Compiles the source file and puts the compiled file in working storage.
// CREATE 'ABC' DATA	Makes compiled file a DATA file with different name.
// LOAD 'ABC' STAT1A	Loads the DATA file and prepares it for execution.
press the RUN button	Executes the test program.

2. Using an assembly language program:

// CREATE '*ABC' TTK	Allows creation of a test program source file.
.	
. Assembly Language	
. statements)	
.	
.	
//	Indicates end of source input and returns control to DOPSY.
//ASM '*ABC' OBJ	Assembles the source file and puts the assembled file in working storage.
//CREATE '=ABC' OBJ	Makes assembled file an OBJECT file
//CREATE '$ABC' COREIMAGE '=ABC'	Creates a named coreimage file from the object file.
// EXEC '$ABC'	Loads the coreimage file.
press the RUN button	Executes the program.

3.2 ERROR RECOVERY

Whenever the system encounters an error that requires user intervention, the message

ERROR--text

is output. The text following the two dashes describes the error condition. If the PID is the keyboard the system responds with an asterisk and expects a command to be typed. This command may be the same one with the error corrected or a new one. If the PID is the CR, the asterisk is printed and either ABRT, CR, TTK, DIF or MTR must be typed as a response. If the response is none of these, the system again responds with the error message and the response must be entered again.

ABRT causes the job to be skipped while CR, MTR, DIF and TTK indicate that the command is to be re-entered from the card reader, magnetic tape, disc file, or keyboard respectively. If the command is to be ignored, type CR and alter the card deck in the card reader. When the response is CR, a halt occurs to allow the input deck to be altered if necessary. Pressing the system START pushbutton causes processing to continue. When inputting commands from magnetic tape, the corresponding procedure may be used. Refer to Appendix C for further descriptions of system recovery procedures.

3.3 DOPSY

DOPSY is a programming system that consists of a collection of programs that operate under the control of a DOPSY monitor. DOPSY organization is shown in Figure 3-2.

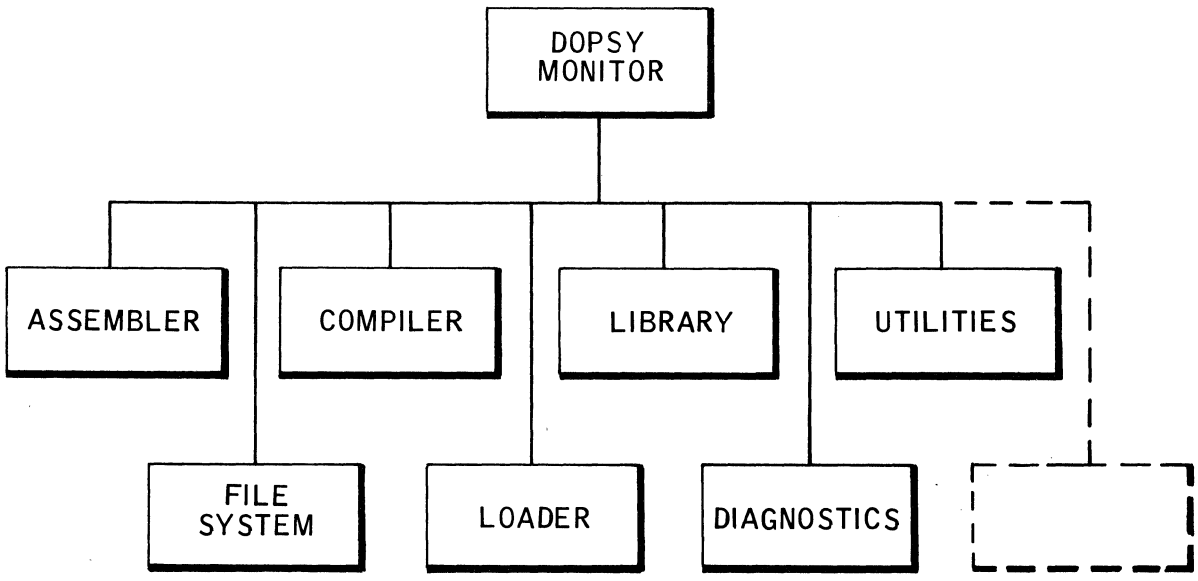


Figure 3-2 DOPSY Organization

Disc memory sector allocations for DOPSY are shown in Figure 3-3. Memory allocations for the DOPSY monitor are shown in Figure 3-4.

Figure 3-3 illustrates how space is allocated on the disc. Most of the facilities used by DOPSY for maintaining the disc and file processing are available to users.

Of the five areas on the disc only the first three:

1. The core buffer (CB),
2. The file directory,
3. The skeleton monitor,

are fixed in size. The size of the file director can change only by issuing the appropriate ASSIGN command. The size of the file area and WS, however, are continually changing as a result of the ASSIGN, DELETE, and CREATE commands, and any increase in the size of one results in a decrease in the size of the other.

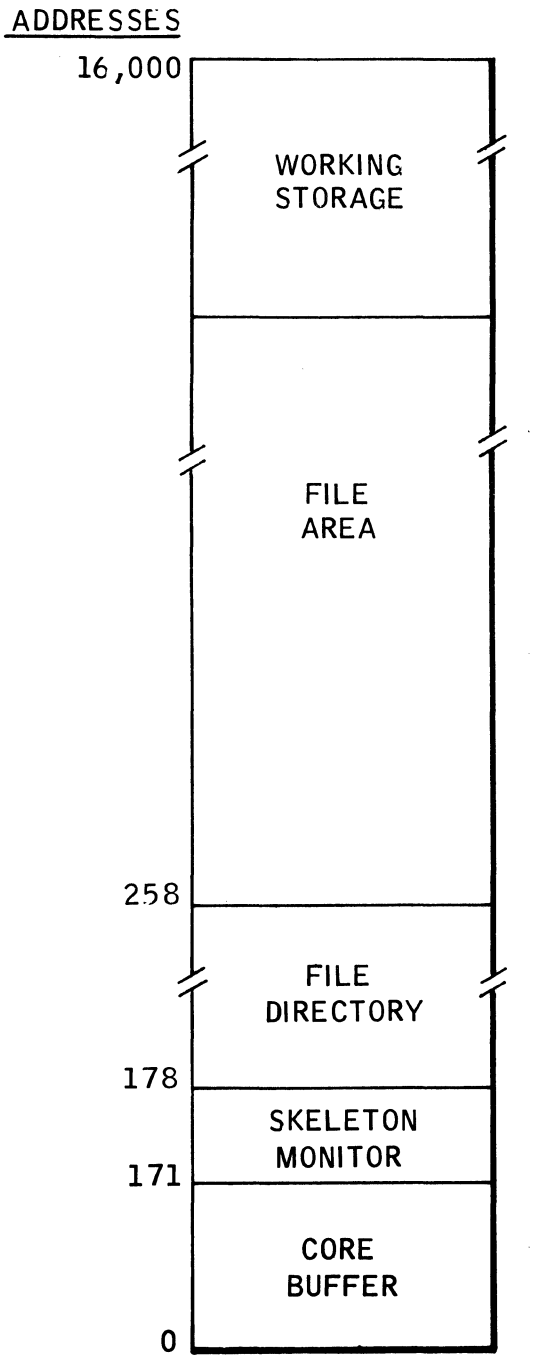


Figure 3-3 Disc Sector Allocations

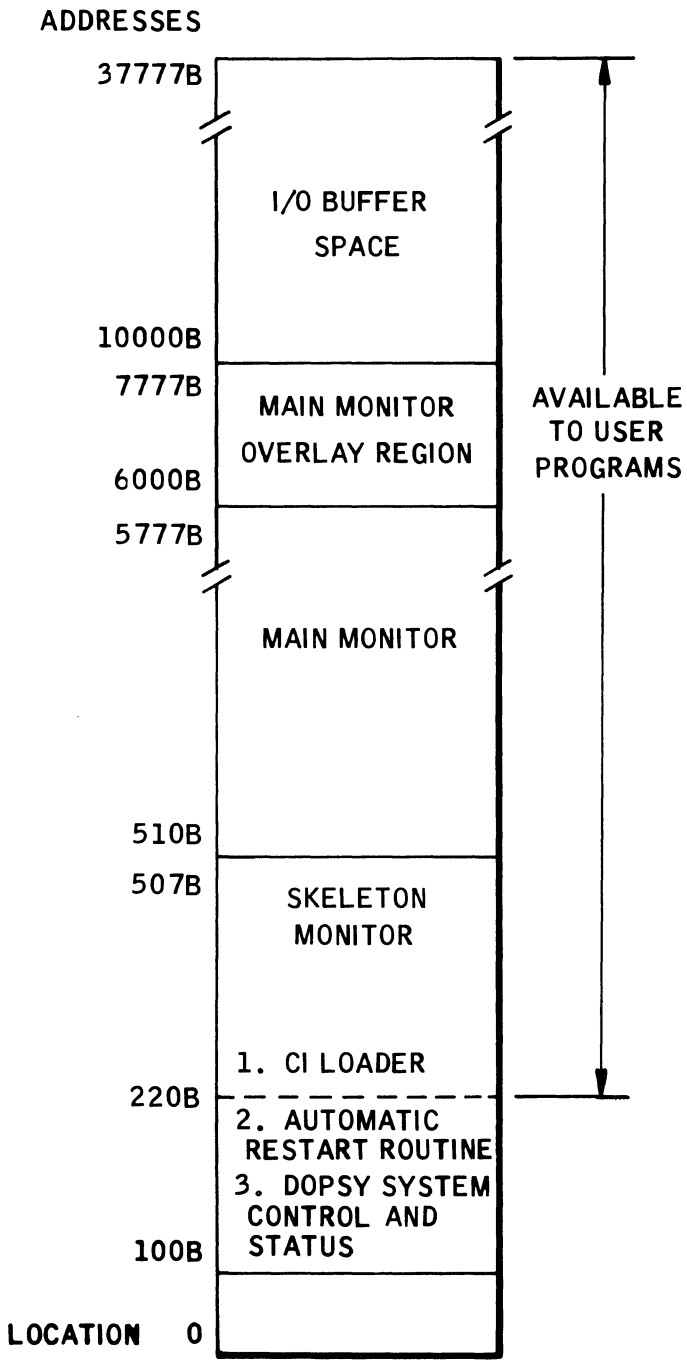


Figure 3-4 Memory Allocations for DOPSY

3.3.1 DOPSY System Commands

The following pages contain the DOPSY system commands. The commands are listed in alphabetical order. The // is optional and not required when entering commands from the TTK and is used in this manual to differentiate between DOPSY and TOPSY commands.

The following DOPSY utility commands are contained in the Sentry Utilities Reference Manual, manual part number 67095661 and are not discussed in this manual:

- BMT
- CHANGE
- COPJOB
- CRDTAP
- DBUP
- DEBUG
- DELJOB
- EDIT
- FCOMP
- FINDJOB
- INIT
- INSERT
- LABEL
- LISTC
- NOTE
- PATCH
- TAPLP
- TDX
- XMIT

3.3.1.1 ASSEMBLE AN ASSEMBLY LANGUAGE STRING FILE

Format:

// ASM input/'filename' (output(LIST)(INSEQ)(SPASS)(XREF)(OBJ/OBJECT)(SYM)

where:

input -	any valid input device
filename -	any valid six character alphanumeric name
output -	any valid output device (POD if none specified)
LIST -	specifies a full assembly listing
INSEQ -	checks card columns 73-80 and flags any record out of sequence
SPASS -	specifies a single pass assembly (forward symbolic reference only)
XREF -	specifies a cross reference listing (ignored if SPASS specified)
OBJ/OBJECT -	generates an object file in working storage at the end of the assembly. OBJ is the default case.
SYM -	produces a symbol table listing

Description:

This statement is used to assemble and assembly language string file from the input specified.

Error Messages:

Message	Description
IN FILE SPECIFICATION/TYPE	The source file cannot be located or its type is not string or data.
EOF-END ASSUMED	The source program file has been exhausted, but no END statement has been read.
MONITOR RECORD IGNORED	The source file contained a monitor record.
MAG TAPE WRITE ERROR	The listing has a bad record. Assembly is continued.
SYMBOL TABLE	The symbol table is not large enough for the assembly.
OVERFLOW	The program must be segmented.

DISC OVERFLOW	The capacity of the disc makes it impossible to assemble the file. Delete some files to make more space available.
INVALID FILENAME	The file name cannot be located on the disc.
MAG TAPE I/O CONFLICT	Magtape was specified as both an input/output device.
LINE PRINTER NOT READY	The line printer is not on-line.

3.3.1.2 ASSIGN SPACE FOR NEW FILE OR EXISTING FILE

Format:

ASSIGN ('filename' integer 1 (WORDS/SECTORS) (STRING/DATA (integer 2))

where:

filename -	six character name of new or old file. If the file is an old file it may be of any file type, including coreimage.
integer 1 -	specifies either the number of words or sectors being assigned or changed.
WORDS -	specifies file space in words. The integer value specified is rounded to the nearest multiple of 48
SECTORS -	specifies file space in sectors. SECTORS is the default case if neither WORDS nor SECTORS is specified
STRING -	indicates filename specified is to be a string file
DATA -	indicates filename specified is to be a data file. DATA is the default case if neither STRING nor DATA is specified
integer 2 -	is the record size if the file is a DATA file. Integer 2 may have a value from 2 to 20. The default record size is 18 if none is specified.

Description:

This statement assigns space for a new file or allows the space assigned for an existing file to be changed. If the file specified is an existing file space is either added or removed from the end of the file so that the allocated space agrees with the space specified. However, in no case is usable information destroyed. Attempting to remove usable information causes a warning message to be issued. The file size is reduced as much as possible so that all usable information is still included.

Error Messages:

Message	Description
System Error 1	$UPDAT overlay is missing (called by $CREAT, $CREAT2, $DELET or $ASSIG).
System Error 9	Working storage is exhausted or input start address greater than top of WS+1.
MISSING PARAMETER	The file name was omitted.
DIRECTORY FULL	The file directory is full.

IN RECORD SIZE	Data records cannot be larger than 20 words or smaller than 2 words.
DISC OVERFLOW	The requested extra space is not available on the disc. The operation is suppressed.
INVALID FILE NAME	The filename specified failed to start with a non-blank character or was a reserved name ($DIRCT or $ARR).
DELETION OF USABLE INFORMATION SUPPRESSED	The requested reduction of file size would destroy usable data; the file size is reduced to the minimum size required to retain all the data.

3.3.1.3 CLOSE DISK FILES

Format:

//CLOSE (filename)

where:

filename - six character alphanumeric name of file to be closed.

Description:

CLOSE closes those disc files used as DOF, (opened by //SET DOF), or any file that has been opened by using the DOF PMF header.

Error Message:

None.

Example:

To close a string file called NEW

CLOSE NEW

CLOSED

3.3.1.4 COMPILE A STRING FILE

Format:

```
// COMPILE ('filename1'('filename2')/CR/TTK/MTR) (TTP/LP/MTW)
    (LIST/LISTOBJ/NOLIST/)(OBJ/NOOBJ)(ADDR/NOADDR)("title")
```

where:

filename -	1-6 character alphanumeric name of file on disc to be compiled. If a second file name is included the first file is the source file and the second file is deleted and a data file is created automatically on the disc with the specified file name at the end of compilation.
CR -	specifies card reader as source of compiler input.
TTK -	specifies VKT keyboard as source of compiler input.
MTR -	specifies magnetic tape as source of compiler input. May not be specified if MTW used.
TTP -	specifies VKT screen as output device.
MTW -	specifies magnetic tape as output device. May not be specified if MTR used.
LP -	specifies line printer as output device.
LIST -	specifies the listing of source code with statement numbers.
LISTOBJ -	specifies the creation of a data file and a complete listing of both the source code with statement numbers and the compiled data file code.
NOLIST -	suppresses the listing. This is the default case.
OBJ -	specifies the creation of a data file in working storage on the disc. This is the default case.
NOOBJ -	specifies that no data file is to be created in working storage.
ADDR -	specifies the listing of the memory address all SET F statements. This is the default case.
NOADDR -	specifies that no memory address listing of SET F statements.
title -	alphanumeric character string enclosed in double quotes (") that is printed at the top of the compiled listing if LIST has been specified.

Description:

COMPILE is used to prepare a FACTOR program for execution. COMPILE calls the DOPSY compiler to convert FACTOR English-like statements into a program file of object codes. The compiler expects input from only one of the input devices, however, the user may elect to not specify an input device, in which case the input is from the PID.

Various output options are available. No more than one output device may be entered. If no output device is specified the output, if any, is directed to the POD.

At the end of the compilation, a DIF file is created and set as the PID to delete and create the data file and set the TTK and TTP.

```
//DELETE 'file2'
//CREATE 'file2' DATA
//SET TTK TTP
```

Restrictions:

Only one input and output device allowed. MTR and MTW may not be specified together.

Error Message:

Message	Description
SYSTEM ERROR 2	DIF/DOF procedural error.
ILLEGAL INSTRUCTION	The instruction is not for this system.
USE ERROR -- DEFINED	Incorrect usage of the applicable variable.
USAGE -- SCALAR/FOR/PAR/ARRAY/FUNCT/ SUBR/LABEL/SS	
FILE NAME ERROR	An incorrect file name was used in the insert statement.
DOUBLE DEFINE "VARIABLE NAME"	Indicates a duplicate label definition is used within the same block.
COMPILER GENERATED ENABLE TEST	The list of local memory SET F instructions exceeds the local memory area defined by the SET PAGE statement.
SEQUENCE ERROR	An error has been found in the sequence numbers punched in the source cards (after column 72). The statement is still compiled correctly.
SS FULL	The compilers capacity for storage of symbols has been exceeded. Reduce the number of symbols used.
NW FULL	Too many noise words have been entered.
WORK FULL/EXIT FULL	The program has a compound tail too large to be processed as one statement. The program should be divided into blocks or subroutines.

DISC OVERFLOW	There is not enough space on the disc memory for further object programs to be built up in working storage.
EXCESS BLOCKS	There are more than eight total blocks nested within the program.
INVALID TERMINATOR	An expected terminator or delimiter is incorrectly specified or missing.
I/O SPECIAL ERROR	The I/O control word has indicated an error.
END OF FILE INPUT	The input field has been exhaused without finding an END statement.
EXCESS VARIABLES	A block with more than 127 variables has been specified.
PROGRAM TOO BIG	The program has more than 1,000,000 instructions.
MISSING))	A left or right parentheses has been left out.
EXPRESSION SYNTAX	An expression has been written incorrectly.
MISSING	A left or right bracket has been left out.
NUMBER EXCEEDS LIMIT	The number is out of the allocated range.
'NAME' ALREADY DEFINED	Indicates a duplicate variable.
SET PAGE ERROR	The SET PAGE statement appears in the program more than once.
NO ADDRESS	No last test address is defined.
LABLE NOT IN BLOCK 0	On fail branch, the label must be in block 0, the main block.
MISSING NAME	An identifier should have been specified in this syntactical position.
MISSING NUMBER	A number should have been specified.
STATEMENT SYNTAX	A statement has been incorrectly written.
NUMBER SYNTAX	A number has been specified incorrectly.

Examples:

A typical initiation command might be:

```
//COMPILE'*TEST' 'TEST' LIST LP
```

followed by a carriage return, if entered from the VKT keyboard. This command causes the source program to be read from the file on disc name '*TEST' and produces both a data file named 'TEST' and also a listing of the source statements on the line printer. Local memory addresses are printed beside local memory load statements.

When a program error is detected, one of two procedures is taken:

(1) If the error is recoverable, i.e., if the compiler can continue, FACTOR continues to compile and notifies the user of further errors.

(2) If the error is not recoverable, the DOPSY monitor is called and an asterisk is typed to notify the user that DOPSY is in control again.

NOTE

When a listing is given, a header is output on the first page followed by three line feeds. The header displays the source file name, data file name if one was specified, any message entered in double quotes on the command, and the compiler revision level.

```
*COMPILE '*X1' "COMPILED AT 2:20PM 9/22/76" LIST

SOURCE FILE *X1
DATA FILE     X1
COMPILED AT 2:20PM 9/22/76
COMPILER REV 11.0

000001          SET PAGE 1024;
                      .
                      .
                      .
000005          END;
0000B COMPILATION ERRS
//DELETE  'X1'
//CREATE  'X1' DATA
//SET TTK TTP
```

3.3.1.5 CREATE A DISK FILE

Format:

```
//CREATE 'filename' (OVLY)(input)(STRING/OBJ/OBJECT/DATA (integer1)
//CREATE 'filename' (OVLY) COREIMAGE (DEBUG)(XPND)(integer2)(CTRL) ('filename'/input)
```

where:

filename - 1-6 character alphanumeric name of:

- disc file being created (format 1)
- coreimage file being created (format 2)
- object file used for coreimage file creation.

If no filename is specified the data is loaded into working storage.

OVLY - specifies an existing disc area is to be used for the new file. If OVLY is used it must immediately follow the filename.

input - any valid input device or working storage if none specified.

STRING - specifies file being created as a string file.

OBJ/OBJECT - specifies file being created as an object file.

DATA - specifies file being created as a data file

integer 1 - when used in conjunction with DATA specifies the number of words per record (2-20) for a data file. If no integer specified the default is 18 words per record.

COREIMAGE - specifies file being created as coreimage.

DEBUG - causes the utility program DEBUG to be loaded. Upon completion of loading, control is transferred to DEBUG and a DEBUG command is needed to return control to the user's program. Refer to Utilities Reference Manual for description of DEBUG.

XPND - causes the EXEC internal buffers to be shortened to allocate more space for the symbol table. It should be noted that specifying XPND slows down the loading process, however, it allows programs that overflow the standard symbol table to be loaded. If an overflow occurs with the XPND option, the number of PROC statements must be reduced.

integer 2 - address of first location to be loaded. If no integer is specifed, loading starts at location 220B. Due to double precision operations the number specified must be even. If the integer is odd it is automatically incremented by one.

CTRL - allows special control records that specify files (either system or current job) to be either loaded or not loaded (even though they are called files). CTRL may also be used to force the order of loading by specifying the files in the order desired. The CTRL record series must be terminated by an EOF record. The format for CTRL record is:

LOAD/NOLOAD filename/'filename'(,filename/'filename')

where:

LOAD - specifies the files listed are to be loaded in the order specified after all programs from the TTK, CR, MTR, PID, named disc file and WS are loaded.

NOLOAD - specifies that the files listed are not to be loaded even though they may be called.

filename - the name of the file that is to be loaded or noloaded.

'filename' - same as filename, however, the single quotes must be used when there are special characters in the filename or the filename starts with a number.

The word LOAD or NOLOAD must appear first in each record. All filenames speified in any one record are either loaded or noloaded depending on the first words specified.

If the same filename appears in both a LOAD and NOLOAD record, the NOLOAD option takes precedence.

Files that are still missing and are not specified in a NOLOAD statement are searched for and loaded after the program specified by the LOAD records.

The object programs that are to be loaded are loaded one after another into ascending memory locatons. The first location to be loaded into is location 220B, unless changed by the integer option. ABS assemblies load independently of the relocation process and should not load into the same areas of memory that relocatable programs are occupying. No program should load below location 220B.

Description:

CREATE is used to create a file from an input source of an object file.

In the first form of CREATE, a named file of the type specified, or a STRING file if no type is specified, is created from the specified input device or working storage. The resulting file is loaded.

In the second form, a named coreimage file is created from an object file specified by a filename or read in from an input device. (Refer to EXEC command for a complete description of coreimage file creation.) The EXEC options MAP and CLEAR are forced when generating coreimage files. When creating a coreimage file, working storage is also loaded if it contains an object file.

For both forms of the CREATE command there are two levels of protection provided against inadvertent overlaying of an existing file.

1. Specifying OVLY in the command
2. System questioning of the operator

If the user is intentionally updating an existing file, OVLY may be inserted into the command specifying deliberate overlaying of any existing file. If this is not done, and the file specified currently exists under the current job number, the operator is queried with the system message:

UPDATE OF EXISTING FILE (Y/N)

Insertion of Y causes the program to continue while insertion of any other letter causes a return to monitor and cancellation of the current request. For the purpose of this text, a file to which space has been assigned, but which contains no data is considered a new file.

If an old file is being rewritten, it must be large enough to accomodate the new data. If it is not, the old information may or may not have been destroyed; it depends on whether CREATE was able to determine the size of the new data before it was moved. If the input was from working storage or the file type was coreimage, the old data is not destroyed. When the input is not from the disc, but is from the card reader or magnetic tape, the old data is overlayed as the input file is read.

When the input file exceeds the assigned disc file size, the following messages are displayed:

FILE TOO SMALL.
TYPE "DELETE" TO CHANGE OLD FILE NAME.
TYPE "SKIP" TO IGNORE NEW FILE.

When SKIP is entered, the CREATE function is terminated and a return to the DOPSY monitor is made. When DELETE is entered and the input is from working storage or the file type is coreimage, the existing filename is modified by changing the first character to an ampersand and a new file is created with the old filename. When the input source is not the disc and DELETE is entered, CREATE continues reading from the input but starts overlaying the existing file from the beginning, thereby overlaying the previous data again. The purpose of this function is to allow the user to modify input (e.g., perhaps a '//' terminator record card was missing in the deck), and then to restart the process.

When CREATE has completed all data transfers, the new file type is set in the directory entry. Working storage is empty if it was the data source or if the file created had not existed previously.

Restrictions:

1. For an overlay, the new file must fit within the previously alotted area.
2. In the second CREATE format the parameters must occur in the order specified up to the parameter COREIMAGE.

If input was from working storage or the file type was coreimage, the old data is not destroyed.

Error Messages:

Message	Description
SYSTEM - 1	$UPDAT overlay is missing (called by $CREAT, $CREAT2, $DELET or $ASSIG).
SYSTEM - 4	Working storage cannot be opened or closed.
SYSTEM - 6	$CREAT or $CREA2 cannot close a file just created. (ENTRFN or DISCIO or hardware: disc write inhibited).
SYSTEM - 8	$EXEC overlay missing (called by $CREAT).
SYSTEM - 9	Working storage is exhausted or INPUT START ADDRESS TOP OF WS+1.
IN FILE SPECIFICATION	The named file is not the same as the type specified. This error can also be generated by various file referencing errors in EXEC when generating coreimage files.
IN RECORD SIZE	DATA records cannot be larger than 20 words, or smaller than 2 words.

IN FILE TYPE	WS type does not agree with the type specified in the operand.
DIRECTORY FULL	The file directory is full and has no room for the new entry (i.e., there is a 688 entry limit).
FILE TOO SMALL	The old file is not large enough for the new data. The old data may not be destroyed. If the input was from working storage or the file type was coreimage, the old data is not destroyed.
INVALID FILE NAME	The file name specified, failed to start with a non-blank character or was a reserved name ($DIRCT or $ARR).
MISSING PARAMETER	The file name before the word COREIMAGE was omitted.
DISC OVERFLOW	There is not enough space available on the disc for the new coreimage file.

EXEC may generate additional error messages when generating coreimage files, since CREATE calls EXEC to relocate the program.

Examples:

```
//CREATE 'TSTB12' CR
```

This statement causes the string file TSTB12 to be created from a card deck.

```
//CREATE 'MATB' DATA 16
```

This statement causes the file MATB to be loaded from working storage. The file type is data and each record is 16 words in length.

```
//CREATE 'BINDEC' TTK
```

This statement allows the string file BINDEC to be input via the teletype keyboard.

```
//CREATE 'OVRLY1' COREIMAGE 4000B '=OVR'
```

This statement causes the coreimage file OVRLY1 to be created from object file '=OVR'. The entire image of the core memory will automatically be set to zero prior to loading. The loading origin for the program is 4000B; a loading map will be produced.

```
//CREATE 'DEMONA' OVLY OBJ
```

This statement causes the object file DEMONA to be created from working storage.

If there is an existing file by that name it will be updated.

3.3.1.6 DELETE NAMED (FILE(S)

Format:

//DELETE 'filename1' (,'filename2',...'filenamen')

where:

filename - six character name of file(s) to be deleted.

Description:

The DELETE command is used to delete one or more named files. Names may be separated by either blanks or commas. For each file specified in the operand, the name of the file is removed from the directory and the space allocated to the file is made available for reassignment.

If no file names are specified, working storage is deleted; i.e., working storage is made to appear empty.

Restrictions:

To save time, names should be specified starting at bottom of a directory listing.

Error Messages:

Message	Description
SYSTEM - 1	$UPDAT overlay is missing (called by $CREAT, $CREAT2, $DELET or $ASSIG).
SYSTEM - 2	DIF/DOF procedural error
SYSTEM - 3	DIRECTORY cannot be opened or closed.
SYSTEM - 9	Working storage is exhausted or INPUT START ADDRESS TOP OF WS+1.
INVALID FILE NAME	The file name specified failed to start with a nonblank character, or was a reserved name ($DIRCT or $ARR). The entire command is ignored.
'filename' MISSING	A named file was not located in the directory. The remainder of the command is processed normally.

3.3.1.7 DUMP CONTENTS OF MEMORY

Format:

//DUMP (output) integer1 - integer2 (OCTAL/DECIMAL)

Description:

The DUMP command is used to output the contents of main memory. The destination of the output may be any output peripheral device. If no device is specified, the POD is assumed. The area(s) of core to be dumped are specified by an integer or integer pairs separated by a non-numeric character. Any number of these may be specified and a device specification may occur anywhere in the operand.

The extent of zero fields in memory is issued as a message:

ZERO FIELD nnn-ppp

where:

nnn and ppp are octal format.

NOTE

DUMP reads the first 4K of memory from the coreimage buffer. To have the latest version, the disc must be enabled and a branch to 125B must be accomplished before executing a DUMP.

Error Messages:

Message	Description
SYSTEM - 2	DIF/DOF procedural error
SYSTEM - 3	DIRECTORY cannot be opened or closed.
SYSTEM - 4	Working storage cannot be opened or closed.
IN FILE SPECIFICATION	An input device is used where an output device was expected or a disc file cannot be located.
DISC OVERFLOW	Working storage is not large enough to accept the file.
INVALID FILE NAME	The file name cannot be located in the directory.
C.I. FILE INCORRECTLY SPECIFIED	Coreimage files cannot be dumped.
TAPE OVERFLOW	Insufficient tape exists for storage.

Examples:

//DUMP LP 500-600

Line Printer Output:

```
00764:  26000563   23000562   03201022   24000657
00770:  12001451   00000652   01001002   24000626
00774:  07022022   23000603   03201036   24000657
01000:  14000656   01001056   24000101   07020005
01004:  26000555   23000554   03500760   24000626
01010:  07022022   23000604   03200760   24000101
01014:  26000576   27000562   14000101   24000657
01020:  14000747   01000760   24000750   02501030
01024:  12004601   12000001   00000652   36000750
01030:  12004601   00000000   01000760   24000657
01034:  14000750   01000773   24000626   07022006
01040:  26000557   02201052   23000120   03201052
01044:  12001166   01001050   36000747   01000760
01050:  12001224   10000620   24000552   14000656
01054:  24000657   14000747   24000747   02500760
01060:  12001166   01001063   12001116   05700656
01064:  12001754   01001071   10000000   10001067
01070:  01000760   14000606   15000607   12001131
01074:  25000606   24000607   26000565   27000604
01100:  27000561   07034022   12040510   01001114
01104:  10000656   24000101   23000574   03041111
01110:  01000760   21000574   14000101   01001036
01114:  12001224   10000610   00000000   24000550
01120:  12002120   00000001   00000652   10000000
01124:  24000550   12002120   00000000   01001124
01130:  01041116   22001074   24000601   23000606
```

3.3.1.8 LOAD AND EXECUTE AN OBJECT PROGRAM

Format:

```
//EXEC input/'filename' (integer)(CLEAR)(DEBUG)(MAP)(CTRL)(XPND)
//EXEC 'filename'(CLEAR)
```

where:

input - any valid input device or DIF. More than one input device may be specified. When more than one is specified the order of loading is: TTK, CR, MTR, DIF, disc file and working storage. Input from a peripheral must be terminated with an EOF record (// in column 1 and 2, or $$ for a DIF file).

filename - 1-6 alphanumeric character disc file name.

integer - address of first location to be loaded. If no integer is specified, loading starts at location 220B. Due to double precision operations the number specified must be even. If the integer is odd it is automatically incremented by one.

CLEAR - causes memory from the load point to the top of memory to be set to zero. For coreimage files the area cleared is from 500B to the top of memory. The forced CLEAR caused by CREATE using EXEC clears memory from location 0 to the top of memory.

DEBUG causes the utility program DEBUG to be loaded. Upon a completion of loading, control is transferred to DEBUG and a DEBUG command is needed to return control to the user's program. Refer to Utilities Reference Manual for description of DEBUG.

XPND - causes the EXEC internal buffers to be shortened to allocate more space for the symbol table. It should be noted that specifying XPND slows down the loading process, however, it allows programs that overflow the standard symbol table to be loaded. If an overflow occurs with the XPND option, the number of PROC statements must be reduced.

MAP - lists the address +1 of the highest location loaded, followed by the names and addresses of all PROC statements. The address of highest location loaded is also transmitted to the user's program in index 0. Following each code is a code. The codes and their meanings are:

Character	Description
Space	Linkage established correctly.
N	PROC has no corresponding CALL statement. The user should note that N entries are frequently produced by PROC statements that establish interrupt linkages and my MAINPR PROC statements, and are not errors.

U	CALL has no corresponding PROC statement. Executing a CALL statement for a U entry causes the machine to halt.
D	More than one PROC statement used the same name. All CALLs are linked to the first PROC entry.
?	Combination of N and D.
System errors	0, 1, 2. See error messages for descriptions.

All PROC statements other than those with the space character are listed on the POD even if the MAP option is not specified.

CTRL - allows special control records that specify files (either system or current job) to be either loaded or not loaded (even though they are called files). CTRL may also be used to force the order of loading by specifying the files in the order desired. The CTRL record series must be terminated by an EOF record. The format for CTRL records is:

LOAD/NOLOAD filename/'filename' (,filename/'filename')

where:

LOAD - specifies the files listed are to be loaded in the order specified after all programs from the TTK, CR, MTR, PID, named disc file and WS are loaded.

NOLOAD - specifies that the files listed are not to be loaded even though they may be called.

filename - the name of the file that is to be loaded or noloaded.

'filename' - same as filename, however, the single quotes must be used when there are special characters in the filename or the filename starts with a number.

The word LOAD or NOLOAD must appear first in each record. All filenames specified in any one record are either loaded or noloaded depending on the first word specified.

If the same filname appears in both a LOAD and NOLOAD record, the NOLOAD option takes precedence.

Files that are still missing and are not specified in a NOLOAD statement are searched for and loaded after the programs specified by the LOAD records.

The object programs that are to be loaded are loaded one after another into ascending memory locations. The first location to be loaded into is location 220B, unless changed by the integer option. ABS assemblies load independently of the relocation process and should not load into the same areas of memory that relocatable programs are occupying. No program should load below location 220B.

Description:

The first form of EXEC is used to load and execute object programs. The programs are loaded into ascending memory locations starting at location 220B unless altered by the integer option. The source of these programs may be any combination of peripherals. Working storage is always loaded if it contains an object program; it is not deleted and is unaffected by the loading process.

When there is more than one source of input, the order of loading is:

1) TTK
2) CR
3) MTR
4) DIF
5) named disc file
6) working storage

When all the programs have been loaded, there may be CALL statements whose corresponding PROC statements have not been loaded. In this case, EXEC attempts to load a disc file with the same name as the missing PROC statement. In searching for this file, EXEC first looks in the user's directory and then in the system directory. If no file can be found, this searching procedure is repeated for the other remaining missing PROC statements have been searched for and there still remains missing PROC statements, the missing statements are flagged with a U in the MAP listing.

If a file named in a LOAD record has no corresponding PROC or CALL statements, it is flagged with zero. This may or may not indicate that the file was not loaded; if an object file with that name exists in the user's directory or the system's directory, the file was loaded.

Example:

```
01754
MAINPR N      00250
LPIO          01500
LPIOIN  N     01535
TTRIO         01557
TTRINT  N     01600
TSUB1   U
TTPIO         01643
TTPINT   N    01665
```

When loading is complete, EXEC transfers control in the following order

1) DEBUG-if it was loaded
2) MAINPR PROC statement-if one loaded
3) First PROC statement

If DEBUG or MAINPR are not present, the name of the first PROC statement followed by 'IS ENTRY PNT' is listed on the POD.

Example:

```
Test1  IS ENTRY PNT
```

If the user's program executes an indirct branch through its entry point when finished, the DOPSY system is reloaded automatically.

The second form of the EXEC command is used for loading coreimage programs. It is the user's responsibility not to execute a coreimage file that does not have an entry point. If CLEAR is specified, main-memory between 500B and the end of memory is set to zero, and the program is loaded by the coreimage loader, CIEXEC. The address +1 of the highest location loaded is transmitted to the user's program in index register 0. If the user's program executes an indirect branch through its entry point when finished, the DOPSY system is reloaded automatically.

The other options should not appear. Most options are ignored; CTRL records, however, are processed but no programs are loaded or noloaded; requesting loading from a peripheral device results in an error condition. This error results from an attempt to CREATE a coreimage file from an existing coreimage file even if no object programs are loaded, or if any peripherals are specified when EXEC loads a coreimage file (even if no programs are loaded from the peripherals). Working storage is never loaded with a coreimage program.

Restrictions

1. ABS assemblies load independently of the relocation process and should not load into the same area of memory that relocatable programs are occupying.
2. Under no circumstance should any program load below location 220B.
3. WS is nevery loaded with coreimage programs.

Error Messages:

Message	Description
SYSTEM - 2	DIF/DOF procedural error
SYSTEM - 4	Working storage cannot be opened or closed.
SYSTEM - 7	$CREA2 overlay missing (called by $EXEC).
xxxxxx IS ENTRY PNT	Neither DEBUG nor main program processing statements were loaded. Control is transferred to the PROC statement xxxxxx. If no PROC statements were loaded, the warning message: xxxxxx IS ENTRY PNT where: xxxxxx is all blanks If EXEC was called directly, a NO ENTRY POINT error occurs, but if CREATE called EXEC to generate a coreimage file, the operation is successfully completed. It is the user's responsibility not to attempt to execute a coreimage file that does not have an entry point.

IN FILE SPEC	An output device is specified, or a disc file cannot be opened or its file type is not correct.
C.I. FILE ILLEGAL	Coreimage files cannot be loaded with object files.
IN CTRL RECORD	The format of a control record is incorrect.
IN REC SEQ - xxxxxx	The object file xxxxxx has been scrambled. Refer to the FST-2 Assembler manual for a description of object-record format and sequence.
PROGRAM TOO BIG	The program is too large for available core-memory.
SYMBOL-TABLE OVERFLOW	There are too many PROC records in the object programs being loaded.
LOADING BELOW 220B	Programs cannot load between 0 and 220B
NO ENTRY POINT	EXEC cannot determine where to transfer control. This check is purposely suppressed when creating coreimage files.
NO OBJECT PROGRAM GENERATED	No machine-instructions were actually loaded.
INV CKSUM XXXXXX	Object records have bad parity. Refer to the FST-2 Assembler manual for a description of object-record format and sequence.

Examples:

```
//EXEC
```

The program in working storage is loaded beginning at location 220B and executed.

```
//EXEC 'TEST1' 500B MAP CLEAR TTK CR
```

Object programs are to be loaded from VKT keyboard, the card reader and the disc file TEST1. Prior to loading, memory is set to zero from the loading point up. The program is to be loaded beginning at location 500B and when loading is complete a memory map is listed on the POD. If there is an object program in working storage, it is also loaded.

```
//EXEC 'TEST2' CLEAR
```

The object file TEST2 is loaded after setting the core-memory to zero from the loading point up. The program is loaded beginning at location 220B. Working storage is also loaded if it contains an object program.

```
//EXEC 'MAINPR' CLEAR CTRL
NOLOAD DISCIO, CPIO, GET, PUT
LOAD '*TEST', CLOSE, TVECT
NOLOAD TTPIO, OPEN
//
```

The object file 'MAINPR' is loaded after setting the main-memory to zero from the loading point up. The files listed in the second and fourth (NOLOAD) records are not to be loaded from the corresponding disc files even though there are CALL records for them. The files listed in the third (LOAD) record are to be loaded even though there are no CALL records for them. File names in CTRL records need not be put in quotes unless they contain special characters or start with a number. Working storage is also loaded if it contains an object program.

Example:

```
//EXEC 'OVR1' CLEAR
```

The coreimage file OVR1 is loaded after setting the main-memory to zero from 500B up. No other options are required.

3.3.1.9 FILE DUMP OF WORKING STORAGE, DIRECTORIES, OR INDIVIDUAL FILES

Format:

```
//FDUMP WS (output)
//FDUMP DIRECTOR (' /↑ ↑') (output)('filename')
//FDUMP ('filename')(OCTAL/SEQ)(integer)(output)(WS)
```

where:

output -	any valid output device
filename -	six character alphanumeric name of file (enclosed in single quotes) to be output
OCTAL -	specifies output in an octal format
SEQ -	specifies sequencing. If SEQ is selected an equal sign (=) appears as a prompting sign for the user to enter an eight character alphanumeric identifier.
integer -	specifies the number of records of the named file or of working storage to be output.
b/↑ ↑ -	specifies that the entire contents of the directory for the complete disc is to be displayed or printed.

Description:

FDUMP WS is used to display or print the number of 24 bit words available for use as working storage.

FDUMP DIRECTORY is used to display directory entries for the current job in the order in which they are written on the disc. If the job is the system job, the contents of the directory for the complete disc may be displayed using the special entry of ' /↑ ↑' (it should be noted that a blank must precede the slash). A single filename may be included to specify the information for a single file. The units used for the amount of space assigned and the space used is in decimal words. If the file is a coreimage file, the number of words is the sum of the program load and the sectors required to retain interrupt loading information. The type of entries are designated by:

C - coreimage
D - data
O - object
S - String

FDUMP 'filename' is used to output either the contents of working storage (if no filename is given) or of the named file. The first n records only may be requested by specifying an integer number in the FDUMP request. The output may be in octal sequenced or unsequenced format. If sequencing is desired, FDUMP outputs the equal sign and an eight character alphanumeric identifier is expected. Output may be to any output device or for this form of FDUMP to working storage.

Error Messages:

None.

3.3.1.10 JOB INITIALIZATION

Format:

//JOB 'jobname'

where:

jobname - 1-4 alphanumeric job name

Description:

This statement places DOPSY in the desired user's job. Specifying a job is required after the system bootstrap procedure is performed.

JOB causes the system to initialize for processing a new job by restoring the DOPSY system control and status data from the permanent copy kept on the disc. The net result of this is that any information in working storage is lost. After boot-strapping the monitor system from the card reader or magnetic tape, a JOB command with a non-blank string in the operand must be accepted by the system before it accepts any other commands. This is required in order to permit proper file referencing.

Error Messages:

Message	Description
MISSING PARAMETER	A non-blank string was not present.
I/O ERROR ON DISC	The disc is not on-line.
DISC WRITE DISABLED	The disc cannot be written upon. Either the DCU or disc write-disable switch is set.

Examples:

//JOB '←←←←'

specifies the files available for referencing are system files.

3.3.1.11 RENAME, REASSIGN, TRANSFER A FILE

Format:

```
//RENAME 'filename1', 'filename2'
//RENAME JOBNUMBER 'jobname'
//RENAME JOBNUMBER 'jobname', 'filename'
```

Description:

The RENAME statement has three forms. The first form is used to rename a file in the current job and assigns them under a new job name. The third form takes the single file named and transfers it from the current job into the job number specified. It is not possible to transfer a file from the system jobnumber.

Error Messages:

Message	Description
SYSTEM ERROR 3	DIRECTORY cannot be opened or closed.
MISSING PARAMETER	One or both of the two required file names are missing.
IN FILE SPECIFICATION	The old file cannot be located.
INVALID FILE NAME	The file name specified failed to start with a non-blank character or was a reserved name ($DIRECT or $ARR).
DUPLICATE FILE	A file already exists with the new file name specified.
INVALID JOB NUMBER	System jobnumber ( ) cannot be renamed.

Examples:

```
//RENAME 'RUDANN' 'RAMSEY'
```

Changes name of file called RUDANN to RAMSEY

```
//RENAME JOBNUMBER 'JIM'
```

Takes all files from current job and assigns them to jobname JIM.

```
//RENAME JOBNUMBER 'JIM' 'ARNIE'
```

Takes the file called ARNIE from current system job and puts it under job and puts it under jobname JIM. All of these can be confirmed by using the FDUMP command to verify the directory changes.

3.3.1.12 SELECT OR CHANGE PID

Format:

//SET (input/DIF ('filename')) (output/DOF ('filename'))

where:

input -	any valid input device.
output -	any valid output device.
DIF -	specifies input device as a disk file.
DOF -	specifies output device as a disk file.
'filename' -	1-9 characters alphanumeric name of either DIF or DOF disk files. Filenames must begin with a period. If no filename specified the PID disk file default name is .IFILE, the POD default name is .OFILE.

Description:

This statement permits selecting or changing of the primary input device (PID) and the primary output device (POD) as the peripherals specified.

SET is used to temporarily alter the devices assigned to PID and POD. These assignments are effective until the next SET command.

The PID and POD may be set to disk files. The file names must begin with the period. The file may be assigned under either the current job number or the system job number (←←←←). When setting the PID or POD to a disk file, the file name need not be specified.

The files .IFILE and .OFILE are ten sectors each and are permanently assigned to the system job number.

Restrictions:

File names if used must begin with a period.

Error Messages:

Message	Description
FIRST CHARACTRER OF FILE NAME MUST BE A DOT (.)	The file name is incorrect.
FILE .xxxxx OF JOB yyyy IS NOT IN DIRECTORY	The file name is missing.
PRECEDE FILE NAME WITH DIF, DOF, SDIF or SDOF	A file name cannot stand alone.
ILLEGAL I/O COMBINATION	An output device was specified as an input device, or an input device was specified as an output device.

Examples:

```
// SET DIV 'OLDFILE' DOF'.NEWFILE'
```

Specifies that the Pid is to be changed to a disk file called .OLDFILE and the POD is to be changed to a disk file called .NEWFILE.

3.3.1.13 TOPSY MONITOR CALL

Format:

```
// TOPSY
```

Description:

This command transfers control to the TOPSY monitor for use of the TOPSY commands.

When initial error checking is complete and TOPSY has verified that the required overlays and $GLOBS are on disc and that the test programs assigned to the stations have been located on the disc, TOPSY returns a prompting signal character to indicate that is is ready for command entry. The colon (:) prompting character is for normal TOPSY mode of command entry which is the mode that TOPSY is first entered. The dash (-) prompting character is for the analysis mode of command entry (see ANALYSIS command (section 3.4) for a complete description of the ANALYSIS mode) which means that the ANALYSIS commands as well as TOPSY commands may be entered.

After the first entry to TOPSY, the prompting character is the same as before the last exit to DOPSY, i.e., TOPSY is returned to the same command entry mode.

Restrictions:

1. TOPSY must have been initialized for at least one station or the message:

   NO STATION

   is output and control is return to DOPSY.

2. If console switch 6 is up (i.e., set) a CPU halt occurs for every tester interrupt which occurs. This feature is for debug purposes only.

Error Messages:

None

Examples:

```
//TOPSY
*
-
```

3.4 TESTER OPERATING SYSTEM (TOPSY)

3.4.1 Test Plan Execution

The tester operating system (TOPSY) is designed to aid the user's interactions with the tester hardware and to supplement the capabilities of the hardware. TOPSY is a programming system comprised of a collection of programs that operate under the control of a TOPSY monitor. TOPSY organization is shown in Figure 3-5. The TOPSY monitor serves as an executive, giving control to the program section which performs the next desired task.

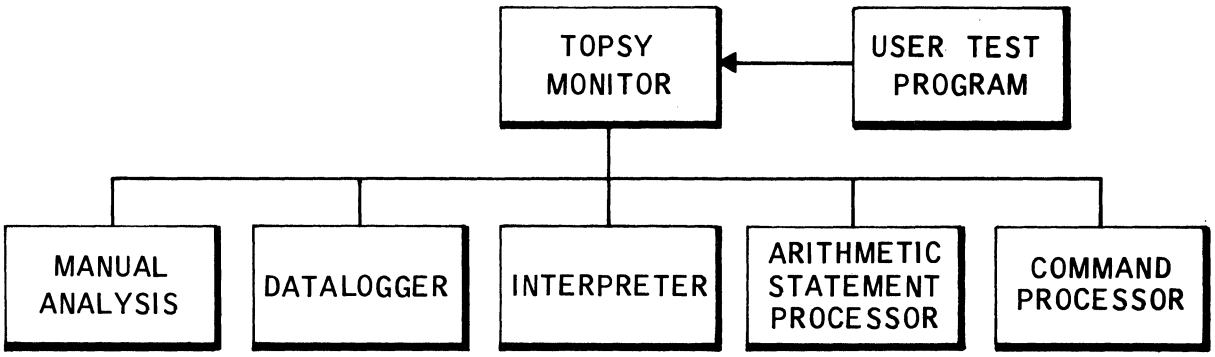


Figure 3-5 TOPSY Organization

The user's test program (also called a data file) is generated by compiling a FACTOR language source file while operating under DOPSY. The test program is written to direct specific tester functions. It is under the TOPSY mode that the test program or data file is executed.

TOPSY executes the user's test program in an interpretive mode. In order to maximize the performance (test rate) of the system, TOPSY user programs are read-only. This minimizes the number of page transfers (disc accesses) required to execute a program. The variables in arithmetic statements are stored, on a first-in last-out basis, in an area of memory called a "run-time stack."

3.4.1.1 MULTIPLEXING OF TEST STATIONS

The Sentry VII is capable of multiplexing four test stations which may each have four test heads, giving a maximum of 16 stations. Once a station has been assigned a test program and the device is inserted in the load board, pushing the tester start pushbutton causes TOPSY to execute the test program. If there is more than one station and during one stations execution the start button for two or more other stations is pressed, control is given to the stations in this sequence: 4D, 4C, 4B, 4A, 3D, 3C,...1B, 1A. If two stations are executed the start requests are honored in the order received.

3.4.1.2 MANUAL MODE TESTING

A test program may be executed in either manual mode or automatic mode. In the manual mode TOPSY executes the first test, stores the updated system work area and then returns to the scanning routine. A subsequent return by this test station to TOPSY initiates testing from the last test is another station has not yet executed, or, if another station has executed, it executes from the first test up to the next sequential test.

3.4.1.3 AUTOMATIC MODE TESTING

In the automatic mode the entire test program is executed at machine speed until one of the following occurs:

(1) The end of the test (EOT) is executed.

(2) A terminal error occurs. A terminal error occurs when a programming machine, or operator error is discovered and testing cannot continue. An error number is displayed.

(3) A FACTOR language PAUSE statement is executed, i.e., the test program directs testing to halt at a point other than EOT.

(4) An operator requested PAUSE is honored, i.e., the operator has entered the analysis PAUSE or FAIL on statement number command.

(5) The Tester RESET button is pressed.

3.4.1.4 SINGLE STEP TESTING

Most testing is done in automatic mode. Manual mode may be selected by depressing the tester MANUAL pushbutton. In manual mode, TOPSY executes one FACTOR statement for each tester start request. This is also called single stepping through a test program. It is sometimes used as a debugging tool so the user can follow the execution of his test program. It is the equivalent of requesting a PAUSE on every statement. If in the middle of a test execution another station start is received, the second station is executed to end of test. The next start for the station in manual mode causes it to begin the test at start and execute all statements at machine speed until the next sequential test. This enables the tester to be returned to the same condition as before the second station came on line. Two stations may bot be in manual mode at the same time.

At any pause, single step, or at EOT the user's globals and the system variables for the test station are stored away. At EOT the system also resets the tester hardware. In the case of a terminal error or an operator reset, the tester hardware is reset but the globals and system variables are not stored away. For example, the serial number (SN) is incremented for each EOT and stored away. However, reset and terminal errors have no effect on the serial number.

3.4.1.5 ENTERING OPERATOR COMMANDS

Generally, operator commands are entered while at a pause in the test sequence or at EOT. Commands may also be entered during a test sequence. However, the command is lost if any I/O to the VKT occurs due to the test plan execution or datalogged output. The command is not processed until the next EOT or PAUSE is reached.

3.4.2 Data Codes

A test program is composed of two types of data cells or data codes:

(1) DMA (direct memory access)

(2) interpretive

DMA data codes address the tester directly. They are generated by the compiler whenever possible because the execution time is very fast. Interpretive code is needed for arithmetic statements, reading registers, directing the order of statement execution if other than sequential, and whenever variables are used in tester statements. During test execution, TOPSY fetches one cell of the test plan at a time from a buffer in memory where the test plan is stored. Each cell is analyzed and the tester or arithmetic function requested is executed. If a code is DMA, the tester is put into "DMA mode" which means that the tester registers are written at the speed of the tester. This is most efficient. When a non-DMA or interpretive statement is reached, DMA mode is exited and the data cells are fetched and executed one by one again.

Example:

If the tester statement is:

```
CPMU PIN 1;
```

instructing the tester to connect the PMU to pin 1, the compiler has all the information it needs to generate a DMA code, i.e., a write to the tester PA register to connect the PMU pin 1.

If the test program contains these statements:

```
A = 1;
CPMU PIN A;
```

the compiler generates interpretive codes because it cannot be certain of the value of A at execution time. The interpretive codes generated for the first FACTOR statement instruct TOPSY to create a variable location for the variable "A" if it has not been previously used or declared, and assign the variable a value of 1. The CPMU statement causes the value of the variable A to be retrieved from storage (the run-time stack). A write to the PA register is formed from the value of A and the register address and is then written to the tester. The actual register write takes place at the same speed as DMA but the total time is greater because of the set-up time required to interrupt the variable.

3.4.3 Assembly Language Programming

The user may also write programs in assembly language to handle special needs. There are two types of files which may be executed under TOPSY, Assembly Language Linkage files (ALLINK) called from a FACTOR test program via the EXEC statement, and non-standard overlays which are called via an operator command. Fairchild Systems Technology also provides special tools using these techniques, such as SPLOT and PSCAN, as part of the standard software release. For more information on assembly language programming refer to the Assembly Language Programming under TOPSY Reference Manual, manual part number 67095720.

3.4.4 TOPSY Memory Management

The following paragraphs describe the internal organization of memory while executing under the TOPSY mode (refer to Figure 3-6 and 3-7). This information is not essential for running test programs but aids in the understanding of the system and provides hints for reducing test time.

TOPSY is comprised of the coreimage file '$TOPSY', three main overlays and a number of suboverlays.

3.4.4.1 $TOPSY

The coreimage file $TOPSY is created from four main object files, the global storage and transfer vectors, the monitor, the interpreter, and the arithmetic package, plus some miscellaneous files or subroutines primarily for I/O control and number conversion.

The global area file is for data cells, transfer vectors, station variables for the station which is on-line (executing), and system variables. Every cell is in an absolute location which does not change with new revision releases so that overlays and possibly ALLINK files may access information. It contains no executable code.

The TOPSY monitor checks for station start requests and analyzes the user test program, passing control to the interpreter or arithmetic package if a data code is interpretive or starting DMA mode if a data code is DMA, and calls the overlays as needed based on operator or program requests.

The interpreter decodes and executes all interpretive data codes which affect the tester hardware. It also contains the tester hardware interrupt services.

The arithmetic package processes all the non-tester related statements such as the arithmetic statements, assigning values to variables or retrieving the value of a variable, and control transferring statements such as GOTO, IF, CALL, and EXEC. It also maintains the run time stack and the buffer area for the test program and the ALLINK files.

3.4.4.2 COMMAND PROCESSOR, DATALOGGER, AND MANUAL ANALYSIS OVERLAYS

The three main overlays are the command processor, the datalogger, and manual analysis. The overlays are notipart of the $TOPSY coreimage file but are created as separate coreimage files. The main overlays are created with the same load point so they load on top of each other and therefore may not be resident simultaneously. Since the overlays are not needed at the same time they can re-use the same The overlays are divided into suboverlays to further maximize memory usage. TOPSY verifies that all overlays and suboverlays are on the disc and issues an error message and exit to DOPSY if any are deleted.

The command processor overlay reads all the command input and the test program read statements. It also processes the commands and performs the requested operation such as listing the value of the global variables or setting flags which controls later test execution such as requests for a pause or datalogging.

The datalogger performs all output and data-formatting for test program write statements, operator requested test results, and terminal error reporting. The dataloger initiates the requested output and returns control to the TOPSY monitor so that testing proceeds while the output device is busy.

Manual analysis executes the operator requested analysis commands to write or read and display tester registers, make measurements, or display the contents of several registers at each pause or EOT.

Above the top of the highest loading overlay an area of 75 words is reserved for each station which the user wishes to use. This buffer area contains the station variables when a station is not on-line. TOPSY is initialized for the number of stations desired rather than the system reserving 76 words for all the possible sixteen stations. When a system is received TOPSY has been initialized for the number of stations at the customer's installation so a user may have no need to alter this. It is this area that is saved on disc when control is given to the DOPSY monitor so that the information is retrieved when TOPSY is re-entered. During test execution, the station variables are moved from the storage area to absolute memory locations in the global storage area for ease of access by the operating system

The remainder of memory, called the user area, is used for the run-time stack, the ALLINK file, if any, and the test program. PPM microprocessors are handled like ALLINK files, so are not discussed separately. If a non-standard overlay is called it also uses this area but only temporarily. The number of words available depends on the memory size of the CPU, the number of stations initialized, and also varies with each software revision; however, it exceeds 4500 words.

The run-time stack contains a word for each variable used and for each element of an array for the currently active test program blocks. The stack size increases by the size of the arrays and the number of variables used. The stack also contains miscellaneous cells for subroutine return points, parameters being passed to subroutines and ALLINK files, and totals accumulating during arithmetic operations.

The test program is stored in the remaining area which may need to share with the ALLINK file. When a test program is larger than the memory available all of the test programs cannot reside in memory at once. It is then necessary to bring the test program into memory in segments. One piece of the test program is brought into memory and executed and then another segment is brought in on top of the previous piece. This technique is called paging. Since a disc access is required for each page, test execution time is affected so it is advantageous to have as much memory available for the test program as possible.

The type of CPU and the size of the memory determines the management of the user area. The FST-1 CPU has 16K words of memory and the FST-2 CPU has between 32K and 196K words of memory. The same Sentry software controls memory management for both the FST-1 and the FST-2 CPU. A magnetic tape contianing Sentry system software (called a system or DBUP tape) may be loaded on either CPU regardless of the memory size the tape was made on. When a system tape is loaded onto the disc, the memory size is printed on the VKT below the user's note and the last word of available memory is stored in cell 117B. This cell is then used by TOPSY to determine the most advantageous memory management scheme to use. If cell 117B is greater than 37777B(16K), FST-2 memory management is used. This cell should not be changed if the system has the FST-1 CPU. If an FST-2 CPU is in use cell 117B may be changed to 37777B using DEBUG while in DOPSY to cause TOPSY to execute in the FST-1 mode. There is no advantage to doing this except to time the difference in execution time between FST-1 and FST-2 mode. The system resets the cell back to the size of the memory at the time the tape was loaded if the DOPSY command JOB is entered or a card or tape boot is done.

3.4.5 FST-1 Memory Management

Figure 3-6 shows the memory allocation of the FST-1 CPU's 16K words of memory. There is over 4500 words available in the user buffer for the stack, test program, and any ALLINK files to share. The area in the user's buffer in which the test program resides is called the test program buffer area or test program area.

The allocation of space within the user buffer is dynamically adjusted during test execution as follows:

(1) After TOPSY is initialized a test program is assigned to a station by the operator using the LOAD command. The user buffer is still empty but the test program has been located on disc and its length is saved. This is the same condition as after any entry to TOPSY from DOPSY.

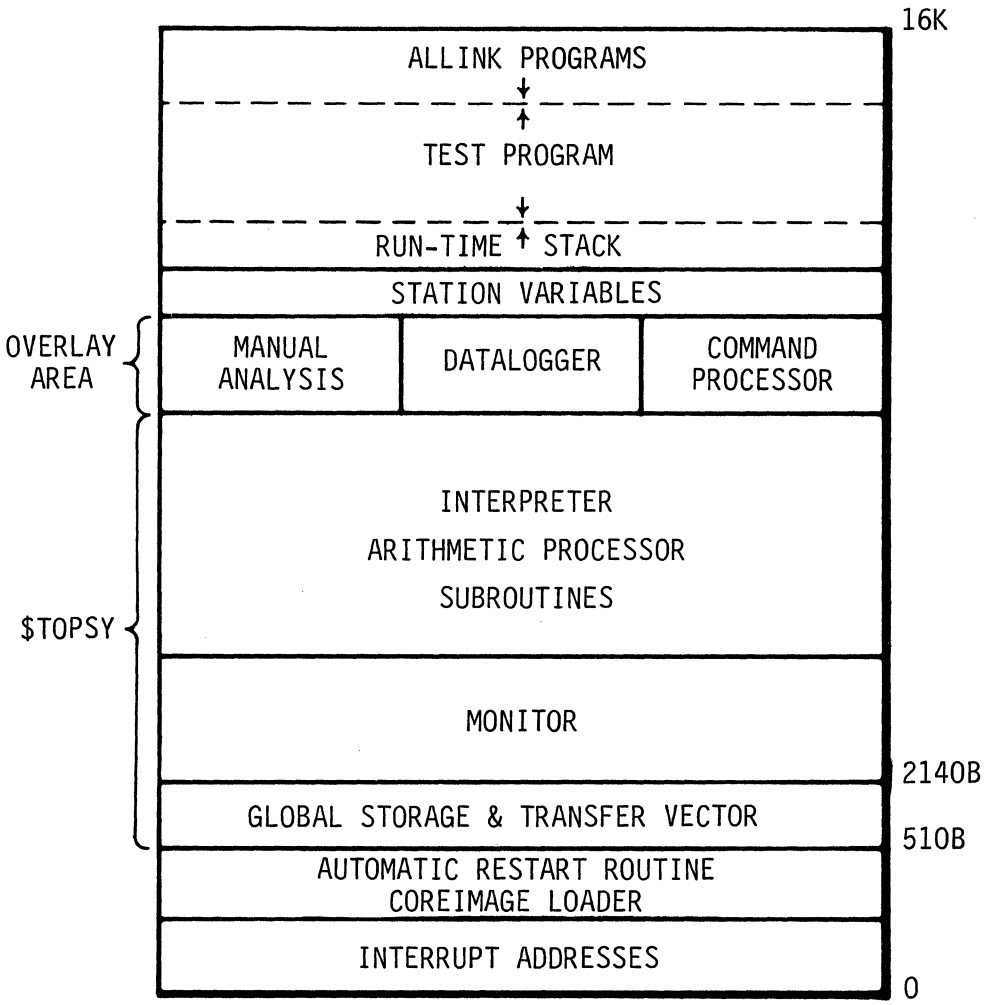


Figure 3-6 FST-1 Memory Allocation in TOPSY

(2) The tester start button is pressed. Before testing begins, 144 words are reserved for the run-time stack. This assures enough space for the stack so that until all the variables in block zero are used, or an equivalent area is needed such as for a large array, the test program buffer area need not be adjusted. The test program buffer area begins on an even sector boundary position above the area allocated for the run-time stack.

In other words, the test program is loaded off the disc into an area which is a multiple of 48 words or the size of a disc sector. Any left over words are below the test program and are also allocated to the stack. As much of the test program as possible is loaded into the remaining area. It is not yet known if any ALLINK files are called so no space is reserved.

There must always be at least 48 words for the test program, or terminal error 54 occurs. Before the error is issued an attempt is made to use any of the area allocated to the stack which has not actually been used.

(3) The test program is executed until the stack grows into the test program area, a program branch to a part of the test program which is not resident occurs, test execution exceeds the resident page, an ENABLE ACCESS statement is executed, an ALLINK file is executed, or the test halts due to EOT, reset, pause, or a teminal error.

(4) If the stack grows into the test program area the stack is allocated another 48 words (or in the case of an array, a multiple of 48 words). A disc access then occurs to bring in a new page of the test program beginning with the next data code to be executed. As much of the test program is loaded as possible.

(5) If a program branch occurs or test execution exceeds the resident page, or ENABLE-ACCESS is executed, a disc access occurs to bring in a new page of the test program beginning with the next data code to be executed. It uses the same area as previously assigned.

(6) The first time an ALLINK file is executed it overlays the test program area. The ALLINK file's load point or origin point becomes the new top of the test program buffer area. Since this takes space away from the test program it is usually best to set the ALLINK file's load point or origin point as high in memory as possible. If the ALLINK file's origin is on or below the stack, terminal error 61 occurs. Following the execution of the ALLINK file, the test program buffer area is recalculated and a disc access occurs to page in the test program beginning with the next data code to be executed. If there is no longer a minimum of 48 words for the test plan, terminal error 54 occurs.

Two techniques are available for the user to allow the test program to use all the available area, and therefore not retain the ALLINK file in memory. (1) A system constant at address 1243B contains the value 10000B. Any ALLINK file larger than 10000B words or 4K is not retained in memory. The cell may be altered by a patch to cell 1243B in $TOPSY on disc or by loading NDEBUG with $TOPSY and changing the cell in memory. (Note that any change to the global storage area during the first entry to TOPSY following an INIT causes the change to become a permanent change to $TOPSY on disc.) Changing this cell to a smaller value causes any ALLINK larger than the new constant to be deleted from memory, regardless of the station it is run on. (2) The second technique allows the ALLINK file to release the ALLINK area for test program paging. The ALLINK file calls a subroutine called ALPCLR, which deletes all resident ALLINK files from memory and makes available the entire buffer from the top of the stack to the top of memory for the test program. This call is coded as follows:

```
ALPCLR    EQU     1244B
          ..
          .
          .
          BSM*    ALPCLR
```

The A register is destroyed by this call.

If the ALLINK file is retained in memory subsequent executions of the ALLINK file cause no disc access. If the user elects to cause the ALLINK file to be deleted from memory, a subsequent EXEC of this ALLINK file will force a disc access to reload the file. However a disc search is not required as the file address on disc is saved by TOPSY. The user must determine that the disc access required to load the ALLINK each time it is executed is not more than the number of accesses saved by paging the test program in a larger area. Generally, if the test program does not fit in memory and the ALLINK file is large and is called only once or less per execution, it would be advantageous to return the ALLINK file's area to the test program.

(7) If other ALLINK files are executed the test program buffer area may be affected. If the latest ALLINK file overlaps a currently resident file, or more than six ALLINK files have been requested all the ALLINK files are deleted from memory and the top of the test program area moves to the load point of the new ALLINK file. If the latest ALLINK file fits below the previous load point of an ALLINK file, the top of the test program area is moved down. However, if the new ALLINK file fits above the lowest loading ALLINK file the test program buffer area is unchanged and no disc access occurs to page the test program.

(8) When the test halts during the first execution due to a reset or terminal error the next test start causes TOPSY to repeat the same steps as though the test program had not been run.

(9) When the test halts due to EOT or a pause, necessary system information is saved by TOPSY regarding the resident ALLINK files and test program. If the next test start is for the same test program, even if on a different station, the test program is paged in the area between the stack and the load point of the lowest loading ALLINK file if the ALLINK files were retained. This means that no disc accesses are required for the ALLINK files and the test program area does not need readjusting as the program executes unless the stack extends into the program area. Generally this retaining of the test program buffer area from the first execution reduces test execution time for second and subsequent tests unless the ALLINK file is large and called infrequently. In that case it is best to delete the ALLINK file from memory as explained in item 6.

(10) When a different test program is executed on this or another station, the ALLINK files are deleted from memory and the test program area is adjusted as in items 1-8 for a new test program execution. If executing two stations and the first station's test program is then reexecuted, the user areas must again be readjusted. All ALLINK files except the last loaded need to be found on the disc and all ALLINK files must be reloaded. The location on disc of the last ALLINK file loaded is retained so it need not be found of disc if it is the next executed.

If two tests stations are operating on a Sentry, the maximum efficiency of execution time is attained by having both stations run the same test program if the test programs to be run call ALLINK files. In other words, the buffer area does not need to be readjusted and execution occurs as in item 9.

(11) When an exit to DOPSY occurs all ALLINK files are deleted from memory. On return to TOPSY the test programs assigned to stations are found on the disc so this does not need to happen at execution time. At the next test start for each station, the ALLINK files are found and reloaded following items 1-8. Re-establishing memory usage on return to TOPSY allows the user to move items on disc while in DOPSY and even change the test program or ALLINK files.

3.4.6 FST-2 Memory Management

The FST-2 CPU has between 32K and 196K words of memory. Memory may be added in 16K increments. Figure 3-7 shows the FST-2 memory allocation. On an FST-2 the memory above 16K is available for the test program. The stack and ALLINK files do not need to share the 4500 word buffer of the FST-1 CPU with the test program. Many disc accesses are eliminated when an FST-2 CPU is used so test execution time is significantly reduced.

The run-time stack is in the same location as for FST-1 mode, however, it does not cause the test program buffer area to be readjusted as it grows. There is more room for the ALLINK files which are also loaded and removed from memory in the same way as for FST-1 mode. If the stack does extend into the ALLINK file, terminal error 54 is issued just as if it extended into the test program in FST-1 mode. Also if an ALLINK file is originated on or below the stack, terminal error 61 is issued.

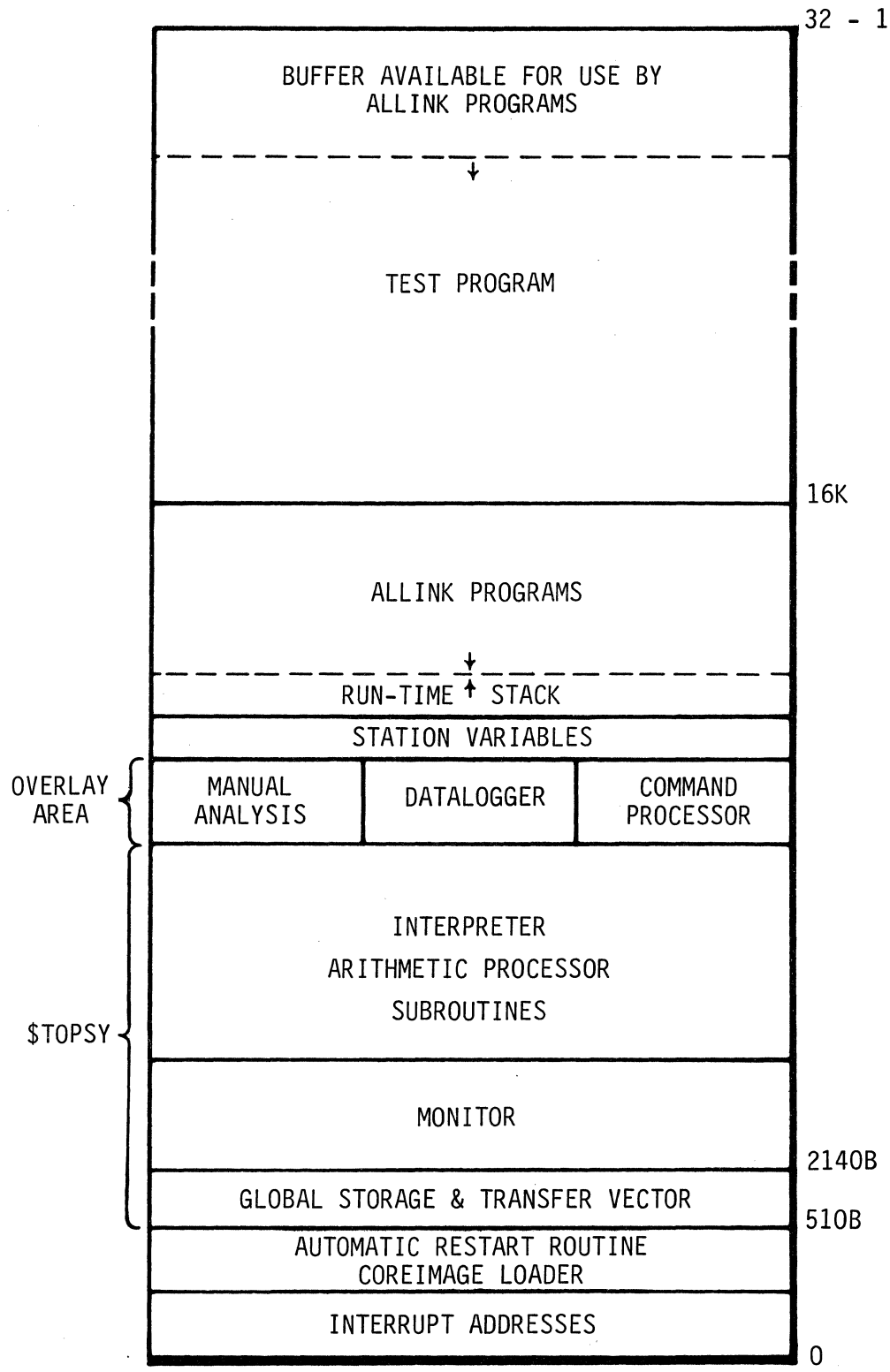


Figure 3-7 FST-2 Memory

In the memory above 16K an area at the top of memory above the test program is reserved for an ALLINK buffer. The buffer may be used by an ALLINK file to store data but may not contain any executable assembly language code. This buffer is not used by the system. It is up to the user to determine that the ALLINK files called by a test program do not conflict in their use of the buffer. If a test program is smaller than the size of the test program buffer area the ALLINK buffer area expands to use all the available space. The minimum buffer size is 4000 words. A test program which does not fit in memory between the 16K boundary and the 4000 word ALLINK buffer is paged in that area. If it is desired to give the ALLINK buffer area to the test program the system constant TPALLOC at addrress 1230B should be patched into DOPSY from 4000 (7640B) to the desired size. Care must be taken that no ALLINK file depending on the buffer is used if this cell is zeroed. A system constant at 1227B called ALLBST gives the first address of the buffer. Cell 117B gives the last address of the ALLINK buffer which is at the top of memory. These cells may be used by an ALLINK file which is using the buffer for data but they must be altered.

FST-2 memory management is as follows:

(1) After TOPSY is initialized a test program is assigned to a station by the operator using the LOAD command. The user buffer is still empty but the test program has been located on disc and its length is saved. This is the same condition as after any entry to TOPSY from DOPSY

(2) The first time the tester START button is pressed after TOPSY is initialzed or after any entry from DOPSY, the test program is loaded into the test program buffer area above the 16K boundary. The starting address of the ALLINK buffer area is set, reserving 4K words if the test program does not fit in memory. If the test area requires more area, all available space above the test program is assigned to the ALLINK buffer.

(3) The test program is executed as in FST-1 mode, with interpretive data codes being executed word by word and DMA code going directly to the tester from the upper memory. If the file fits in memory, no disc accesses occur. If it does not fit, a disc access occurs when a program branch to a part of the test program which is not resident occurs or when test execution exceeds the resident page. An ENABLE ACCESS statement does not cause a disc access if operating in FST-2 mode. Neither thestack growing or executing an ALLINK file affect test program paging. Execution stops when EOT is reached or a reset, pause, or terminal error occurs.

(4) The stack cannot extend into the test program buffer area so no readjusting of the test program buffer area is required.

(5) ENABLE ACCESS statements are ignored in the FST-2 mode as the test plan forcing an access only slows down execution time.

(6) The first time an ALLINK file is executed it is loaded into memory if it does not load on or below the stack. If it cannot be loaded, terminal error 61 occurs. If the stack extends into the ALLINK file during subsequent execution, terminal error 54 occurs.

There is usually no advantage to releasing the ALLINK file when in the FST-2 mode. If large arrays force the stack to extend into the ALLINK file then the ALLINK file should release itself by a call to ALPCLR. However, this only eliminates terminal error 54 if the ALLINK file is not called again or if the stack is smaller when the ALLINK file is called again. The call is coded as follows:

```
ALPCLR      EQU     1224B
             .
             .
             .
            BSM*    ALPCLR
```

The A register is destroyed by this call.

If the ALLINK file is deleted from memory a disc access is required to reload the program if it is executed again.

(7) Additional ALLINK files executed also do not affect the test program buffer area. An ALLINK file overlapping another or a seventh ALLINK file forces all ALLINK files to be deleted and only the new one is retained. This forces a disc search and load if a previously loaded file is executed again.

(8) When the test halts during the first execution due to a reset or terminal error the next test start causes TOPSY to repeat the same steps as though the test program had not been run.

(9) When the test halts due to EOT or a pause, necessary system information is saved by TOPSY regarding the resident ALLINK files and the test program. If the next test start is for the same test program even if on a different station, and the test program fits in memory, the test program is not reloaded into memory. If it does not fit in memory a disc access takes place to reload the first page of the test plan.

If the ALLINK files are retained in memory no disc access is required for the ALLINK files. Calling more than six ALLINK files causes the first six files to be deleted. It is generally not a good programming practice to call more than six ALLINK files.

If the test program fits in memory and if all ALLINK files called do not overlap each other or request to be deleted, no disc accesses are required on the second and subsequent test program executions.

(10) When a different test program is executed on this or another station, the ALLINK files are deleted from memory and the new test program is loaded into the test program buffer area. Memory management is handled according to items 1-8. If executing two stations and the first station's test program is then reexecuted, the test program and ALLINK files must again be paged into memory. All ALLINK files except the last loaded need to be found on the disc and all ALLINK files must be reloaded. The location on disc of the last ALLINK file loaded is retained so it does not need to be found on disc if it is the next executed.

If two test stations are operating on a Sentry, the maximum efficiency of execution time on an FST-2 is attained if both stations run the same test program until testing is complete and then both run the second test program if either test program to be run fits in memory or if either calls one or more ALLINK files. If one station runs one test program while the other station runs a different test program, disc acceses are required for both which are not required unless the test program is so large it needs to be paged anyway.

(11) When an exit to DOPSY occurs all ALLINK files are deleted from memory. On return to TOPSY the test programs assigned to stations are found on the disc so this does not need to happen at execution time. At the next test start for each station, the ALLINK files are found and reloaded following items 1-8. Re-establishing memory usage on return to TOPSY allows the user to move items on disc while in DOPSY and even change the test program or ALLINK files.

3.4.7 TOPSY System Commands

The following pages contain the TOPSY system commands. The commands are listed in alphabetical order, however, ANALYSIS mode commands are handled separately. The /. is optional and not required when entering commands from the TTK and is used in this manual to differentiate between TOPSY and DOPSY commands.

The following TOPSY Utility commands are contained in the Sentry Utilities Reference Manual, manual part number 67095661 and are not discussed in this manual.

- DEBUG
- LMIO
- PPLOG
- PSCAN
- SPLOT
- XMIT

3.4.7.1 CALLING TOPSY

Two DOPSY commands are available which load the TOPSY system into memory. They are:

//TOPSY — passes control directly to the TOPSY monitor. TOPSY commands may now be entered and DOPSY commands are not understood by the system. See section 3.3.1.13 for a complete description of the TOPSY command.

//INIT -- allows user to check or configure the TOPSY system for the stations to be used and then passes control to TOPSY. When a customer receives his system TOPSY has already been initialized for the physical test stations at the customer's installation so it may never be necessary to use this command. Refer to the Sentry Utilities Reference Manual for a complete Throughout this section STATn is used in the command syntax to indicate that a station identifer is required and that the command is applied to only the station specified by the user. If the station identifier is required for the command syntax but is not entered, a check is made to see if only one station was initialized. If so, that station number is used. Also, if in the analysis mode and no station identifier is specified, the station assigned to analysis is assumed. If the command syntax requests STATn and more than one station was initialized and TOPSY is not in analysis mode, an error message is output.

3.4.7.2 TOPSY ERROR MESSAGES

TOPSY issues three types of error messages. The first type is a message displayed on the VKT when a station is not on line (Table 3-4). The second type is a message displayed following the entry of any command which could not be processed by TOPSY (Table 3-5). The third type is called a terminal error (Table 3-6). Terminal errors occur while a station is on line but can no longer exexute the test program. This usually occurs due to a program or operator error buy may result from system hardware errors. When a terminal error occurs the station number and error number are displayed to the VKT. Alto the EIR register contains the error number in octal and both the DC pass and fail lamps are lit. The EOT lamp is off.

TABLE 3-4
MESSAGES APPEARING WHEN A STATION IS NOT ON LINE

Error Messages	Description
filename SYS 11 ERR.	The TOPSY overlay or $GLOBS is not on the disc under the system job. TOPSY cannot execute without all the overlays and $GLOBS so control is returned to DOPSY.
CSW6 SET HALT ON INTRUPT	This message is printed only when TOPSY is first entered. Console switch 6 set on causes the CPU to halt on each tester interrupt. This is used for debugging only. The message informs the operator that the switch is set for this mode so it can be turned off if not desired.
I/O DEVICE NOT READY	An I/O device was not on when TOPSY initiated an I/O operation to it.
NO STATION	This message is printed only when TOPSY is first entered. No stations have been configured so TOPSY cannot execute a test program. Control is returned to DOPSY.
NO STATION	The tester START button has been pressed for a station which is not configured. TOPSY must be initialized for the station if testing is desired for the station.

TABLE 3-5 TOPSY GENERAL ERROR MESSAGES

Error Message	Description
COMMAND?	The command name is missing or is not a valid TOPSY or analysis command, or is an analysis command entered while not in analysis mode.
DUPL./MISSING PARM.	Two contradictory modifiers have been entered (such as two output devices) or a required modifier is missing.
STATION MISSING	The station identifier has not been entered on a command which requires it. TOPSY is not in analysis mode or more than one station was initialized so a station cannot be assumed.
STATION UNASSIGNED	The station identifier entered on a command is not a station which has been configured for TOPSY. The user must either enter the command correctly or re-configure TOPSY with INIT for the stations desired.

TABLE 3-6 EXECUTION TERMINAL ERROR NUMBERS

Terminal Error Number	Description
1	A program has not been loaded for this station.
2	Station is disabled (power off)
3	Value programmed is negative or exceeds the hardware limit: SET DELAY, DC > 5.734 sec SET MAJOR loop count > 4096 SET MINOR loop count > 4096
4	DMA statement execution process did not start. (Hardware error).
5	Magnitude programmed exceeds hardware limit: FORCE [E0/E1/EA0/---/EC1] > 10 bits → -1024 or 1023 SET [S0/S1/SA0/SA1] > 10 bits FORCE [VF1/VF2/VF3] > 10 bits FORCE [IF1/IF2/IF3] > 10 bits ENABLE [TRIPI1/TRIPI2/TRIPI3] > 10 bits ENABLE [TRIPV1/TRIPV2/TRIPV3] > 10 bits SET DCT > 10 bits SET TGx [DELAY/WIDTH] > 10 bits
6	Value programmed is negative, zero or is outside of limit: SET PERIOD > 40 milliseconds SET PERIOD > 12 bits → -4096 or 4095 SET PERIOD < 200 nanosec for 5 MHZ SET PERIOD < 100 nanosec for 10 MHZ SET TGx [DELAY/WIDTH] < 10 nanosec
21	Value outside of limits set by ENABLE IHI/ILO
22	Value outside of limits set by VHI/VLO
23	Pin number is greater than 120; CPMU PIN
24	Value programmed for RVS exceeds hardware limit: [SET S0/S1/SA0/SA1] +6, -30V for 5 MHZ [SET S0/S1/SA0/SA1] +6, -16V for 10 MHZ FORCE [E0/E1/---EC1] → as above

Terminal Error Number		Description
26		Illegal OPCODE in FACTOR interpretive tester statement.
31	†	FACTOR magtape read error (File skip forward executed to move tape to the next tape file).
33	†	FACTOR magtape write error (File skip backward executed to move tape to the start of the last file. When start is pressed the program continues execution from this tape location).
35	†	FACTOR magtape EOT on write.
36	†	FACTOR magtape EOT on read.
37	†	FACTOR magtape memory protect on tape read.
40	†	FACTOR magtape data count less than 7 or greater than assigned buffer size. Also a memory overflow may have occurred.
42	†	FACTOR magtape irrecoverable error.
50	(a)	No DCL statement appears before this reference to the array element.
	(b)	Array has zero or negative number of elements.
51	(a)	The number of actual parameters does not agree with the number of formal parameters.
	(b)	TOPSY internal address error during store of a value, array element or formal value.
52	(a)	Array subscript exceeds 8388607, is negative or greater than the array size.
	(b)	Attempt to change array element 0 (i.e,, the array size)
53	(a)	The number of entries on the top of the working stack is less than required for current statement execution. (System error.)
	(b)	A block header memory address of zero has been encountered during update of Current Active Block pointer table. (System error.)
54	(a)	Array size declared exceeds 8388607 or available memory.
	(b)	Memory buffer available for the test program is less than 1 disc sector (48 words).
55		The statement to be executed is not within the FACTOR object file. (System error).
56		Illegal FACTOR data code. (System error).
57		The number of array elements being initialized exceeds the declared array size.
58	(a)	FACTOR I/O started without previous I/O being completed.
	(b)	Text is to be output without I/O being initialized.
	(c)	Column formatting outside of I/O Process.
	(d)	Literal variable outside of I/O process.
	(e)	Column formatting is allowed on output only.

†Tape status issued in octal. On terminal errors 35 or 36 a tape rewind is executed.

Terminal Error Number	Description
59	For statement loop control start value is less than end value.
60	Assembly Language Linkage program or PPM microprogram is not on the disc.
61	Assembly Language Linkage program or PPM microprogram load entry point overlaps the top of the working stack.
62	Arithmetic or logical operation overflow (ADD, SUBTRACT, MULTIPLY, DIVIDE, EXPONENTIATION, AND, OR, EOR, NOT, NEGATE).
67	DOF (disc output file) is not open.
68	Attempt to read beyond EOF (end-of-file) if DIF (disc input file) or DIF not open.
69	Attempt to write beyond EOF (end of file) of DOF (disc output file)
70	Attempt to execute a program without a SET PAGE statement on a SII and SVII or a SII and SVII Program on a S200/400 or a system without a tester.
71	Local memory size requested exceeds local memory available.
72	Programmed timing generator delay/width error (checked on SET PERIOD): Delay + Width ≥ Period SII/SVII Delay or Width ≥ Period SII/SVII + 1 nsec. option Delay or Width range ≥ Period range Width range ≥ Delay range
74	Local memory address is negative or exceeds size requested by SET PAGE.
75	Attempt to execute a 10 MHZ FACTOR statement on a 5 MHZ system.
76	Attempt to execute a program with SET PAGE, SPM on a Sentry VII without the Sequence Processor Module.
77	Attempt to execute a PPM program on a Sentry VII without the Pattern Processor Module, i.e., one of the following was encountered: SET APERIOD SET ATG4 [DELAY/WIDTH] SET PPM REXEC

Terminal Error Number	Description
78	Attempt to execute a program with extended capabilities on a system without the hardware, i.e., one of the following was encountered: SET IFAIL, COUNT SET IOM3 SET Q ENABLE TEST AMATCH
79	Attempt to execute a 2v/2mv program on standard hardware.
81	The microprogram called by REXEC contains an assembly error.
82	The module number passed to the microprogram by the REXEC statement is negative.
83	The module number passed to the microprogram by the REXEC statement is greater than the number of modules in the microprogram.
84	Error in DMA loading the control RAM or in DMA Loading the PPM registers when a PPM microprogram is executed.
100-999	Terminal errors generated by ALLINK programs.

3.4.8 TOPSY Mode Commands

3.4.8.1 ANALYSIS

ANALYSIS - Refer to Analysis Mode Commands, Section 3.4.8.

3.4.8.2 CLEAR A STATION

Format:

/.CLEAR STAT(n)

Description:

The following operator requested conditions and test programs are cleared or reset:

1) SN - serial number is set to one.
2) GLOB1-GLOB20 - Globals are set to zero.
3) SWITCH - switch is set to zero.
4) VALUE - value is set to zero.

Datalog requests are turned off except the peripheral selection, the title on datalog output is cleared, the analysis requests for PAUSE, SYNC, MODIFY, OVERRIDE, MEASURE, READ, WRITE and DISPLAY are turned off, the PPM analysis requests for LOOP and STOP are turned off.

In addition, if executing in the FST-2 mode, the test program is reloaded into memory at the next ececution.

Error Messages:

None.

3.4.8.3 CLOSE A DISC FILE

Format:

/.CLOSE

Description:

The disc file opened as a DOF (for writing to by the test program) is closed. The file must be closed before it can be opened and used as a disc input file (DIF).

When the file has been closed the following message is displayed:

DOF filename CLOSED

The disc output file is automatically closed on exit to DOPSY via the DOPSY command.

Error Messages:

Message	Description
FILE ID WRONG	No disc output file has been opened.

3.4.8.4 CONTINUE

Format:

/.CONTINUE STATn

Description:

The manual mode selection is turned off for the specified station if it was on and a start request is issued for the specified station.

Error Messages:

None.

3.4.8.5 DATALOG TEST RESULTS FOR A STATION

Format:

```
/.DATALOG (DCT) (MEASURE) (LOG) ((FCT) (COUNT) (IFM) (n))
          (TRIP) (FRQn) (TTP/LP/MTW) STATn
/.DATALOG (TTP/LP/MTW) (FRQn) STATn
/.DATALOG OFF (TTP/LP/MTW) STATn
```

where:

DCT	Log all parametric test failures.
MEASURE	Log the results of all MEASURE statements.
LOG	Log the results of all MEASURE statements in the test program specifying LOG.
FCT (n)	Log all functional test failures. If n is specified, the first failure plus n additional failures for each ENABLE TEST statement are logged. If neither COUNT nor IFM is requested, log the functional failures by address only. (Only one failure per address may occur.) Test program IFAIL statements requesting the COUNT mode are ignored.
COUNT (n)	Log all functional test failures by test step (test counts). This is an SPM option. If n is specified the first failure plus n additional failures for each ENABLE TEST statement are logged by count. COUNT mode allows logging of multiple failures at an address if they occur and display the test count of the failure. Test program IFAIL statements not requesting COUNT mode are ignored.
IFM (n)	Log all functional test failures by address or by count mode depending on the mode of the test program IFAIL statements. If COUNT is also entered, begin logging in COUNT mode until the first IFAIL statement, otherwise begin in address mode. If n is specified, the first failure plus n additional failures for each ENABLE TEST statement are logged.
TRIP	Log all DPS trip failures.
FRQn	Log data on every nth device. The first device is logged followed by every nth device. For example, if FRQ10 is entered, devices 1, 11, 21, 31,... etc. are logged. If the frequency is changed without changing other positions the next device is logged followed by every nth device. FRQ1 causes every device to be logged.

TTP/LP/MTW	Specifies output device as either the TTP, line printer, or magnetic tape. The default output device is the POD if no device is specified in the DATALOG and test program WRITE statements. If MTW is specified the MAGT command (section 3.4.7.10) must be used.
OFF	Logging of test results is turned off for the station specified. The frequency is set to 1 and the output device becomes the system POD unless an output device is specified.

Description:

The datalogger lists the requested test results for the station to the selected output device or to the system output device if no output unit is specified.

Any or all of the datalog options may be entered in any order in the same command request. If any of the above options is specified, any option not selected is turned off. No logging occurs if the enabled condition is not met for the device tested.

The frequency or output unit may be specified on the options command or may be changed independently if none of the log type options is requested. Note that the datalogger command may be used to direct test program output without changing the system POD even if no datalogging is requested.

When FCT (or COUNT or IFM) is specified with a number, the number requests the multiple fail datalog mode. In this mode, n additional failures are logged. After the first functional failure is logged, TOPSY restarts local memory setting the ignore failure value to the address or test count (depending on the mode) of the last failure. This causes all failures to that address or count to be ignored so that the next failure can be logged. Local memory is restarted at 0 for non-SPM test programs and at the local memory start address for SPM test programs.

Functional fail datalogging is inhibited in the enable latches mode (set by the test program) and no fails are logged except the accumulated result when the functional test sequence is complete.

CLEAR turns off the datalog option requests but does not affect the output selection which may be indicating the device test program output goes to.

Error Messages:

Message	Description
INVALID NUMB.	FRQ is not followed by a valid integer between 0 and 99.

Datalog Output

The datalogger outputs a station header once for each test start request if any test program or datalog output occurs. The station header displays the station identifier, the test program name, and the serial number of the device test which is incremented for each completed test execution.

The station header line is followed by a title line. The title line is blank unless specified by the operator command TITLE.

Individual heading lines are printed above the columns of datalogged output for each type of output which occurs. When the type of data being logged changes (or after the title) an appropriate header is output. The same header is used for DCT, MEASURE, and LOG requests.

3.4.8.6 DEBUG

Format:

/.DEBUG

Description:

If the DEBUG utility has been included as part of TOPSY when the coreimage of $TOPSY was created, this command transfers control to the DEBUG utility. All of the DEBUG directives are allowed. Memory locations may be displayed or altered, testers and CPU registers may be read or written, and address halts may be established to cause re-entry into DEBUG if a specified address is executed. T causes return to TOPSY. D causes return to DOPSY. If return to DOPSY occurs in this way the testing environment is not saved and at the next entry to TOPSY the station and system vairable is the same as they were at the last entry to DOPSY.

When $TOPSY is created with DEBUG, MTIO is not loaded in order to make room. MTIO and DEBUG are never both resident.

Error Messages:

Message	Description
COMMAND	DEBUG is not resident in memory since it was not created as part of TOPSY. Control cannot be given to DEBUG.

3.4.8.7. DOPSY

Format:

/.DOPSY

Description:

This command returns control to the DOPSY monitor and enables the DOPSY command language. TOPSY commands are no longer understood and pressing the tester start button has no effect. In addition, the tester hardware is reset.

When TOPSY is recalled, the system and station variables are restored to the state at the last exit to DOPSY caused by this command. All operator requested options such as the test programs assigned to a station and datalog and analysis selections, as well as global values set by the test program are unchanged. However, if when TOPSY is reentered a test program assigned to a station cannot be located on the disc under the current job, the station assignment is erased. If exit from TOPSY occurs in some other way such as through debug, card boot, or a brench to 100B through the switch register, the current TOPSY environment is not saved and is still set to the same condition as at the last exit caused by the DOPSY command.

Error Messages:

None.

3.4.8.8 GLOBAL DISPLAY OR CHANGE

Format:

/.GLOBAL (n_1) (n_2) (LP/TTP) STATn

where:

- n_1 - an integer in the range of 1 to 20. The value of the corresponding global is displayed.
- n_2 - an integer in the range of 1 to 20. The global value specified by n_1 is updated with the global value specified by n_2.

Description:

The globals, serial number, and the test program assigned to a station may be displayed or individual globals 1 through 20 may be displayed or changed. The display is to the TTP and also to the line printer if it is the POD or if the LP is requested.

If no number is entered, the test program name and SN, SWITCH, VALUE, and GLOB1 through GLOB20 are displayed on the TTP and written on the LP if desired.

The global variables may be assigned values by the operator using the TOPSY GLOBAL command or they may be assigned by the test program (refer to the FACTOR Programming Language Reference Manual, publication number 67095738). The test program may check the value of GLOB1 through GLOB20 and SWITCH to control program execution. VALUE is the value of the last DC measurement.

The globals are only altered by the GLOBAL command if the program is at end-of-test. To change a global while at a pause, refer to the command VAR (section 3.4.7.21).

If CLEAR is specified the values of all globals are set to zero, except SN, which is set to 1.

Error Messages:

Message	Description
INVALID NUMB	The first number entered is not between 1 and 20.

Example:

```
/.GLOBAL   LP    STAT1D

 TEST PLAN       Filename
 SN         =         5
 VALUE      =   +0.000E + 00
 SWITCH     =         0
 GLOB1      =   +     0
 GLOB2      =   +     0
 GLOB3      =   +     0
 GLOB4      =   +     0
 GLOB5      =   +     0
 BLOB6      =   +     0
 GLOB7      =   +     0
 GLOB8      =   +     0
 GLOB9      =   +     0
 GLOB10     =   +     0
 GLOB11     =   +     0
 GLOB12     =   +     0
 GLOB13     =   +     0
 GLOB14     =   +     0
 GLOB15     =   +     0
 GLOB16     =   +     0
 GLOB17     =   +     0
 GLOB18     =   +     0
 GLOB19     =   +     0
 GLOB20     =   +     0
```

3.4.8.9 LOAD AND ASSIGN A FILE

Format:

/. LOAD 'filename' (SAVE) STATn

where:

filename	name of file to be loaded and assigned to a specified station. The filename must be enclosed in quotes and contain no blanks. The file must be a type DATA and exist in the current job directory.
SAVE	retains all operator requested conditions and the values of the global variable.

Description:

This command causes the test program to be located on the disc and assigned to the station specified. The next time the tester start button for the station specified is pressed, the named test program is executed.

If operating in the FST-2 mode the test program is loaded into memory at the next tester start even if this is the same test program as previously assigned to this test station.

If the SAVE option is not specified LOAD performs the following reset conditions:

- SN is set to 1
- GLOB1 - GLOB 20 are set to 0
- SWITCH is set to 0
- VALUE is set to 0
- DATALOG requests are turned off except for peripheral selection
- ANALYSIS requests for PAUSE, SYNC, MODIFY, OVERRIDE, ALTER, MEASURE, READ, WRITE, and DISPLAY (for ANALYSIS, LOOP and STOP) are turned off.

Error Messages:

Message	Description
BAD NAME	The 'filename' is missing, contains a blank or is not enclosed by single quotes.
FILE ID WORNG	The file named cannot be found on disc under the current job or the file is not a DATA type file.

3.4.8.10 MAGNETIC TAPE REQUEST

Format:

```
/. MAGT (IN0/IN1/IN2)(OUT0/OUT1/OUT2)(REW0/REW1/REW2)
     STATn
```

where:

INx	specifies the mode of the tape drive (x) to be input or read for test programs
OUTx	specifies the mode of the tape drive (x) to be output for datalog output or for test programs writing to mag tape
RWx	rewinds the specified tape drive (x). An IN or OUT is not required

Description:

The MAGT command sets the mode of the specified magnetic tape unit to INPUT or OUPUT, for use by FACTOR READ or WRITE statements. MAGT can also be used to rewind tapes.

Restrictions:

The same unit may not be specified for both input and output. Without this command tape I/O requests are ignored.

Error Messages:

Message	Description
DUPL ./ MISSING PARM.	Neither INn, OUTn, or REWn is specified.
WRONG I/O	The same mag tape unit is specified for both input and output.

3.4.8.11 MANUAL KEYBOARD CONTROL

Format:

/. MANUAL (OFF) STATn

where:

OFF resets the manual (keyboard) mode. The CONTINUE and CLEAR command also resets the manual mode.

Description:

This command allows the tester start and reset to be controlled from the input device. When this has been selected for a station, a carriage return is equivalent to pressing the tester START button. Typing R and carriage return at a pause in the middle of a test execution is equivalent to pressing the tester reset button.

Only one station may be in this mode at a time. Selecting a new station resets the mode for the previous station.

Restrictions:

This command is only valid in ANALYSIS mode. It applies to the test station given in the ANALYSIS command.

Only a return without a preceding character starts the test.

Leaving TOPSY causes the return key to revert to its normal purpose.

Error Messages:

Message	Description
COMMAND?	R or carriage return has been entered and MANUAL has not been selected.

3.4.8.12 NON-STANDARD OVERLAYS

Format:

/. filename (options)

Description:

It is possible to transfer control to an assembly language program whose name on disc begins with a color. The user may wish to write a non-standard overlay to call from TOPSY or may use one of the TOPSY utilities supplied by Fairchild Systems Technology such as the assembly language program to display contents of local memory. For example, a program is created on disc with the name ':DSPLM'. It can be called by the TOPSY operator command as follows:

/. DSPLM

A non-standard overlay is an assembly language program written according to precise rules. The program should be created in the ALLINK buffer area above the run-time stack. It must be in the system job.

Following the execution of a non-standard overlay, any ALLINK files which were resident must be reloaded at the next execution of the test program, and if exeucting in the FST-1 mode, the test program must also be reloaded.

Restrictions:

A non-standard overlay must not have the same name as any of the TOPSY command names.

Error Messages:

Message	Description
COMMAND?	A name has been entered which could not be found on the disc with a color preceding the name.

3.4.8.13 NOTE

Format:

/. NOTE 'string' (LP/TTP)

where:

string	any group of up to 72 alphanumeric characters enclosed in single quotes.

Description:

NOTE is used to annotate listings or datalog output. It may also be used to give the operator a message from a DIF file. The note may be output to the VKT and the line printer if LP is specifed. If no output device is specified output is to the POD.

Restrictions:

A note sent from the TTP by a command from the TTK is not typed.

Error Messages:

Message	Description
DUPL/MISSING PARM.	The string is missing or the string is too long.
BAD NAME	The closing quote of the string is missing.

3.4.8.14 OPEN A DISC FILE

Format:

/. OPEN [DIF/DOF] 'filename'

where:

DIF	disc input file
DOF	disc output file
filename	six character name of DIF or DOF file to be opened. The filename nust be enclosed in quotes and if a DOF file is specified the filename must begin with a period.

Description:

The disc file specified is opened as an input file (DIF) or an outpu file (DOF) for input to or output from the test program. If a test program is reading or writing a disc file, the file must be opened using this operator command.

The file must be on the disc under the current job. This is done while in DOPSY with either the CREATE command to load a file or the ASSIGN command to assign space to a file.

When the file is opened, the test program automatically begins reading or writing from the beginning of the disc file when the READ DIF/WRITE DOF statement is executed. If the file successfully opened one of the following messages is displayed:

DIF filename OPENED
DOF filename OPENED

Restrictions:

Only one DIF or DOF file may be opened at a time.

Open allows the same name to be used for a DIF and a DOF at the same time, thus caution should be used in running test programs.

Error Messages:

Message	Description
BAD NAME	The 'filename' is missing, contains a blank, or is not enclosed by single quotes.
FILE ID WORNG	The file named cannot be found on disc under the current job.
INVALID DOF FILE ID	The DOF filename must begin with a period.

Example:

The sequence of DOPSY/TOPSY commands required to read and write to the disc from the test program are shown. Refer also to the FACTOR manual.

Command	Description
//JOB 'DARRYL'	
//ASSIGN '.DOUT' nDATA	Assign space (n sectors) on disc for the disc output file.
//TOPSY	Enter TOPSY.
/.OPEN '.DOUT' DOF	Open the disc output file which will receive the data.
/.LOAD' FACT1' STAT1A	Load the test program which will write to dsic.

Press tester START button and run program for n devices.

/.CLOSE DOF	Close the DOF. The DOF is also closed automatically whenever a return to DOPSY is made.
/.LOAD 'DATRED' STA1A	Load the data reduction test program.
/.OPEN '.DOUT' DIF	Open the disc file as an input file.

Press start button to run data reduction program.

/.DOPSY	Finished running data reduction

Note /.LOAD and /.OPEN can be in either order.

3.4.8.15 RESET

Format:

/.RESET STATn

Description:

This command is entered while at a pause in test execution due to a test program pause, analysis pause, or while in manual mode (single-stepping.) Entering this command does not reset the hardware at that time, however, the next test start whether by the START button or a keyboard command restarts the test program at the beginning and a hardware reset occurs at that time.

Typing R and carriage return while in the operator requested MANUAL mode is equivalent to this command.

3.4.8.16 SERIAL NUMBER

Format:

/.SN (n) (TTP/LP)STATn

where:

n a six digit decimal integer.

Description:

The serial number may be changed or displayed using this command. If n is specified, SN is changed to n. Otherwise the serial number is displayed to the VKT and also printed on the line printer if requested.

The serial number is output as part of the datalog header whenever the header is output. It is incremented by one for each completion of a test program execution. Terminal errors and resets do not cause the serial number to be updated.

The serial number begins at 1 unless altered by the SN command. CLEAR sets SN equal to 1.

Error Messages:

Message	Description
INVALID NUMB.	The number entered is negative.

3.4.8.17 SET

Format:

/.SET (TTK/CR/MTR/DIF '.filename') (LP/TTP/MTW)

Description:

The primary input device (PID) or the primary output device (POD) is set to the peripheral specified. These assignments are effective until the next SET command from either TOPSY or DOPSY.

If the input device is set to a disc input file (DIF) the file name must be specified and must begin with a period. The file may be either in the current job or the system job.

If the input device is CR, MTR, or DIV, the last record of the command file must be /. SET TTK to return command input to the keyboard.

Error Messages:

Message	Description
BAD NAME	DIF is specified and the 'filename' is missing or contains a blank, is not enclosed by single quotes, does not begin with a period, or could not be found on the disc in the current job or the system job.

3.4.8.18 START

Format:

/.START STATn

Description:

A start signal is sent to the tester hardware. This start request from the input device is equivalent to pressing the tester START button.

The carriage return while in the operator requested MANUAL mode is equivalent to this command.

3.4.8.19 SWITCH

Format:

/.SWITCH (n) (TTP/LP) STATn

where:

n is the value to which the global variable is to be set. The value may be a decimal or octal integer, or a floating-point number.

Description:

The value of the global variable SWITCH may be displayed or changed using this command. If n is specified, SWITCH is changed to n. Otherwise the value of SWITCH is displayed to the VKT and also the line printer if requested.

SWITCH may be set by this operator command or the test program and may be displayed using the SWITCH or the GLOBAL command. The test program may test the value of SWITCH to control program execution.

The CLEAR command sets the value of SWITCH to zero.

3.4.7.20 TITLE

Format:

/.TITLE 'string' STATn

where: string

Description:

This command specifies a string of up to 64 characters which is output following the datalog station header. The title is output each time the station is executed if datalogging or test program output takes place.

The title is cleared by the CLEAR command or by a blank between single quotes on the TITLE command. If no title is specified a blank line is output following the header.

Error Messages:

Message	Description
DUPL./MISSING PARM.	The string is missing on the TITLE command or the string is too long.
BAD NAME	The closing quote of the string is missing.

3.4.8.21 VARIABLE DISPLAY OR CHANGE

Format:

/.VAR (ARR/ARRAY) $n_1(n_2)$ (TTP/LP) STATn

where:

ARR/ARRAY	specifies an array variable
n_1	unique number assigned by the compiler to an array or variable. It must be included to specify which variable or array to access and display.
n_2	specifies the variable specified by n_1 is to be updated with the value of n_2. This is only valid for variable.

Description:

The value of a test program variable or a global variable may be changed by the operator at a pause in the test execution or the value of a test program variable, array element, or an array size may be displayed. This command should be used if the value of a global is to be changed or displayed while at a pause. To access a global at EOT the GLOBAL command should be used.

The variable or array number must be determined from the block number the variable is defined in and the order of definition. This is easiest to do if the variables are declared in a DCL statement by the user, rather than letting the compiler define them in the order of use also, if the variables are declared the variable/block number is in the object listing of the test program.

To determine the variable block number for a variabl,e or array, note that the variable numbers are assigned beginning with 5 for each block and the block numbers are assigned beginning with 0. In block 0 the globals have the following assigned variable/block number:

VALUE	= 5	GLOB6	= 15B	GLOB14	= 25B
SWITCH	= 6	GLOB7	= 16B	GLOB15	= 26B
TIME	= 7	GLOB8	= 17B	GLOB16	= 27B
GLOB1	= 10B	GLOB9	= 20B	GLOB17	= 30B
GLOB2	= 11B	GLOB10	= 21B	GLOB18	= 31B
GLOB3	= 12B	GLOB11	= 22B	GLOB19	= 32B
GLOB4	= 13B	GLOB12	= 23B	GLOB20	= 33B
GLOB5	= 14B	GLOB13	= 24B		

In block 0 the first defined variable is assigned number 34B, and the maximum variable/block number in block 0 is 177B. The first defined variable in block 1 is 205B, i.e., bits 7, 8 and 9 define the block number and bits 0-6 define the variable number. Each additional variable has the next higher octal number assigned up to 177B. The first two variable numbers for each block are:

Block	Variable number of first defined variable	Second defined variable
0	34B	35B
1	205B	206B
2	405B	406B
3	605B	606B
4	1005B	1006B
5	1205B	1206B
6	1405B	1406B
7	1605B	1606B

n_1 must be an acceptable variable/block number for a currently active block. Once the test program exits from a block a variable in that block may not be accessed.

If n_2 is not entered the value of the variable registered is displayed. If two numbers are entered, the variable is updated with the second value (n_2) unless the variable is an array. This differs from the analysis command ALTER in that the variable contains the new value from the time the command is entered until the next test program assignment statement affects this variable, whereas ALTER specifies that a specific assignment statement is to be replaced by the operator supplied value.

If the variable to be printed is an array either ARR or ARRAY must be entered. Otherwise the value displayed will be incorrect and attempting to change the value will cause undeterminable results. The first number is the variable/block number n_2 is the element number to be displayed. If n_2 is missing or zero the array size is displayed.

The system performs error checking an n_1 to determine that the block number is not greater than the current block and that the variable number is valid for the current block. If ARR is entered n_2 is checked to see that the element requested does not exceed the size of the array. However, if a block contains an array it is possible for the user to enter too large a variable number. The error will not be detected and an incorrect value will be displayed.

Error Messages:

Message	Description
INVALID NUMB.	No number has been entered, or the variable/block number is for a block or variable which is not valid, or if ARR is specified n_2 is for an array element outside the actual array.

3.4.9 Analysis Mode Commands

The manual analysis mode provides the user with tools to analyze, debug, and modify the test program and its execution. The dash (-) prompting character is output in this mode.

This mode is invoked by the ANALYSIS command. Analysis commands may not be entered while in the TOPSY mode, although all TOPSY commands except ANALYSIS may be entered from analysis mode.

3.4.9.1 ANALYSIS

Format:

/.ANALYSIS STATn

Description:

This command assigns the station specified to the analysis mode. In this mode the dash (-) prompting character is output to indicate that the analysis commands may now be entered for this station. On analysis type commands the station number may be entered, however, if entered it must be the same as the analysis station. Only one station may be assigned to analysis at a time so the ANALYSIS command is not allowed while in analysis mode.

Other TOPSY commands may be entered while in analysis mode. If no station identifier is specified the command is applied to the current analysis station. If the station identifier is specified that station is used.

Error Messages:

Message	Description
COMMAND?	The ANALYSIS command is entered while in analysis mode. To change the analysis mode, return to TOPSY mode and re-enter the command.
DUPL./MISSING PARM.	An analysis type command is entered with a station identifier other than the station assigned to analysis.

3.4.9.2 ALTER THE VALUE OF AN ASSIGNMENT STATEMENT

Format:

/.ALTER n_1 n_2
/.ALTER n_1 OFF
/.ALTER LIST

where:

n_1	an octal integer which specifies the statement number
n_2	the new value to be assigned to the variable in place of the test program's assignment.
OFF	resets the ALTER request for the specified statement. An ALTER must have been previously turned on for that statement.
LIST	lists each statement number which has an active ALTER request and the value of the ALTER for the station assigned to analysis.

Description:

The first form of the command provides the capability of replacing the value of an arithmetic expression in a test program assignment statement with a value enterrd by the operator.

Because the statement numbers are displayed in octal it is recommend that they be written in octal in the command. The statement referenced must be a test program assignment statement or the ALTER request is ignored. Examples of assignment statements are:

```
A   = 1;
B 3 = 10E-6;
C   = (A*3)/4;
```

When the specified statement is executed, the ALTER value replaces the value of the arithmetic expression. The variable retains this value until the test program assigns it a new value in a different assignment statement.

The ALTER remains in effect for the statement until changed by a new The ALTER remains in effect for the statement until changed by a new ALTER for the statement, or reset by the OFF option or a CLEAR command.

A maximum of twenty statements for all stations may be altered. However, if a new ALTER statement is entered for the same station and statement number, it replaces the previous entry, rather than using another of the twenty allowed.

The CLEAR command resets all the alter requests for the station being cleared.

Error Messages:

Message	Description
ALTER BUFFER IS FULL	Twenty alters have already been requested. This is the 21st alter.
DUPL./MISSING PARM.	Either two numbers are required or OFF and one number are required or LIST is required.
INVALID NUMB.	The statement number entered was not a legal number or if OFF is specified the number entered does not match a previous request.

3.4.9.3 DISPLAY MACHINE STATUS AND SELECTED REGISTERS CONTENTS

Format:

/.DISPLAY (PMU)(FCT)(EIR)(PWR)(CLK)(STRB)(TG)(ALL)(ON/OFF)
(RANKn)

where:

PMU	Precision Measurement Unit status. The pin (shown as a decimal number) connected to the PMU is shown and also the forcing value. The sensing value is shown if the PMU has made a measurement since the last display.
FCT	Long registers: MA/MB, DA/DB, S, R, F, C. The initial rank for the 60 pins selected by specifying RANKn (where n is 1 through 8) is displayed.
EIR	External Interface Register. The EIR controls the lamps on the station control box.
PWR	List of pins connected to DPS1, 2, 3 or tester common (TCOM)
CLK	Clock. List of pins connected to Clock Reference
STRB	Strobe. List of pins connected to TG8.
TG	List of timing generators TG1-TG6 that are in use and the pins connected to each.
ALL	Selects all options
ON	Displays the selected options at every pause and end of test until the request is turned OFF.
OFF	Turns the request for a display off. The CLEAR command also turns the display off.
RANKn	Specifies the rank for the pins where n is 1 through 8.

Description:

This statement provides a display of machine status and selected registers contents at each pause, at the end of a test sequence, and at each step in the manual mode, if ON is specified or immediately if ON is not specified. The display is always to the VKT and the screen is cleared before the register contents are displayed. If no options are selected the station number and the current statement number are displayed.

Restrictions:

Only one station at a time should have DISPLAY on, to prevent loss of display information during multiplexing.

No other station should come on line to modify tester register states if a display is requested.

Error Messages:

None.

Example:

```
        /.DISPLAY ALL
  STATION  4A
  STATEMENT NUMBER      000144

  EIR 1       10
     1111111100        FCT   FAIL     DCT  PASS      EOT
  PMU PIN 019  PMU FORCING +3.105E- 3.I  PMU SENSING +1.022E- O,V
  LOCAL MEM ADDR  0101
       1    .    10      .     20      .     30      .     40      .     50      .     60
  MA  0000100010  0011111100  0000000000  0000000000  0000000000  0000000000
  DA  0100001000  0000000000  0000000000  0000000000  0000000000  0000000000
  R   0000000000  1000000001  0000000000  0000000000  0000000000  0000000000
  S   0000000000  0000000000  0000000000  0000000000  0000000000  0000000000
  F   1010101000  1110000000  0000000000  0000000000  0000000000  0000000000
  C   1010101000  1110000000  0000000000  0000000000  0000000000  0000000000
  PWR   16  26  27
  CLK   05  10
  TGEN
  TG3   01  03  06  13
```

Note that the statement number and local memory address are in octal and the PMU pin number is decimal.

3.4.9.4 EXECUTE TEST CONTINUOUS

Format:

/.ETC

Description:

This command starts local memory test execution in the continuous mode. The test program or the operator must have previously set the local memory start and loop addresses. This is equivalent to writing the continuous loop mode and the busy bits of SAMA.

To stop the continuous test, write the momentary mode bit (bit 2) of SAMA or press the tester RESET button.

3.4.9.5 LOOP (PPM)

Format:

/.LOOP [ON n/OFF]

where:

n control RAM address. An integer in the range 0 to 77B. Because the address is listed in octal it is recommended that it be written in octal in the command.

Description:

This command requests the microprogram loop mode. In this mode the microprogram loops between address 0 of the control RAM and the control RAM address (n) specified in the command.

When the loop mode has been selected and the test execution started, the test station remains on line and other stations are locked out until the loop is terminated by pressing the RESET button. Memory failures are not ignored while looping in the microprogram.

The request for a control RAM loop remains on until the 'OFF' option is entered. It is also reset by the CLEAR command or a STOP ON command.

Restrictions:

LOOP and STOP may not be used concurrently.

Error Messages:

Message	Description
DUPL./MISSING PARM.	ON and OFF are both specified or neither is entered, or no number is specified with ON.
INVALID NUMB.	The control RAM address is not in the range 0 to 77B.

3.4.9.6 MEASURE

Format:

/.MEASURE (ON)(NODEn)

where:

ON — requests the measurement to be made at the next station pause (before multiplexing) or end of test. If ON is not specified the measurement is made immediately. The ON condition is cleared as soon as a measurement is made.

NODEn — requests the PMU to connect to the RVS/DPS supply. After the measurement the PMU is reconnected to the previous pin. The node number (n) must be between 200B and 221B. If NODEn is not specified, the measurement is made without changing the PMU pin connection or the forcing and sensing mode.

Description:

This command causes the PMU to make a measurement and display the results on the VKT in scientific notation.

Error Messages:

Message	Description
DUPL./MISSING PARM.	NODE is specified without a number.
INVALID NUMB.	The node number entered is not between 200B and 221B.

3.4.9.7 MODIFY

Format:

/.MODIFY [ON n/OFF]

where:

n = 0, or 350 E-6 $\leq$ n $\leq$ 5.734 seconds

Description:

MODIFY alters the value of the programmed time delay from that specified in the SET DELAY DC statements in the test program to the value specified by n. The new time delay is assumed to be in seconds.

The value specified in the MODIFY command is written to the time delay register when each SET DELAY DC statement is sensed, i.e., it overrides the programmed delay and remains in effect until turned off by operator request. The time delay register is also written with the MODIFY value at test execution start, when a FORCE RESET statement is executed, or when RESET is pushed during the test program execution.

If OFF is specified, the value in the time delay register is controlled by the SET DELAY DC statements when the next SET DELAY DC statement is executed. Before it is executed the value remains at the modified value until the next test execution start or reset is pressed, which causes a zero to be written to the time delay register.

The CLEAR command resets the MODIFY request and has the same effect as the OFF option on the time delay register.

Error Messages:

Message	Description
INVALID NUMB.	The time delay value is not within the specified limits.
DUPL./MISSING PARM.	ON and OFF are both specified or neither entered, or no number is specified with ON.

3.4.9.8 OVERRIDE

Format:

/.OVERIDE [ON/OFF]

where:

ON	causes the branch to be disabled and program execution continues as though no failures occur.
OFF	turns off the OVERRIDE request and returns control to the test program. The CLEAR command also resets the request.

Description:

This command provides the capability to inhibit the transfer of program control that results when a failure occurs if the test program contains the FACTOR statement: ON[DCT/FCT/TRIP], label;

This capability is useful in debugging device classification test programs because it permits all of the programming for the top grade of the device to the executed regardless of the actual grade of the device.

Error Messages:

Message	Description
DUPL./MISSING PARM.	Both ON and OFF are specified or neither is specified in the command.

3.4.9.9 PAUSE

Format:

/.PAUSE FAIL [ON/OFF]

/.PAUSE n ON

/.PAUSE OFF

where:

n statement number. Must be an integer in the range of 1 to 177777B.

Description:

PAUSE causes testing to stop at each failure or at a specified statement number. At a pause, the tester environment may be examined using analysis type commands or the station may be put into manual mode to single step through the test program execution.

The first form of the command causes testing to stop at each failure if ON is specified. If FAIL and OFF are both specified, TOPSY does not pause on failures.

The second form of the command causes testing to stop on the statement number (n) specified after executing the statement. Because the statement number is displayed in octal it is recommended that it be written in octal in the command.

Specifying OFF without FAIL causes both the requests for pausing on failures and pausing on a statement number to be reset.

FAIL and n may not both be specified in the same command, however, they may both be on at the same time. PAUSE and SYNC may not be used concurrently. A PAUSE request turns off all SYNC requests.

Error Messages:

Message	Description
INVALID NUMBER	The number is not in the range: $1 \leq n \leq 177777B$
DUPL./MISSING PARM.	ON and OFF are both specified or FAIL and n are both specified, or ON is specified and neither FAIL nor n is specified.

3.4.9.10 READ

Format:

/.READ register name (ON)

/.READ functional register (RANKn) (ON)

/.READ F(RANKn)(n)(ON)

/.READ LMI (n)(ON)

/.READ PW/PD/PWV/PDV (n)(ON)

/.READ PPA (PINn)(ON)

where:

register-name	any register identified in Table 3-7.
functional register	F, C, MA, MB, DA, DB, S, R, TG1, TG2, TG3, ST, RZ
F	F register reads a specific address in local memory if address is supplied. Otherwise address 0 is read.
RANK n(n)	rank of 60 pins to be read, where n is 1-8. The second value for n is the local memory address to be read, if the address is not specified 0 is assumed.
ON	causes the register to be read and displayed at the next station pause (before multiplexing). Otherwise the register is read and displayed immediately.
PW(n)	Pulse width register. The generator number (n) must be specified to read the register in engineering units. If n is not specified the result is the binary display of the address, range and value.
PD(n)	Pulse Delay register. The n is similar to n described for PW.
PWV(n)	Pulse width Vernier register. The n is similar to n described for PW.
PDV(n)	Pulse Delay Vernier register. The n is similar to n described for PW.
PPA	Power Pin Address register.
PINn	pin number for PPA in order to read actual register contents. Otherwise the pin address register contents are displayed.

LMI(n)	Local Memory Instruction. Reads rank 8 of local memory when it contains an SPM instruction. The n indicates the local memory address to be read. The display is a 16 bit binary pattern. Bit 18 which is in the address field but is a part of the function code is displayed as bit 15.

Description:

This command allows any tester register to be read and its contents displayed to the VKT. The display format depends on the register type. It may be displayed in octal, binary, functional, decimal, two octal, or engineering format. See the Register List (Table 3-8) for a list of the register names and their formats as well as a complete list of the register and their identifiers to be used when reading from analysis. 'R/W' indicates that at least some of the bits may be read. 'W' indicates that all the bits are write only so the register may not be read. For a complete description of each register and its bits, usage, ranges, etc, refer to the Sentry Systems Register Formats Manual.

The following registers may not return correct data if read during a continuous test: MA, MB, DA, DB, J, K.

Options are provided for registers with additional ranks or other special features. For the functional registers, 60 pins are listed beginning with rank 1, or pins 1 through 60. If other pins are desired, RANK n may be entered to specify the rank to begin the display at. For example, if RANK 2 is entered the display begins with rank 3 and lists pins 31 through 90.

The F register reads a specific address in local memory if the address is supplied. If neither RANK nor the address is supplied address 0 is read. If the RANK is specified the address must also be specified. However, an address may be specified without the rank. If both are entered the 'RANK n' must appear first on the command.

To read F data from an address above 1K in a 2K size local memory, bit 2 of SAMB must be set. Writing 71B to SAMB in a 4K size local memory allows reading local memory from 0 to 4K. Setting bit 2 of SAMB allows reading of local memory from 0 to 2K. If reading during a test at a pause these bit are correctly set for the size specified by the SET PAGE statement. If changed during a test the user should restore them because they control the wrap-round feature of local memory. At EOT the SET PAGE selection is reset so to read above 1K the user must write either SAMB or SAMD as required.

The time delay register is always read as a DC time delay.

To read the clamp information from the PSL register, the register-name SPSL is entered.

The registers dislayed in engineering notation may be followed by letters which further describe the register contents.

TABLE 3-7 REGISTER LIST FOR READ

Registers	Letter	Description
DPS1,2,3,E1,E0,S1,S0,(etc)	V	Value is in voltage.
DPT1,2,3	L	Trip is set "less than."
	G	Trip is set "greater than."
	I	Current force, voltage trip
	V	Voltage force, current trip
PSL	I	Current sense mode
	V	Voltage sense mode
PPS	I	Current force mode
	V	Voltage force mode
PA	V	The voltage conditioner relay is connected
SPSL(CLAMP)	S	SYM
	+	POS
		NEG
	V	Voltage (for CLAMP OFF value equals 0)
DCT	I	Current sense mode (read from PSL)
	V	Voltage sense mode (read from PSL)
	L	Fail if "less than."
	G	Fail if "greater than."
	P	pass
	F	fail
TD,TR,PW,PD,PWV,PDV	S	Value in seconds

Error Messages:

Message	Description
INVALID NUMB.	The pulse width or pulse generator number is not between 1 and 8. The rank number (RANK entered) is not between 1 and 16. The pin number (PIN entered) is not between 1 and 160.
DUPL./MISSING PARM.	PIN or RANK is specified without a number.

Example:

User Command	Output	Description
/.READ IND	000463	Octal display of IND register.
/.READ EIR	. 9 . 0 0001100110111000	Binary display of EIR register.
/.READ S	1 . 10 . 60 0001100000 00000 00	Functional display of S register.
/.READ F RANK2 231B	. 25 . 75 0000011100 00000...00	Functional display of F register, local memory contents of address 231B, starting with rank 2.
/.READ DCT	6.000 E-03,VLP	Engineering notation display of DCT register. Failure will occur at less than 6.0 E-3 volts. Measurement passed.
/.READ PW5	1.400E-07, S	Engineering notation display of TGS width register.
/.READ PW	. 9 . . 100000000000000	Binary display of PW register since no generator number was supplied.

/.READ PA	005	Decimal display of PPA register. The voltage conditioner relay is not connected.
/.READ TOPO	351 333	Two octal number display of topological scrambler register.
/.READ PPA PIN 5	. 9 . 0 1000001100000000	Binary display of PPA register contents. Bits 8-10 indicate PIN 5 is connected to DP52.
/.READ SPSL	S1.500E+0.0,V	Engineering notation display of the clamp valve. The mode is symmetrical.

3.4.8.11 STOP (PPM)

Format:

/. STOP [ONn/OFF]

where:

n the control RAM address. Aan integer in the range of 2 to 74B

Description:

This command requests that microprogram execution stop at the RAM address (n) specified. Because the address is listed in octal it is recommended that it be written in octal in the command.

After the microprogram has stopped at the address, the next microprogram execution will be initiated from address 0 of the control RAM at the next test start.

The STOP ON command must be issued in conjunction with a PAUSE ON statement number command, where the statement number is that of the appropriate REXEC or ENABLE PPM statement, as follows:

/.PAUSE ON 16	(Statement #16 is a REXEC statement)
followed by	
/.STOP ON 4	(Stopping at location 4 in the control RAM for the particular microprogram resident in the Control RAM).

The request for a control RAM stop remains on until the 'OFF' option is entered. It is also reset by the CLEAR command or a LOOP ON command.

LOOP and STOP may not be used concurrently.

In the STOP mode, the control RAM continues addressing three more locations beyond the stop address, i.e., the CRA register which contains the last control RAM address referenced, has the value of the stop address + 3. The control RAM executes one more instruction cycle byond the stop address before it actually halts. Depending upon the contents of that extra instruction, the status of the registers may be different from what the user expects for the stop address. Due to the pipeline, an address above 74B should not be used although the RAM's size is 775B.

3.4.8.12 SYNC

Format:

```
/.SYNC ON statement-number
/.SYNC ON local-memory-address ADDR
/.SYNC ON test-sequence-count COUNT
/.SYNC OFF
```

where:

statement number	test program statement-number in the range of 1 and 177777B
local memory address	address in range of 0 and 7777B
test sequence count	sequence count in range of 0 and 37777777B.
OFF	resets all sync requests

Description:

The first form of the command generates an external sync pulse at the test station sync connector when the specified statement of the test program is executed.

The second and third forms of the command generate an external sync pulse at the test station jack labeled EXT SYNC. If ADDR is specified the sync pulse occurs when the local memory location specified is addressed during functional testing. COUNT is an option for SPM. If COUNT is specified, the pulse occurs at the specified test count during functional testing.

The sync options are mutually exclusive. Requesting one automatically resets any previous sync request. Sync may not be used concurrently with PAUSE. Any request for a pause is reset by a sync request.

The ignore fail mode may not be used with SYNC ON ADDR or SYNC ON COUNT. The SET/FAIL statement is ignored if either sync request is on. Also a request to datalog additional functional failures is not honored if either a ADDR or COUNT request is on.

If ADDR is specified, failures prior to the local-memory-address are ignored. If COUNT is specified, failures prior to the test-sequence count are ignored.

The CLEAR command also resets all sync requests.

Error Messages:

Message	Description
DUPL./MISSING PARM.	ON and OFF are both specified or neither is specified, or ON is specified and n is missing.
INVALID NUMB.	The number entered is not in the valid range for the type of SYNC specified.

3.4.8.13 TOPSY

Format:

/.TOPSY

Description:

The manual analysis mode is reset, and return is made to the TOPSY mode. The TOPSY colon (:) prompting character is output. Analysis requested options for PAUSE, ALTER, DISPLAY ON, etc. are still set and occurs regardless of the mode until a CLEAR command.

3.4.8.14 WRITE

Format:

```
/.WRITE   register-name          data (ON)
/.WRITE   functional-register (RANK n) data* (ON)
/.WRITE  engineering-register (RNG0/RNG1/RNG2/RNG3/RNG4)
                                 data (ON)
/. WRITE  PPA (PINn) data (ON)
/. WRITE  SPSL(SYM data/+data)  (ON)
/.WRITE   [PW/PD/PWV/PDV]   (n) (RNG1/RNG1/RNG2/RNG3) data
(ON)
/.WRITE     DCT  (G) (STRB)/(RNG0/RNG1/RNG2/RNG3/RNG4) data
(ON)
/. WRITE    PPS (V) (RNG0/RNG1/RNG2/RNG3/RNG4) data (ON) /.
WRITE   [DPT1/DPT2/DPT3]  (I) (G) (RNG2/RNG3) data (ON) /.
WRITEPAI(V)
```

Description:

This command allows any tester register to be written by the operator. The data must be entered in the format required by the register type, either octal, binary, functional, decimal, two octal, or engineering format.

The ON option causes the register to be written at the next station pause (before multiplexing). Otherwise the register is written immediately.

Refer to the Register List (Table 3-) for a complete list of the register names, formats and their identifiers to be used when writing from analysis. 'R/W' indicates that at least some of the bit may be written. 'R' indicates that all the bits are read only so the register may not be written. For a complete description of each register and its bits, usage, ranges, etc. refer to the Sentry Systems Register Formats Manual.

Options are provided for registers with special features, such as mode bits. If the option is a number, the data to be written follow the number i.e., the data must be the only value or else the last value on the command. This restriction does not apply to 'RNGn' type options which are treated like identifiers rather than numbers. All other options are free format.

For functional registers the functional data is written to RANK 1 unless RANK n is specified. RANK n must precede the data. The data is binary (up to 15 bits) and is left justified (i.e., pin 1 or bit 0 of the register is left most) which is the same as the data is presented in FACTOR SET statements. Binary data must be immediately followed by an asterisk to flag it as binary. Only one rank may be entered at a time. For writing the F register the rank load mode is turned on so that only one rank is written. To write data to a specific address in local memory the MCS register must first be written with the address in a separate write command. The write to the F register increments the MCS register. The user must return the MCS register to the contents required by the test program, if the value is changed from what the program needs. (The MCS register is a write-only register). To write F data to an address above 1K in a 2K size local memory, bit 2 of SAMB must be set. Writing 71B to SAMD in a 4K size local memory allows writing local memory from 1 to 4K. Setting bit 2 of SAMB allows writing

local memory from 1 to 2K. If writing the F register during a test at a pause these bits are correctly set for the size specified by the SET PAGE statement. If changed during a test the user should restore them because they control the wrap-around feature of local memory. At EOT the SET PAGE selection is reset so to write above 1K the user must write either SAMB or SAMD as required.

To write rank 8 of local memory with an SPM instruction, write the MCS register with the local memory address and then write the LMI register with the 19 bit binary pattern. (Only 15 bits may be written if WRITE F is used.) Bit 18 is required as part of the function code.

The engineering format registers except TD and SPSL may have e the range specified. If the range is not specified, the registers TR, PW, PD, PWV, PDV default to range 0. The remainder default to range 3. The user must verify that the value entered is within the specified or default range for the mode selected.

To write the power pin address register (PPA), a pin number may be supplied with PIN n to address the specific pin register. If it is not, the PPA register is addressed directly. PIN n must precede the data.

Writing to the pulse generator register (PW/PD/PWV/PDV) requires the input of the generator number for engineering unit data. With no generator specified the data must be in binary (i.e., for generator address, range and value). The generator number must precede the data.

To write the strobe bit (bit 14) of the DCT register, STRB may be specified. This also causes a write lockout of bits 0-13. The 'G' option for the DCT register selects the 'greater than' mode, otherwise the mode is 'less than'.

To set the PPS register into the voltage force/current sense mode, the 'V' option is entered. This causes bit 13 of the PPS register to be set high. Otherwise the mode is current force/voltage sense.

To set the DPT registers into the current force/voltage sense mode, the 'I' option is entered. This causes bit 14 of the DPT register to be set high. Otherwise the mode is voltage force/current sense. The 'G' option for the DPT registers selects the 'greater than' mode, otherwise the mode is 'less than.'

To write a pin number to the PA register the pin number only should be entered. Bit 14 is off, allowing bits 0-7 to be written. To alter bit 8, the realy bit, bit 14 must be set. This is done by entering the option 'I'. If 'I' is entered any data is ignored and bits 8-13 are written. To enable the voltage conditioner relay, enter 'V'. This sets bit 8 on. Otherewise entering 'I' without 'V' causes the PMU not to be connected to the driver, i.e., the disable relay condition.

In general, for any register, entering the 'I' or 'STRB' option causes bit 14 to be set and entering 'G' or 'V' sets bit 13 except in the case of the PA register where 'G' or 'V' sets on bit 8.

Write Formats:

Type	Description	Example
octal format	1 to 8 digits followed by B	261B
binary format	1 to 16 bits followed by *, bit 0 is rightmost bit.	100111*
functional format	1 to 15 bits followed by *, pin 1 is leftmost bit	100111*
decimal format	0 to 8388607	29
2 octal format	two 3 digit octal numbers	351B 331B
engineering format	1 to 4 digits plus power of ten	6.3E-3

TABLE 3-8 REGISTER LIST

ID	Special Input	Name	RD/WR	Format
MAR		Memory Address	R/W	Octal
INC		Instruction Number Compare	R/W	Octal
IND		Instruction Number Display	R/W	Octal
MAD		Write: Test Start Addr	W	Octal
		Read: Test Stop Addr	R	Octal
M		Minor Loop Count	R/W	Octal
N		Major Loop Count	R/W	Octal
MCS		Local Memory Main Frame Access	W	Octal
J		Minor Loop Start Address	R/W	Octal
K		Minor Loop End Address	R/W	Octal
L		Major Loop End Address	R/W	Octal
IF		Ignore Fail	R/W	Octal
MODE		Mode	R/W	Binary
SR		Status	R/W	Binary
IR		Instruction	R/W	Binary
TSC		Test Station Control	R/W	Binary
EIR		External Interface	R/W	Binary
STSC		Mux Slave Test Station Control	R/W	Binary
CH		Chaining	R/W	Binary
SAMA		Status and Mode (A)	R/W	Binary
SAMB		Status and Mode (B)	R/W	Binary
SAMC		Status and Mode (C)	R/W	Binary
SAMD		Status and Mode (D)	W	Binary
LRAX		Long Register Address Extend	R/W	Binary
PPA	PIN n	Power Pin Address	R/W	Binary
RZ	(RANK n)	Return to Zero	W	Functional
ST	(RANK n)	Strobe Select	R/W	Functional
DA	(RANK n)	I/O Pin Definition (A)	R/W	Functional
DB	(RANK n)	I/O Pin Definition (B)	R/W	Functional
MA	(RANK n)	Mask (A)	R/W	Functional
MB	(RANK n)	Mask (B)	R/W	Functional
F	(RANK n) (n)	Functional Test Pattern	R/W	Functional
S	(RANK n)	Data/Clock RVS Select	R/W	Functional
TG1	(RANK n)	Timing Generator Pin Address #1	R/W	Functional
TG2	(RANK n)	Timing Generator Pin Address #2	R/W	Functional
TG3	(RANK n)	Timing Generator Pin Address #3	R/W	Functional
C	(RANK n)	Read: Functional Compare	R	Functional
		Write: Invert Register	W	Functional
R	(RANK n)	Utility Relay	R/W	Functional
XOR	(RANK n)	Exclusive OR	W	Functional

TABLE 3-8 REGISTER LIST
(Continued)

ID	Special Input	Name	RD/WR	Format
PA	(I)(V)	PMU Pin Address	R/W	Decimal
TD		Time Delay	R/W	Engineering
SPSL	(SYM)	Special Precision Sense Level (Clamp)	R/W	Engineering
DPS1	(RNGn)	Digitally Programmed Power Supply #1	R/W	Engineering
DPS2	(RNGn)	Digitally Programmed Power Supply #2	R/W	Engineering
DPS3	(RNGn)	Digitally Programmed Power Supply #3	R/W	Engineering
E1	(RNGn)	Reference Voltage Supply	R/W	Engineering
E0	(RNGn)	Reference Voltage Supply	R/W	Engineering
S1	(RNGn)	Reference Voltage Supply	R/W	Engineering
S0	(RNGn)	Reference Voltage Supply	R/W	Engineering
EA1	(RNGn)	Reference Voltage Supply	R/W	Engineering
EA0	(RNGn)	Reference Voltage Supply	R/W	Engineering
EB1	(RNGn)	Reference Voltage Supply	R/W	Engineering
EB0	(RNGn)	Reference Voltage Supply	R/W	Engineering
EC1	(RNGn)	Reference Voltage Supply	R/W	Engineering
EC0	(RNGn)	Reference Voltage Supply	R/W	Engineering
SA1	(RNGn)	Reference Voltage Supply	R/W	Engineering
SA0	(RNGn)	Reference Voltage Supply	R/W	Engineering
TR	(RNGn)	Test Rate	R/W	Engineering
PPS	(V)(RNGn)	Precision Power Select	R/W	Engineering
PSL	(RNGn)	Precision Sense Level	R/W	Engineering
PW	n (RNGn)	Timing Generator Pulse Width	R/W	Engineering
PD	n (RNGn)	Timing Generator Pulse Delay	R/W	Engineering
PWV	n (RNGn)	Timing Generator Width Vernier	R	Engineering
PDV	n (RNGn)	Timing Generator Delay Vernier	R	Engineering
DCT	(G)(STRB) (RNGn)	PMU Hardware Compare	R/W	Engineering
DPT1	(I)(G)(RNGn)	DPS Trip #1	R/W	Engineering
DPT2	(I)(G)(RNGn)	DPS Trip #2	R/W	Engineering
DPT3	(I)(G)(RNGn)	DPS Trip #3	R/W	Engineering

TABLE 3-8 REGISTER LIST
(continued)

SPM Register List				
ID	Special Input	Name	RD/WR	Format
SA		Start Address	R	Octal
RA		Return Address	R	Octal
FC		Clock Burst	R	Octal
LCS		Loop Count Stack	R	Octal
LC		Loop Count	R	Octal
STAM		Stack Address	R/W	Octal
IF2		Ignore Fail #2	R/W	Octal
QL		Sequential Length	R/W	Octal
Q		Sequential Pattern	R/W	Binary
LMI		Local Memory Instruction (RANK 8)	R/W	Binary

PPM Register List				
ID	Special Input	Name	RD/WR	Format
SD		Shift Data	W	Octal
CRA		Control RAM Address	R	Octal
RFC		Refresh Count	W	Octal
DR1		Data Readout #1	R	Binary
DR2		Data Readout #2	R	Binary
CD1		Control Ram #1	R/W	Binary
CD2		Control Ram #2	R/W	Binary
CA		Control Ram	R/W	Binary
DRAM		Data Ram	R/W	Binary
CSMD		Chip Select and Address Mask	W	Binary
TOPO		Topological Scrambler	R/W	2 Octal
HLD1		Hold Register #1	W	2 Octal
HLD2		Hold Register #2	W	2 Octal
HLD3		Hold Register #3	W	2 Octal
IR1		Index Register #1	R	2 Octal
IR2		Index Register #2	R	2 Octal
IR3		Index Register #3	R	2 Octal
MAX		Maximum	W	2 Octal
CMP		Compare Address	R	2 Octal
DEL1		Delta #1	W	2 Octal
DEL2		Delta #2	W	2 Octal
DEL3		Delta #3	W	2 Octal
SSA		Stop Address and Storage Address	R/W	2 Octal

Error Messages:

Message	Description
INVALID NUMB.	The pulse width or pulse delay generator number is not between 1 and 8. The rank number (RANK entered) is not between 1 and 16. The pin number (PIN entered) is not between 1 and 160.
DUPL./MISSING PARM.	PIN or RANK is specified without a number.

Examples:

User Command	Description
/. WRITE IND 463B	The IND is set to 463B.
/. WRITE EIR 10111*	Bits 0, 1, 2, and 4 of the EIR are set on. The rest are zero.
/. WRITE MCS 231B /. WRITE F RANK 2 11001*	The MCS register is written with the address 231B. Rank 2, pins 1 thru 5 contain 11001 and the rest of rank 2 is zero. The remaining ranks are not changed. The MCS register increments to location 232B following the write of the F register.
/. WRITE MCS 231B /. WRITE LMI 1000101111111111010*	The MCS register is written with the address 231B. Rank 8 of that local memory location is then written with the data specified. In this case bits 12, 13, 14 and 18 indicate the instruction SET FC MATCH. Bits 0-11 contain the one's complement of to indicate a count of.
/. WRITE PA 5	The PA register is set to 5, i.e., the PMU is connected to Pin 5.
/. WRITE PA I V	Connect the voltage conditioner relay.
/. WRITE PA I	Disconnect the voltage conditioner relay.
/. WRITE TD 7.35E-3	The TD register is set to 7.35 ms.
/. WRITE DCT 5.63 RNG2 G	The DCT register is set to the limit: greater than 5.63. This is a value within range 2 for voltage sense. The PPS register must be in current force mode.
/. WRITE DPT2 364E-3	The DPT2 register is set to the trip: less than 364E-3. Less than is used because G was not entered. Range 3 is used by default. Voltage force mode is set by default.
/. WRITE PPS 633E-3 V RNG1	The PPS register is set in the voltage force mode at 633E-3.
/. WRITE PPA PIN 5 10100000000*	Pin 5 is connected to DPS1. The 101 in bits 8 to 10 indicate DPS1 to the PPA register.
/. WRITE SPSL + 1.5	Set the clamp at POS 1.5 volts.

/. WRITE TOPO 351B 331B

The PPO register topological scrambler is written. The first digit is the Y scramble data and the second digit is the X scramble data. The location within the topological Ram is controlled by the current value in the SSA Register. SSA # is automatically incremented by each Read or Write at TOPO.

SECTION 4

EQUIPMENT CONTROLS, INDICATORS & PRIMARY OPERATING PROCEDURES

This section describes the location, appearance, function and primary use(s) of the SENTRY VII standard and optional equipment, controls and indicators. Primary operating procedures, where applicable, are also described.

4.1 SENTRY VII EQUIPMENT CONFIGURATION

The major equipment groups of a SENTRY VII test system (see Figure 4-1) and the subsections in which they are described are:

	Equipment Group	Subsection
1.	Mainframe	4.2
2.	Standard Peripheral Devices	4.3
3.	Optional Peripheral Devices	4.4
4.	Test Station	4.5

The standard and optional peripheral devices are listed in Table 4-1 and 4-2, respectively.

TABLE 4-1 STANDARD SENTRY VII PERIPHERALS

Item	Model No.	Vendor Ident.
Card Reader	8426-10	True Data 300
Magnetic Tape	8420/8421-10	Kennedy 9000
Disc Memory	8410-10	Alpha Data AD9370
Video Keyboard Terminal	8422-00	Hazeltine 2000

TABLE 4-2 OPTIONAL SENTRY VII PERIPHERALS

Item	Model No.	Vendor Ident.
Medium-Speed Line Printer	8427-10	Printronix 300
Magnetic Tape Drive	8421-10	Kennedy 9000

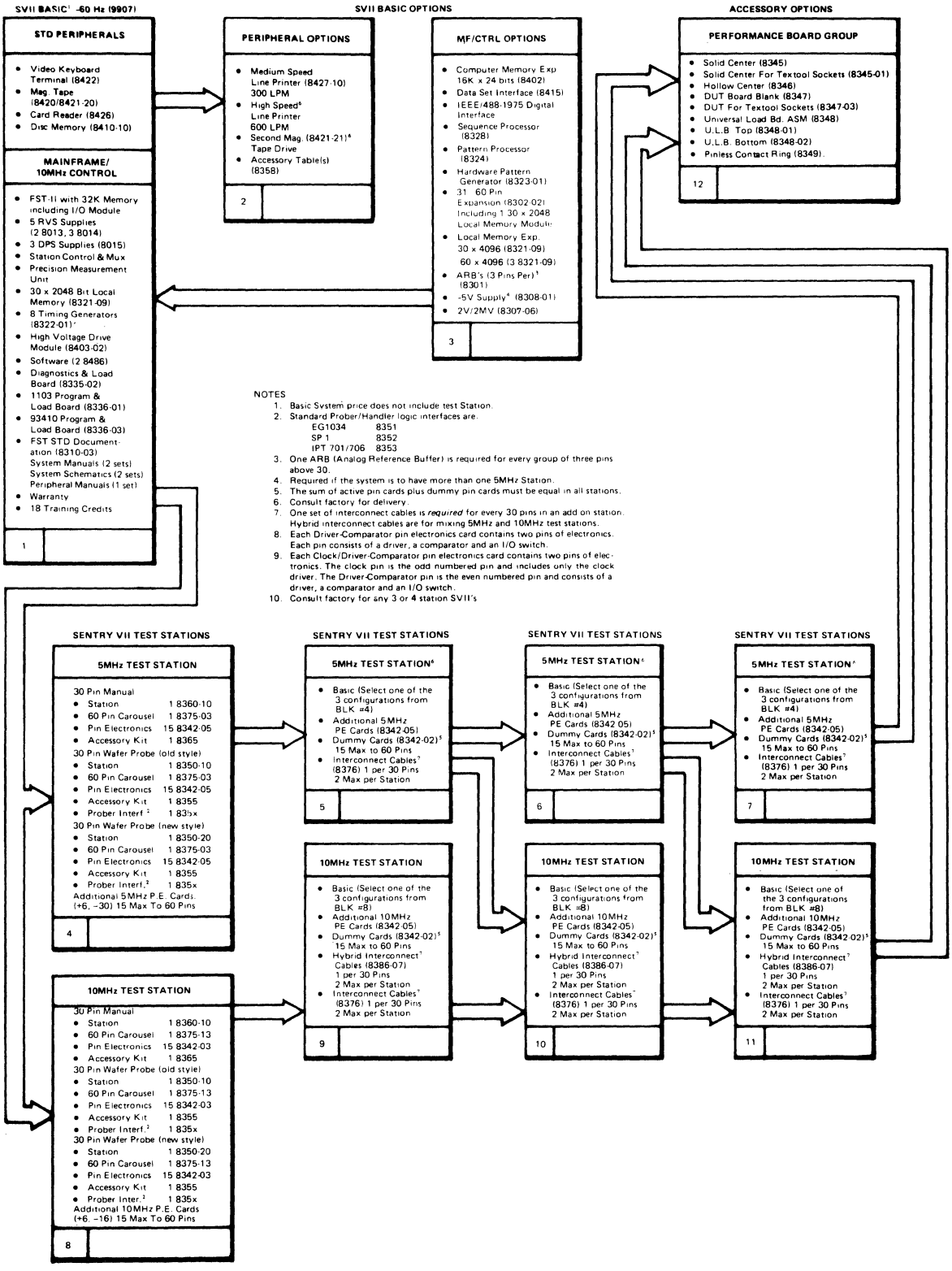


Figure 4-1 SENTRY VII Test System Equipment

4.2 MAINFRAME

The mainframe controls and indicators are located on:

1. a power distribution panel,
2. an operator control panel,
3. a maintenance control panel.

The mainframe control panels and a system power up/down procedure are described in this subsection.

4.2.1 Power Distribution Panel

The controls and indicators used to control and monitor the primary AC power inputs to:

1. the mainframe,
2. standard and optional peripheral devices,
3. mainframe DC power supplies,

are illustrated in Figure 4-2 and described in Tabe 4-3.

TABLE 4-3 POWER DISTRIBUTION CONTROLS AND INDICATORS

Fig. 4-2 Item	Controls Indicators	Functions
1	ELAPSED TIME METER	Six-digit readout of equipment power-on time.
2	DC POWER ALARM	Audible alarm that sounds when a DC failure or a percentage variation occurs within the bay.
3	STATION POWER Ganged circuit breakers	Three ganged circuit breakers, one per phase, used to switch primary power input at J14 to the bay.
4	PERIPHERALS Ganged Circuit Breakers	Three ganged circuit breakers, one per phase, used to switch primary power input at J13 for peripherals.
5	Circuit Breakers	Individual circuit breakers for the four separate power supplies. Must be in ON position for operation of the SENTRY II.

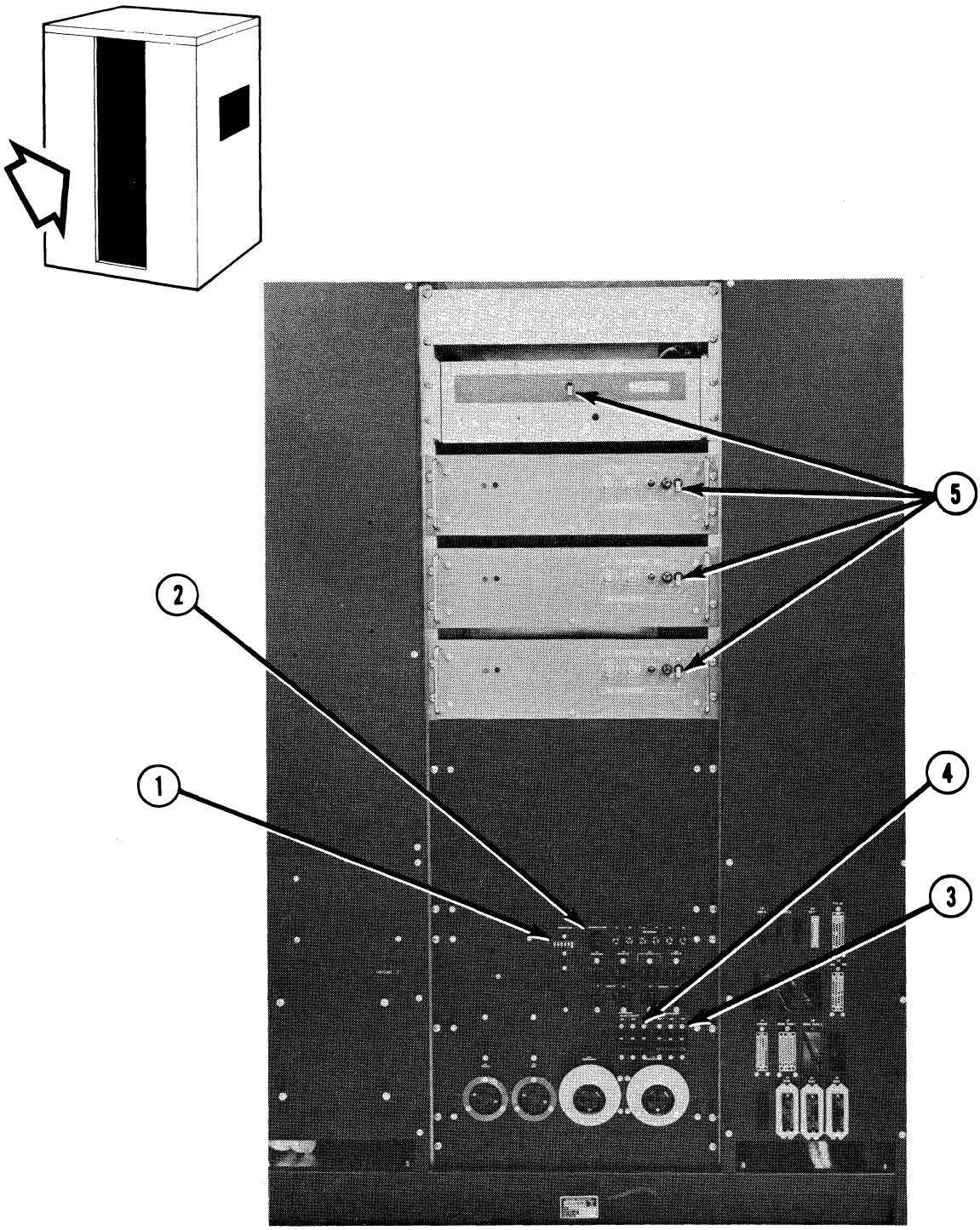


Figure 4-2 Mainframe Power Distribution Controls and Indicators

4.2.2 Operator Control Panel

An operator control panel located on the front of the mainframe enclosure permits the user to:

1. Power up/down memory, the FST-2 Computer, and system I/O modules.
2. Load the system bootstrap loader program from either the magnetic tape unit or the card reader.
3. Initialize, stop, and restart program executions.

The operator control panel controls and indicators are illustrated in Figure 4-3 and described in Table 4-4.

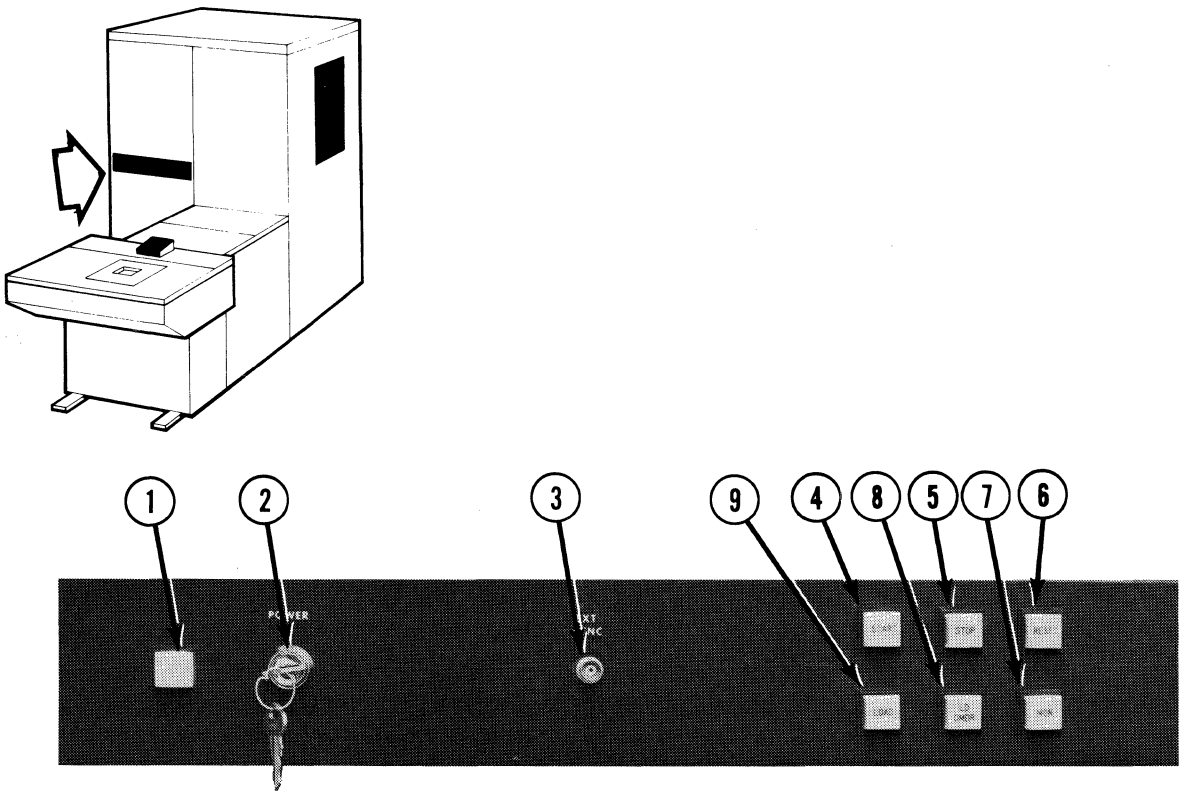


Figure 4-3 Mainframe, Operator Control Panel

TABLE 4-4 OPERATOR CONTROL PANEL, CONTROLS & INDICATORS

Fig. 4-3 Item	Controls Indicators	Functions
1	SYS PWR Pushbutton Switch/ Indicator	Pressing this momentary pushbutton applies AC power to the memory and to the computer and I/O module power supplies if (1) the power distribution panel circuit breakers are on, and (2) the Station Power Lock Key switch is on (clockwise).
2	POWER Key Switch	When the key is inserted and the switch turned on (clockwise), the SYS PWR pushbutton is enabled.
3	EXT SYNC BNC Connector	External connector provided for equipment syncing on local memory address.
4	START Pushbutton Switch/ Indicator	When pressed, this switch indicator is illuminated and program execution is started at the instruction contained in the C-register and continues with the instruction at the location specified by the program counter unless the C-register contains a branch instruction. The STOP indicator goes out and its stop function is inhibited when START is pressed.
5	STOP Pushbutton Switch/ Indicator	When pressed, this switch is illuminated and stops program execution at the current instruction; the next instruction is the C-register and the address of that instruction plus one is the program counter. The START indicator goes out and program execution is stopped when STOP is pressed.
6	RESET Pushbutton Switch/ Indicator	Halt program executing using the STOP pushbutton before using this pushbutton. When pressed, this switch is illuminated and clears the program counter to count 100B to prepare for an instruction fetch when execution resumes.
7	MON Pushbutton Switch/ Indicator	This switch is used for Sentry II maintenance purposes only. When MON button is activated, TOPSY enters the monitor mode, all output to VKT is suppressed and the MON switch is illuminated.

TABLE 4-4 OPERATOR CONTROL PANEL, CONTROLS & INDICATORS
(continued)

Fig. 4-4 Item	Controls Indicators	Functions
8	LD CMDR Pushbutton Switch/ Indicator	When pressed, this switch is illuminated and the C-register is loaded with the bit configuration held in the computer maintenance panel switch register as selected by the switch settings on the maintenance panel. This switch cannot be used during program execution.
9	LOAD (or LOAD IPL) Pushbutton Switch/ Indicator	When pressed, this switch is illuminated and starts bootstrap loading (initial program loading) from either a magnetic tape unit or card reader. The data thus read is stored in memory commencing at address 100B.

4.2.3 System Power Up/Down Procedure

Power up and power down procedures for the system are provided in the following subparagraphs. The power down procedure is written such that, when performed, it allows the use of a simplified power up procedure for subsequent powering up.

NOTE

Refer to Figures 4-2 and 4-3 for the location of the controls and indicators specified in the power up and power down procedures.

4.2.3.1 POWER UP PROCEDURE

CAUTION

To prevent damage to the peripherals and unnecessary current surge, place all peripheral equipment power switches in the OFF position before performing this procedure.

1. Ensure that all system components are connected to the proper AC line power source and that all external circuit breakers are ON.
2. Ensure that all internal maintenance power supply switches are ON.
3. Set both ganged circuit breakers STATION POWER and PERIPHERALS on the power distribution panel to ON.
4. Turn the operator control panel Station Power Lock Key switch ON (clockwise).
5. Press the operator control panel SYS PWR pushbutton.

NOTE

If the mainframe primary AC power input fails for a period of more than 8 milliseconds, power is automatically turned OFF. To restore power, repeat the above power up procedure. If a power failure occurs in the mainframe, an audible alarm is activated.

6. Ensure that all peripherals are connected to the proper AC power line source and turn on power to the peripherals.

4.3.3.2 SYSTEM POWER DOWN PROCEDURE

1. Power down all peripheral equipment (refer to applicable procedure given in this section).
2. At operator control panel, turn station POWER lock key OFF (completely counterclockwise).

NOTE

The above steps remove all DC power from the system, but allow the AC circuit breakers to remain ON. A subsequent power up is accomplished by performing only steps 4, 5 and 6 of the procedure given in paragraph 4.2.3.1. To remove the power, proceed to step 3 below.

3. Prior to removing all primary power from bay, power down the card reader and disc memory

4. Set ganged circuit breakers STATION POWER and PERIPHERALS on the mainframe power distribution panel to OFF.

5. Disconnect all plugs and connectors at the power distribution panel.

4.2.4 Maintenance Panel

A maintenance panel containing controls and indicators for the monitoring and manual control of FST-2 computer operations is located on the mainframe and accessed via a cover panel (see Figure 4-4). The maintenance panel is intended, primarily, for use by maintenance personnel; and enables the user to:

1. Manually select and display the contents of the FST-2 registers.

2. Manually enter data into the FST-2 registers.

3. Control program execution.

4. Control the loading of data from a selected peripheral device.

The maintenace panel controls and indicators are shown in Figure 4-4 and are described in Table 4-5.

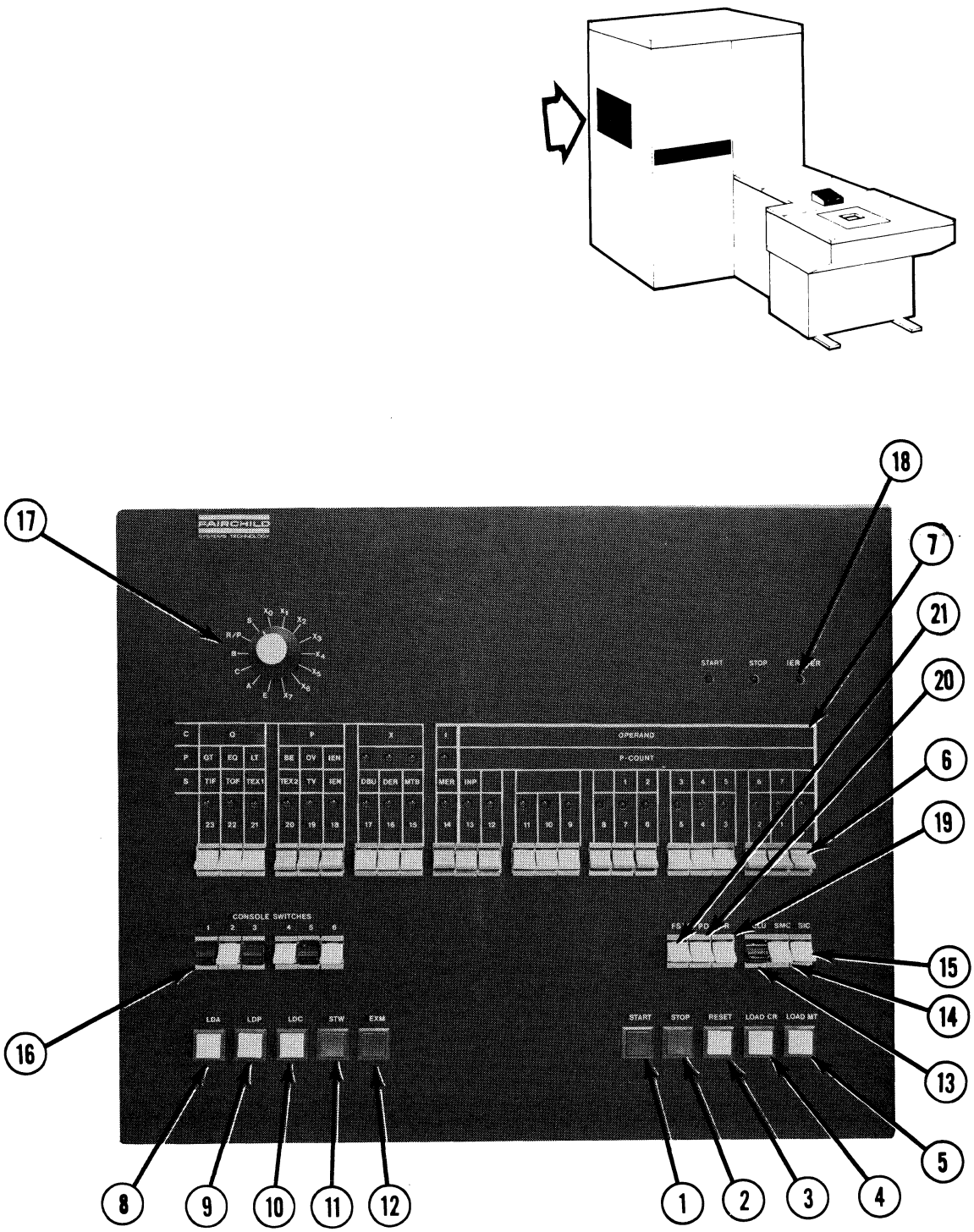


Figure 4-4 Mainframe, FST-2 Computer Maintenance Panel

TABLE 4-5
MAINTENANCE CONTROL PANEL, CONTROLS AND INDICATORS

Fig. 4-5 Item	Controls/ Indicators	Functions
1	START Pushbutton/ Indicator	Causes the CPU to start executing program instructions, beginning with the instruction currently held in the command register and turns on the START indicator. While the START indicator is ON, all CPU control switches are disabled except STOP, SIC, and SMC. If SMC (single memory cycle) or SIC (single instruction cycle) are in the up position, execution is limited to single operations as selected.
2	STOP Pushbutton/ Indicator	Halts program processing at the termination of the instruction currently being executed, turns OFF the START indicator, and turns ON the STOP indicator. While the STOP indicator is ON, all console control switches are enabled.
3	RESET Pushbutton	Resets the program counter 000000B, and clears any interrupts which may be in process.
4	LOAD CR Pushbutton	Causes the card reader to read a single card (in binary read mode). The binary data on the card is loaded into 40B consecutive memory locations beginning with address 00100B.
5	LOAD MT Pushbutton Switch	Loads one record of the magnetic tape DOPSY bootstrap program into 4000 consecutive memory locations beginning with address 00100B.
6	Switch Register Switch (0 thru 23)	These 24 switches allow manual entry of a 24-bit word. The contents of the Switch Register are loaded into the program counter by the LDP switch, into the command register by the LDC control, into the A-register by the LDA switch, or by executing an RSR instruction.
7	Register Displays (0 thru 23)	Displays contents of the respective operating register as selected by the Register Display Selector Rotary switch.

TABLE 4-5 MAINTENANCE CONTROL PANEL, CONTROLS AND INDICATORS
(continued)

Fig. 4-5 Item	Controls/ Indicators	Functions
8	LDA Switch	Loads the contents of the switch register into the A-register. The SIC or SMC switch must also be ON (up) when attempting this operation.
9	LDP Switch	Loads the contents of the switch register into the P-counter. The SIC or SMC switch must also be ON (up) when attempting this operation.
10	LDC Switch	When pressed, this switch loads the contents of the switch register into the command register.
11	STW Switch	Loads the contents of the switch register into the buffer register and the memory location specified by the current content of the program counter. When the store operation is completed, the program counter is incremented by one. Thus, information in sequential memory addresses may be stored by repeated operation of the STW switch. The SIC or SMC switch must also be ON (up) when attempting this operation.
12	EXAM Switch	Loads the contents of the memory location specified by the current contents of the program counter into the buffer register. When the examine operation is completed, the program counter is incremented by one. Thus, the contents of sequential memory addresses may be examined by repeated depression of EXAM switch. The SIC or SMC switch must also be ON (up) when attempting this operation.
13	CLU (command lock-up) Switch	Locks the current command in the command register. The effective memory address is formed by joining bit 0 from the command register with bits 1 thru 17 from the program counter. The P-counter advances by one after each execution of the command. This switch, when used with the SIC switch and START button, affords an alternate means to load manually or to examine consecutive memory locations, one at a time, with either the STA or LDA instruction, respectively, in the command register. It may be used also to clear memory by loading a STA instruction in the command register, zero in the A-register, and then pressing START.

TABLE 4-5
MAINTENANCE CONTROL PANEL, CONTROLS AND INDICATORS
(continued)

Fig. 4-5 Item	Controls/ Indicators	Functions
14	SMC Switch	Halts the CPU at the end of the current memory-cycle of operation. Repeated depression of the START button steps the program one memory-cycle at a time so the contents of the various register displays and indicators may be examined.
15	SIC Switch	Halts the CPU at the end of the last memory-cycle of the program instruction being executed. Repeated depression of the START button steps the program one instruction at a time.
16	CONSOLE SWITCHES (1-6)	The six CONSOLE SWITCHES allow manual control of the execution sequence of any program that contains appropriate Branch on State (BOS) instructions. The state of each switch may be individually tested with a BOS instruction. The switches have particular significance during diagnostic procedures and their use is explained fully in the diagnostics manual.
17	Reg. Display Sel. Rotary Switch	Refer to Positions and Functions listed below.

Position	Function
E(E-Register)	Selects and displays the contents of the 24-bit extension register on the register display indicators. This register is an extension of the accumulator register and is used with double-precision arithmetic instructions such as DADD, DSUB, MUL, and DIV.
A(A-Register)	Selects and displays the contents of the 24-bit accumulator register on the register display indicators. The accumulator is the main arithmetic register for such operations as ADD, SUB, MUL, and DIV, as well as the logical operations of AND and OR. It also serves as the input/output register for the transfer of data under program control.

TABLE 4-5
MAINTENANCE CONTROL PANEL, CONTROLS AND INDICATORS
(continued)

Position	Function
C(C-Register)	Selects and displays the contents of the 24-bit command register on the register display indicators. In the idle state, the command register stores the next instruction word.
B(B-Register)	Selects and displays the contents of the 24-bit buffer register on the register display indicators. All information written into or read out of memory from the CPU during the execute phase is temporarily held in the buffer register. This information can thus be monitored by the operator using the STW and EXAM switches while the SIC (single instruction cycle) or the SMC (single memory cycle) switch is on.
R/P(P-Register)/(RR-Register)	Selects and displays the contents of the 18 bit program counter or relocation register on the register display indicator (bits 0-17). In the STOP state, the program counter holds the memory address of the next instruction word that will be loaded into the command-register, if the current instruction is not a branch instruction. See also the RR switch.
S (Control States)	Selects and displays the contents of 8 control states and programmable flip-flops. The contents of the 8 flip-flops (1 2 3 4 5 6 7 8) are displayed by bits 0 thru 7. Each of the eight bits indicates the state of its corresponding flip-flop. The state of a programmable flip-flop may be used to automatically control the execution sequence of any program that contains appropriate BOS instructions. An ON indicator indicates its corresponding programmable flip-flop has been set to the "1" state by a SST instruction. Each flip-flop can be reset to the "0" state, turning its indicator OFF, with a RST instruction. The state of each programmable flip-flop may be individually tested with a BOS instruction.
X0 thru X7 Registers	Selects and displays the contents of the appropriate 18 bit index register.

TABLE 4-5
MAINTENANCE CONTROL PANEL, CONTROLS AND INDICATORS
(continued)

Placarding	Function
TIF	When executing any instruction, the TIF (time-of-instruction-fetch) flip-flop will be set, turning ON the TIF indicator, while the CPU is in the instruction-fetch cycle.
TOF	When executing any memory-reference instruction, the TOF (time-of-operand-fetch) flip-flop is set, turning ON the TOF indicator, while the CPU is in the operand-fetch cycle.
TEX 1	The TEX 1 (time-of-execution, phase 1) flip-flop is set, turning ON the TEX 1 indicator for at least one memory-cycle time while executing any instruction that requires two or more memory-cycle times.
TEX 2	The TEX 2 (time-of-execution, phase 2) flip-flop is set, turning ON the TEX 2 indicator, for one memory-cycle time while executing and of the insturctions AOM, SOM, MUL, or DIV.
TV	The TV (timing-for-variable-length-shift) flip-flop will be set turning ON the TV indicator while any shift instruction with a non zero shift count is being executed.
Position	
IEN Interrupt Enable	The interrupt-enable flip-flop is set and the IEN indicator goes ON as the result of executing an IEN instruction. The flip-flop may be reset, turning OFF the indicator, by executing an IDA instruction, by executing a priority interrupt, or by pressing the RESET pushbutton.
DBU	The disc-busy flip-flop is set, turning ON the DBU indicator when the disc is performing an operation such as read, write, or parity check. The flip-flop is reset, turning the indicator off, when the operation is completed.
DER	When ON, indicates that a disc parity-check error has been detected.

TABLE 4-5
MAINTENANCE CONTROL PANEL, CONTROLS AND INDICATORS
(Continued)

Position	Function
MTB	When ON, indicates that the magnetic tape unit is busy.
MER	When ON, indicates that a magnetic tape read or write error has been detected.
INP	The input-pending flip-flop is set, turning ON the INP indicator, by an ION instruction for the VKT. This indicator is a visual indicator only to the operator that the program is expecting data from that input device. The flip-flop is reset, turning the indicator OFF, by an IOFF instruction for the VKT, or by depressing the RESET switch. The state of the flip-flop cannot be tested; hence, it cannot control the program-execution sequence. (This function is disabled in FST-2).
Status Register Flip-Flop Indicators (bits 19-23)	Each of the five lamps indicates the state of its associated status-register flip-flop. The mnemonic definition of each indicator follows:

Mnemonic	Definition
GT	Greater than
EQ	Equal
LT	Less than
BE	Bit equal
OV	Overflow

The indicators GT, EQ, LT, BE, and OV are ON (with the associated flip-flop set) in various configurations after executing one of the instructions CAM, ATX, SPU, or BRU (BRU with indirect bit set). The indicators affected by each instruction are shown below; refer to the detailed description of each instruction to interpret the meaning of each indicator for that specific condition.

Instruction	Used
CAM	GT,EQ,LT,BE
ATX	GT,EQ,LT (ignore BE state)
SPU	GT,EQ,LT,BE
BRU	GT,EQ,LT,BE,OV

TABLE 4-5
MAINTENANCE CONTROL PANEL, CONTROLS AND INDICATORS
(Continued)

Position	Function
OV	The overflow flip-flop will be set and the OV indicator will go ON, in addition to a BRU instruction, by one of the following conditions: if the accumulator overflows as the result of executing an ADD,SUB,DADD,DSUB, or DTC instruction. The overflow flip-flop can be reset, turning OFF the OV indicator by executing the appropriate RST instruction or by depressing RESET.
P-COUNT	Defines P-Register or RR-Register contents for rotary switch position R/P.
OPERAND (memory address field)	Defines the instruction word memory address field.
O P X I OPERAND	Defines command register fields: operation code (O P), index (X), indirect (I), and operand (OPERAND) fields.
(placards) C P S	Identifies placards which apply when register selector switch is set for command register (C), program counter (P), and status (S), respectively.

Fig. 4-5 Item	Controls/ Indicators	Function
18	IER/PER IER Indicator PER	Not Used. Memory parity is provided. When a parity error occurs, the CPU halts and the parity indicator will light up.
19	RR (Relocation Register Switch)	This switch is used when the rotary display switch is at position R/P. At this time, the toggle switch when up displays the relocation register. In the down position, the P counter is displayed.
20	PD Switch	This is the parity disable switch. In the up position it disables parity error detection and can not be overriden by software. In the down position, it allows software to enable or disable parity.

TABLE 4-5
MAINTENANCE CONTROL PANEL, CONTROLS AND INDICATORS
(Continued)

Fig. 4-5 Item	Controls/ Indicators	Function
21	FST-2 Switch	This switch selects the operating mode of the computer. Up runs the CPU in the new FST-2 mode. When the switch is down, the CPU runs as a standard FST-1. Note: Throwing the switch has no effect on the mode selection until RESET is pushed. This prevents accidental changes while programs are running.

4.3 STANDARD PERIPHERALS

This subsection describes the location, appearance, functions, and, where applicable, operating procedures for the:

1. Video keyboard terminal (VKT),
2. Magnetic tape unit,
3. Disc memory unit, and
4. Card reader.

4.3.1 Video Keyboard Terminal (VKT)

The VKT is the primary operator/system interface device. The VKT consists of separate keyboard and display units (see Figure 4-5).

The keyboard unit enables the user to:

1. Initialize and interface with system and user software.
2. Select operating parameters.
3. Enter system commands.
4. Build and edit program and user files.
5. Compile and execute user programs.

The display unit provides a visual display of user inputs and outputs and system error messages.

The general characteristics of the VKT include:

Character Set:	63 USACII alphanumeric characters, space and special symbol
Data Transmission Rate:	9600 baud (when used with the Sentry system)
Keyboard:	Solid state with teletype key arrangement.

4.3.1.1 CONTROLS AND INDICATORS

The VKT display unit and keyboard unit controls and indicators are illustrated in Figures 4-6 and 4-7, respectively, and are described in Tables 4-6 and 4-7, respectively.

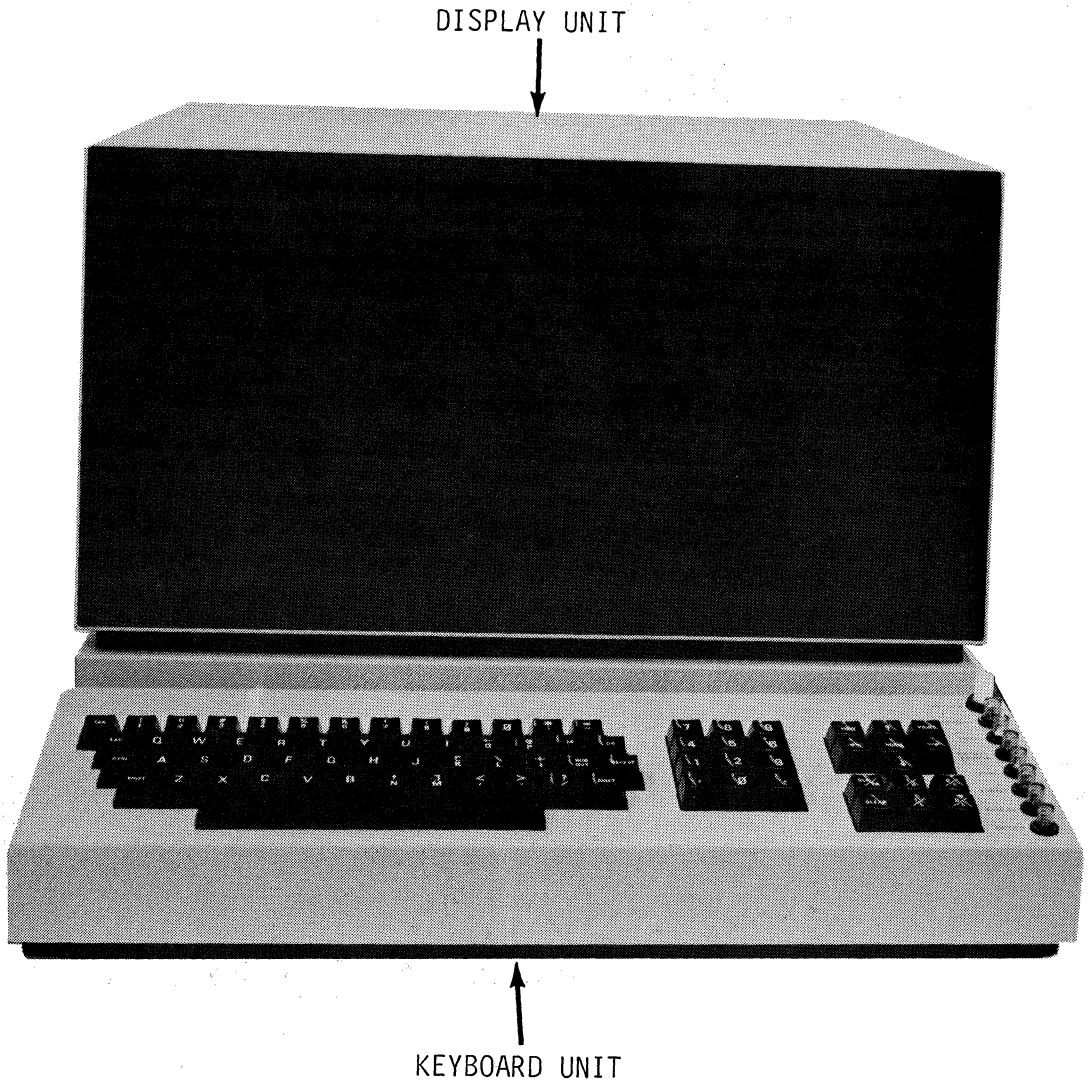


Figure 4–5 Video Keyboard Terminal (VKT).

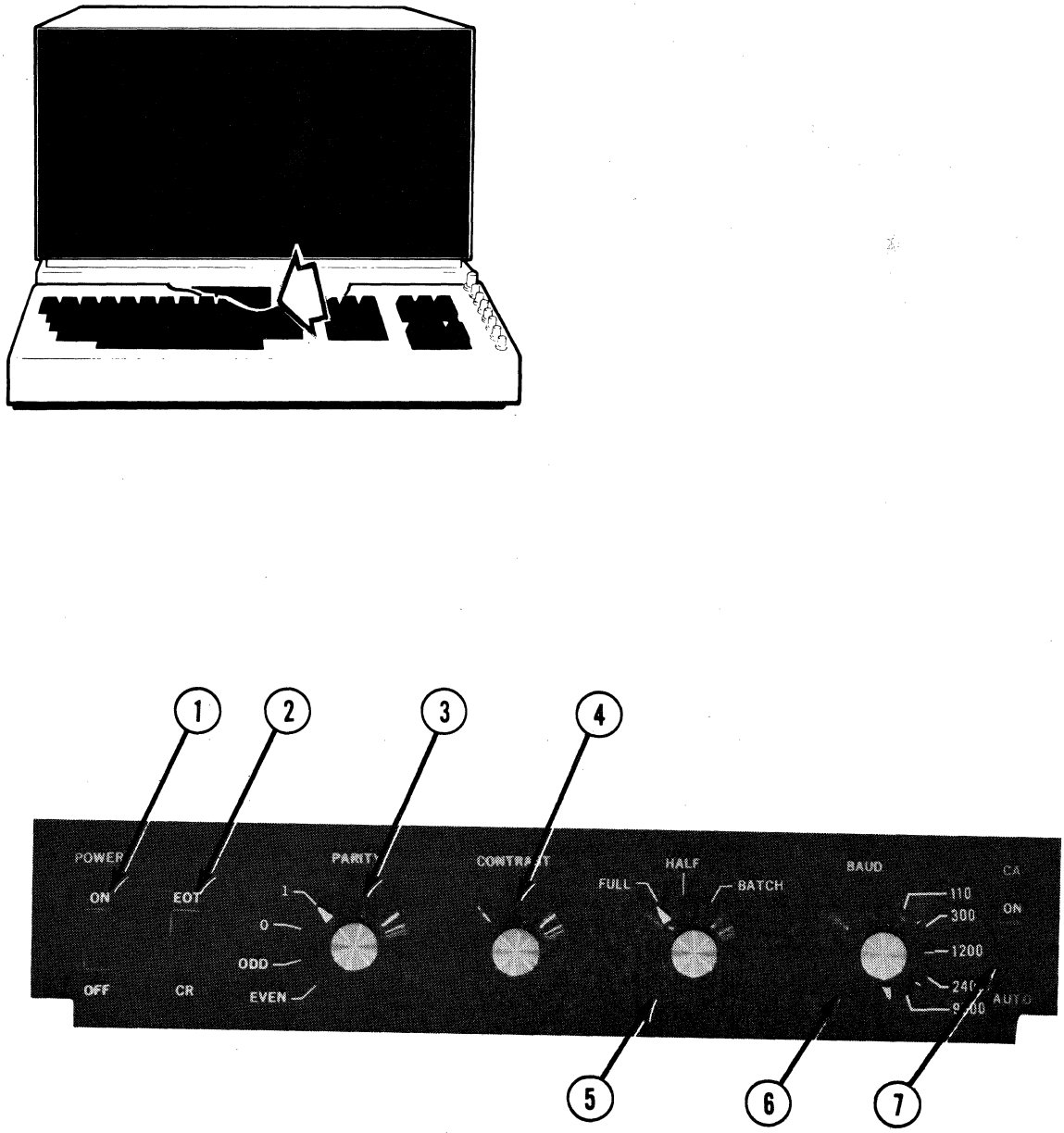


Figure 4-6 Display Unit Control Panel

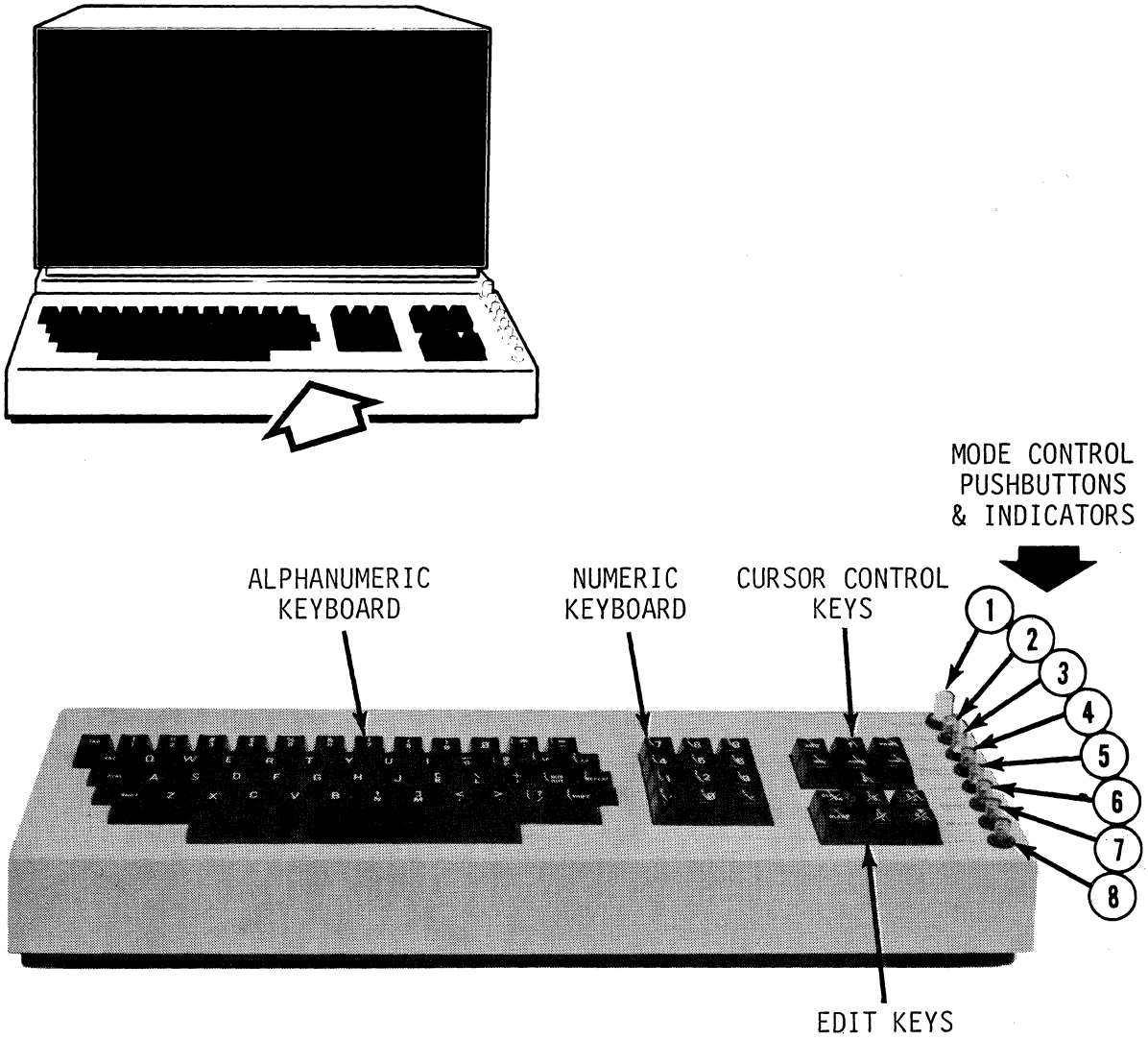


Figure 4-7 VKT Keyboard Unit, Controls and Indicators

TABLE 4-6
VKT DISPLAY UNIT, CONTROLS AND INDICATORS

Fig 4-6 Item	Controls/ Indicators	Functions
1	ON/OFF Toggle Switch	Controls the application of primary AC power to the VKT. When in the OFF position, the keybaord ON/OFF switch has full control. When the ON position, power remains ON and the keyboard ON/OFF switch is inoperative.
2	EOT/CR Toggle Switch	Selects end-of-transmission code (EOT) or carriage return (CR) code to indicate end of message to remote computer. Normally placed in CR position for Sentry II use; carriage return provides an end-of-record signal to the computer.
3	PARITY Switch	Normally set at 1. Parity checking is not used for Sentry VII operation.
4	CONTRAST Control	Adjusts contrast of CRT display.
5	FULL/HALF/ BATCH Switch	Selects mode of operation. Sets at FULL duplex position for normal Sentry VII operation.
6	BAUD Switch	Selects data transfer speed. Set at 9600 for rapid display of information; slower rates (110,300, 1200, 2400, 4800, and 9600 baud) maybe used if desired.
7	CA ON/CA AUTO Toggle Switch	Placed in CA AUTO position for operation at 600 baud or greater.

TABLE 4-7
VKT KEYBOARD UNIT, CONTROLS & INDICATORS

Fig 4-7 Item	Controls/ Indicators	Functions
	ALPHANUMERIC KEYBOARD	Provides the alphabetic, numeric, symbolic and control keys for the entry of up to 128 ASCII character/control codes. Special FACTOR control functions are provided by the keys or key combinations: 1. CTRL & B - Moves cursor back one character position for each entry (backspace). 2. CTRL & L - Coverall characters of the current line to be deleted (delete line). 3. CTRL & CLEAR - Causes all displayed characters to be deleted from the display CRT (clear screen). 4. CR - Input line terminator.
	NUMERIC KEYBOARD	Provides ten numeric entry keys arranged in a typical adding machine configuration.
	CURSOR CONTROL KEYS	Not used for SENTRY VII operations.
	EDIT KEYS	Not used for SENTRY VII operations.
	MODE CONTROL KEYS	
1	ON/OFF Pushbutton/Indicator (White)	Controls power to VKT when video display ON/OFF switch is in OFF position. Pushbutton indicator is illuminated when switch is in ON position.
2	TRANSMIT Indicator (Amber)	Illuminated when transmit mode is initated by XMIT key or by the computer.
3	RECV Pushbutton/ Indicator (Amber)	Illuminated when VKT is able to receive information from computer. Not illuminated in local, print, or transmit modes. Pressing this pushbutton terminates these modes and returns the VKT to the ready mode.

TABLE 4-7
VKT KEYBOARD UNIT, CONTROLS & INDICATORS
(continued)

Fig 4-7 Item	Controls/ Indicators	Functions
4	PARITY ERROR Pushbutton/ Indicator (Amber)	Not used for SENTRY VII operation.
5	LOCAL Pushbutton/ Indicator (Amber)	Not illuminated in print, transmit, or receive modes, the keyboard. Pressing the pushbutton terminates these modes and places VKT in the local mode.
6	PRINT Indicator (Amber)	Illuminated when print mode is initiated by either pressing the PRINT pushbutton or by the computer.
7	BREAK Pushbutton/ Indicator (Amber)	Causes a break signal to be sent to the computer and will cause the computer to stop sending and to prepare to receive data from the VKT. Pushbutton indicator is illuminated when the pushbutton is pressed.
8	RESET Pushbutton/ Indicator (Amber)	Interrupts and resets all internal functions and returns the VKT to ready mode (or to receive mode if characters are being received).

4.3.1.2 VIDEO KEYBOARD TERMINAL POWER UP AND USE

NOTE

A display unit brought in from a significantly colder environment should be allowed to set for at least one hour prior to turn-on.

1. Open the display unit control access panel and place the following switches in the positions indicated:
   a. POWER ON/OFF switch to OFF,
   b. EOT/CR switch to CR,
   c. PARITY switch to 1,
   d. FULL/HALF/BATCH switch to FULL,
   e. BAUD switch to 9600,
   f. CA ON/CA AUTO switch to CA AUTO.
2. Press the keyboard ON/OFF switch/indicator and observe that the keyboard ON/OFF, RECV, and LOCAL indicators are illuminated, indicating that the VKT is in the ready mode and is ready to receive data.

NOTE

If the RECV and LOCAL indicators are not illuminated when the power is turned ON, press the RESET pushbutton. If either or both indicators still are not illuminated, check to see if the cooling fan inside the display unit is in operation. This can be done by either listening for the fan motor or feeling air movement near the grill at the rear of the display. If the fan is not operating, turn the power OFF and check the fuses at the rear of the display.

3. Allow 30 seconds for display warmup. At the end of this period, press the keyboard cursor HOME key. The cursor will appear in the upper left corner of the CRT display. There may be other characters on the screen, depending on whether or not the display memory was cleared before the power switch was last turned OFF.
4. Set the display unit CONTRAST control completely clockwise, and then adjust to obtain the preferred display intensity. The unit is now under software control and may be placed on or off-line via the system. The following 12 display and keyboard functions are software controlled:
   a. Transmit
   b. Address Cursor
   c. Home Cursor
   d. Delete Line
   e. Set Background Intensity
   f. Insert Line

g. Clear Screen

h. Clear Foreground Data

i. Print

j. Set Foreground Intensity

k. Carriage Return

l. Backspace Cursor

When the VKT operates in either the full duplex or the standard transmission mode, data keyed in is sent directly to the computer and is echoed back to CRT. Each line entered must be terminated with a carriage return (CR); any editing or correction that takes place is a function of the software program being executed.

The following status modes, with functions as described, may be used:

1. Ready Mode - Keyboard RECV and LOCAL indicators illuminated. This is the normal state of the unit when awaiting either keyboard inputs or incoming data from the computer system. The unit starts in the ready mode when turned ON and returns to the ready mode at the completion of print, transmit, or receive functions. The operator may interrupt and function to return the unit to the ready mode by depressing either RECV or RESET.

2. Transmit Mode - Keyboard TRANSMIT indicator illuminated. When in the transmit mode, LOCAL and RECEIVE indicators are OFF and the keyboard is electronically disabled to prevent garbling by inadvertent typing. In this mode, the unit cannot receive incoming characters.

3. Receive Mode - Keyboard RECEIVE pushbutton indicator illuminated. This mode is initiated from the ready mode when incoming characters arrive. When not in the receive mode, the keyboard is electronically disabled to prevent garbling.

4. Print Mode - Keyboard PRINT pushbutton/indicator illuminated. This mode is initiated for the purpose of printing the contents of the display memory onto an optional hard copy printer or to a tape. When in the print mode, the keyboard is electronically disabled.

5. Local Mode - Keyboard LOCAL pushbutton/indicator illuminated. The keyboard is electronically unlocked and is in full control of the display with all external communication prevented. Return to the ready mode is accomplished by depressing the RECV or RESET pushbuttons.

4.3.1.3 VIDEO KEYBOARD TERMINAL POWER DOWN PROCEDURE

1. If the VKT is to be used frequently throughout the day, power should be left ON.

2. To power down the VKT, press the keyboard ON/OFF switch.

4.3.2 Magnetic Tape Unit

The standard magnetic tape unit (see Figure 4-8) provides the user with a fast means of loading the system software and of storing and retrieving user programs. An additional magnetic tape unit may be added as an option to a SENTRY VII system. A separate mounting rack or cabinet is required for an optional unit. The general characteristics of the magnetic tape unit include:

Tape Speed	
Normal Read/Write Rewind &	24 inches/second
Fast Forward	150 inches/second
Tape size (Max)	1/2 inch by 1.5 mill by 2,400 feet mounted on a 10 1/2 inch reel (IBM or NAB)
Recording Density (9-track)	800 bits/inch
IBM-Compatible ANSCII Format	
Recording Mode	MRZI

Two control panels are provided on the magnetic tape unit: an operator control panel (see Figure 4-9) to be used by the system operator, and a test panel (see Figure 4-20) to be used by maintenance personnel.

NOTE

The test panel and its controls and indicators are illustrated and described only for informational purposes. This test panel is to be used only by qualified maintenance personnel.

Procedures for mounting and dismounting the magnetic tape reels, and for powering up and powering down the magnetic tape unit are also given in this subsection.

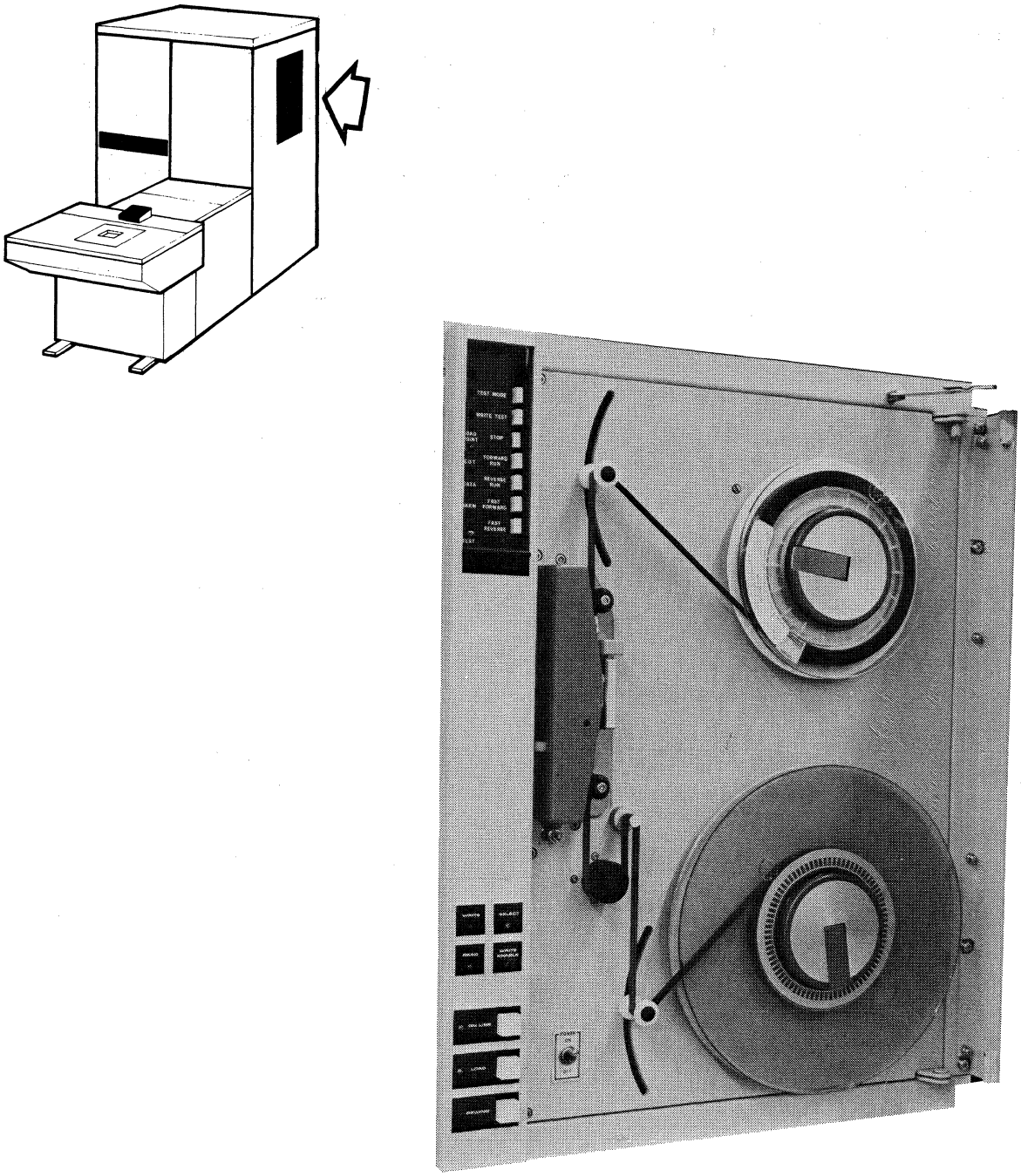


Figure 4–8 Magnetic Tape Unit

4.3.2.1 OPERATOR CONTROL PANEL

The operator control panel controls and indicators are shown in Figure 4-9 and are described in Table 4-8.

TABLE 4-8
OPERATOR CONTROL PANEL, CONTROLS & INDICATORS

Fig. 4-9 Item	Controls/ Indicators	Functions
1	READ Indicator	Illuminated when tape unit is on line, selected for use, and read status is selected.
2	WRITE Indicator	Illuminated when tape unit is on line, selected for use, and write status is selected.
3	SELECT Indicator	Illuminated when tape unit is on line, and is selected for use by the system.
4	WRITE ENABLE Indicator	Illuminated if a reel with Write enable ring installed is mounted on the supply hub.
5	ON LINE pushbutton & indicator	Control is a momentary contact pushbutton used to enable alternate actions: 1. First activation causes tape unit to be placed in an on-line mode of operation. Indicator is illuminated during the on-line mode. 2. Second activation causes tape unit to be placed in an off-line mode of operation. Indicator is not illuminated during the off-line mode.
6	LOAD pushbutton & indicator	Control is a momentary-contact pushbutton. Pressing LOAD activates the magnetic tape reel servos to tension the tape and starts a load sequence of operation. The LOAD indicator is illuminated while the reel servos are activated and the mounted magnetic tape is tensioned. NOTE: LOAD is disabled while tape unit is on-line.
7	REWIND pshbutton & indicator	Control is a momentary-contact pushbutton. Pressing REWIND causes a rewind (locally controlled) operation to be performed. The REWIND indicator is illuminated during either a local or remote initiated tape rewind operation.

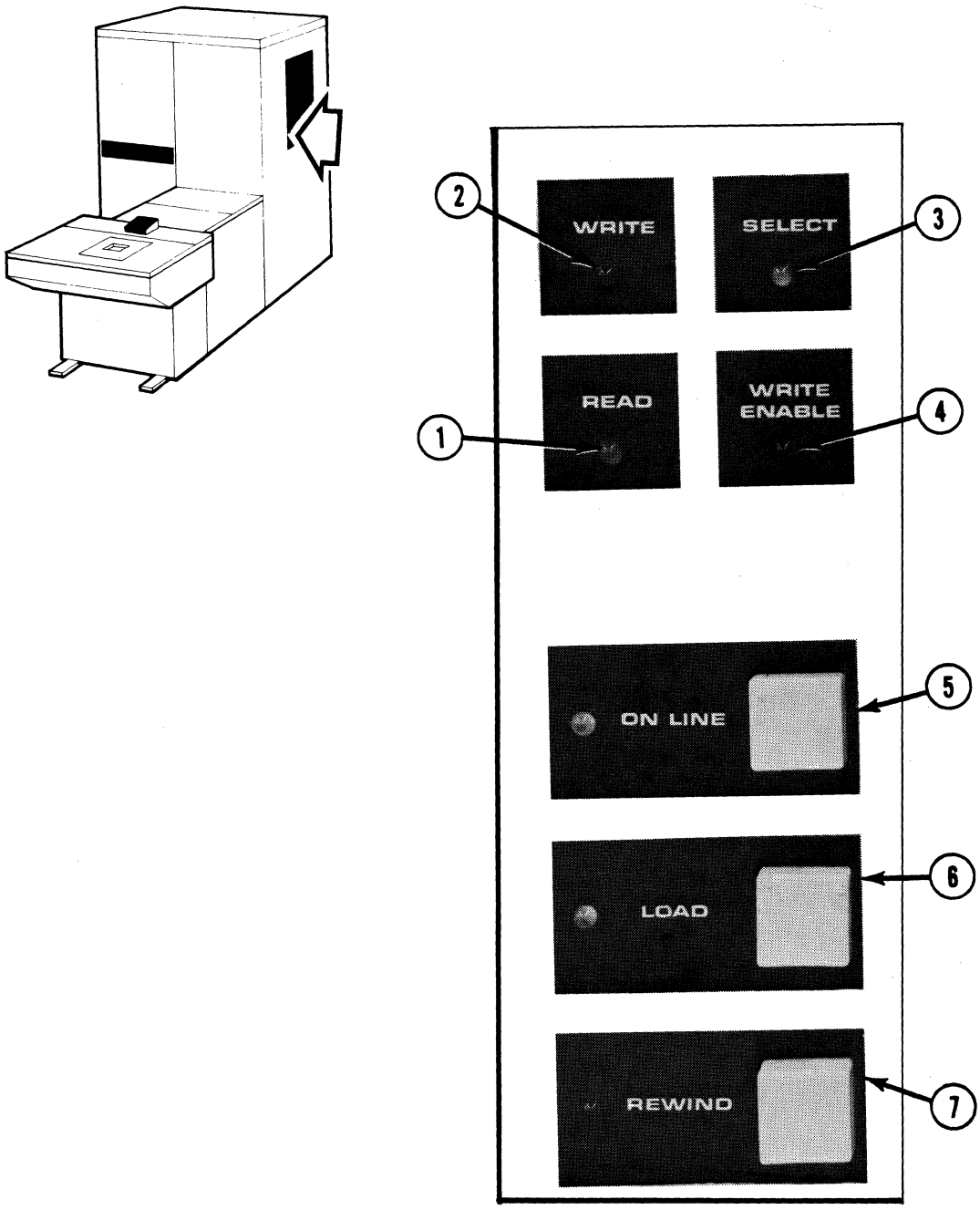


Figure 4-9 Magnetic Tape Unit, Operator Control Panel

4.3.2.2 PREPARATION FOR ON-LINE OPERATIONS

The following steps describe the tape mounting, load and on-line initialization operations needed to prepare a magnetic tape unit for system on-line operations (remote select, read/write, and control).

1. Set POWER ON/OFF switch to ON (see Figure 4-8 for location).
2. Mount tape to be loaded as follows:
   a. If write operations are to be permitted, install a write enable ring on the reel to be mounted.
   b. Lift supply hub (top) reel hold/release lever.
   c. Mount desired reel on supply hub with the write enable side of the reel next to the transport deck. Ensure that the reel is seated against the hub flange.
   d. Press hub hold/release lever in. Ensure that the mounted reel is held firmly on the supply hub.
   e. Mount a take-up reel, if needed, and thread the tape from the supply reel to the take-up reel as shown in Figure 4-10.
   f. Hold tape end against the take-up reel and rotate reel clockwise until tape is secure (approximately two revolutions).
3. Initiate load operations by pressing the operator panel LOAD pushbutton. Transport advances tape until the load point (BOT) is detected, then stops.

NOTE

If the load point marker had been moved past the load point sensor prior to the load operation, the transport advances the tape until the tape's EOT marker is detected. If the preceeding operation occurs, press the operator panel REWIND pushbutton to return the tape to its load point.

4. Press the ON-LINE pushbutton on the operator control panel and verify that the ON LINE indicator is illuminated.

NOTE

On line status allows remotely controlled operation of the tape drive by the system. The LOAD and REWIND pushbuttons of the operator control panel are disabled while the tape drive is on line.

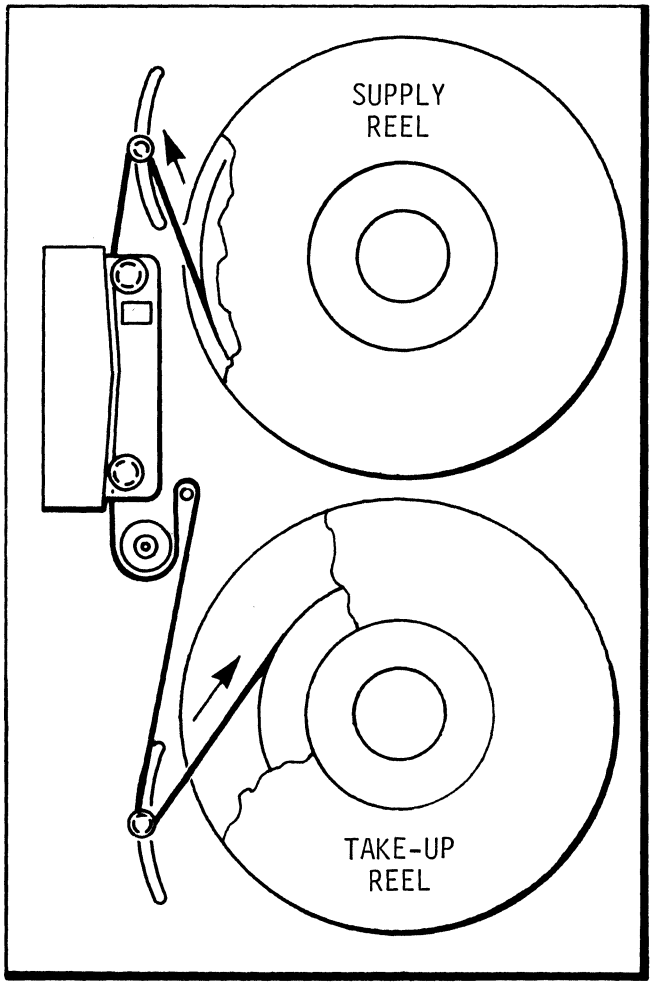


Figure 4-10 Magnetic Tape Unit, Tape Threading Diagram

4.3.2.3 OFF LINE POWER DOWN PROCEDURE

The following steps describe the operation needed to place a magetic tape unit off-line, dismount a supply reel and power down the unit.

1. Press ON LINE pushbutton on operator control panel to return tape unit to local control.
2. Press REWIND pushbutton on operator control panel to rewind tape to load point.

NOTE

The rewinding operation may also be performed remotely using system commands before placing the tape memory system in the local mode of operation.

3. After the tape has stopped at the load point, press the REWIND pushbutton again to rewind the tape leader on to the supply reel.
4. Turn supply reel counterclockwise by hand to rewind remainder of tape.
5. Lift supply hub hold/release lever to free reel.
6. Remove file reel from supply hub.
7. Place POWER ON/OFF switch in OFF position.

4.3.2.4 POWER FAIL RECOVERY PROCEDURE

A magnetic tape unit should not be turned off when a tape is loaded and has been advanced past its load marker.

In the event that a power failure occurs or a unit is accidently turned off during on line operations, perform the following steps:

1. Manually advance the tape forward several feet.
2. Restore power.
3. Press the operator panel LOAD pushbutton, then press the REWIND pushbutton. The tape will rewind to its load point, then stop.

4.3.2.5 TEST PANEL

The test panel controls and indicators are shown in Fugure 4-11 and are described in Table 4-9. No test panel operating procedures are given in this subsection since this panel is to be used only by maintenance personnel.

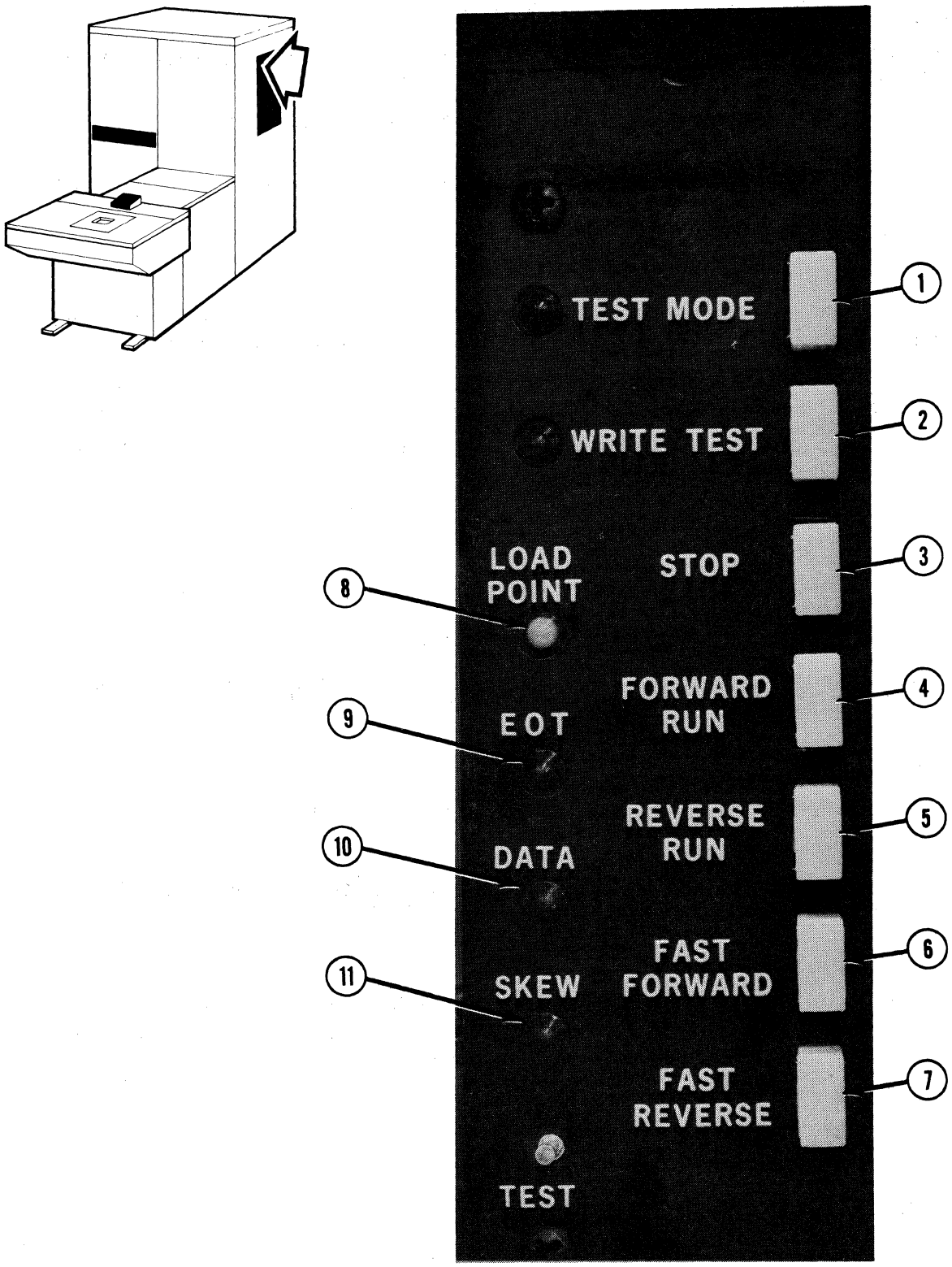


Figure 4-11 Magnetic Tape Unit, Test Panel

TABLE 4-9 TEST PANEL CONTROLS & INDICATORS

Fig. 4-11 Item	Controls/ Indicators	Functions
1	TEST MODE Alternate Action Pushbutton Switch & Indicator	When pressed, selects TEST MODE and activates the test panel. (Tape drive must be OFF LINE and STOP must be selected). When pressed for the second time, normal operation is selected and TEST MODE is disabled. Indicator lamp is illuminated during a TEST MODE.
2	WRITE TEST Alternate Action Pushbutton Switch & Indicator	When first pressed, selects a WRITE TEST mode on which 1's are written on all channels of the tape. (STOP and TEST MODE must be selected to enable this switch.) When pressed for the second time, WRITE TEST mode is disabled. Indicator lamp is illuminated during a WRITE TEST mode.
3	STOP Pushbutton Switch	Terminates all tape motion when pressed. Switch is interlocked (mutually exclusive) with FORWARD and REVERSE switches.
4	FORWARD RUN Push-button Switch	When pressed, causes tape to run forward at normal speed. Switch is interlocked (mutually exclusive) with STOP, FAST FORWARD, and REVERSE switches.
5	REVERSE RUN Pushbutton Switch	When pressed causes tape to run in reverse at normal speed. Switch is interlocked (mutually exclusive) with STOP, FAST REVERSE and FORWARD switches.
6	FAST FORWARD Pushbutton Switch	When pressed causes tape to run forward at high speed. Switch is interlocked (mutually exclusive) with STOP, FORWARD RUN, and REVERSE switches.
7	FAST REVERSE	When pressed causes tape to run in reverse at high speed. Switch is interlocked (mutually exclusive) with STOP, REVERSE RUN, and FORWARD switches.
8	LOAD POINT Indicator	Indicator is illuminated when the loaded tape is at its load point.
9	EOT Indicator	Indicator is illuminated when the end-of-tape (EOT) marker of the loaded tape is sensed by the transport.
10	DATA Indicator	Indicator is illuminated during data processing (read or write) operations.

TABLE 4-9 TEST PANEL CONTROLS & INDICATORS (Continued)

Fig. 4-11 Item	Controls/ Indicators	Functions
11	SKEW Indicator and Test Point	Indicator is illuminated when skew (read or write) exceeds acceptable values as determined by setting of skew gate. Oscilloscope test point available for monitoring all read pulse outputs (simultaneously).

4.3.3 Disc Memory Unit

The disc unit provided with a SENTRY VII test system (see Figure 4-12) is used as an extension to the system's main memory.

The characteristics of the disc memory unit include:

Storage Capacity:	768,000 24-bit words
Transfer Rate:	113,000 words/second
Average Access Time:	17 milliseconds
Disc Rotation Speed:	1745 rpm

4.3.3.1 CONTROLS AND INDICATORS

The disc memory units' controls and indicators are shown in Figures 4-13 and 4-14 and are described in Table 4-10.

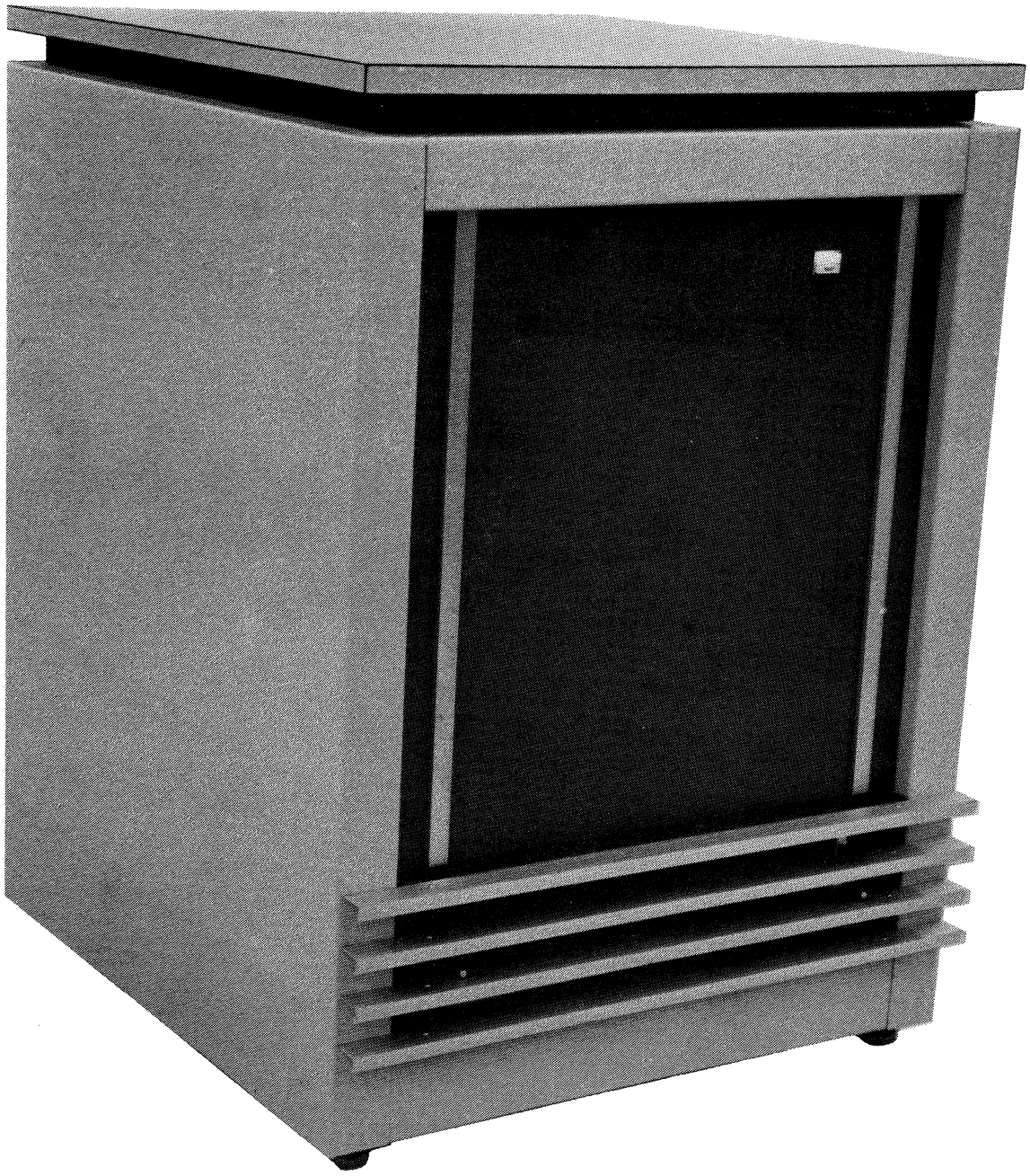


Figure 4-12 Disc Memory Unit

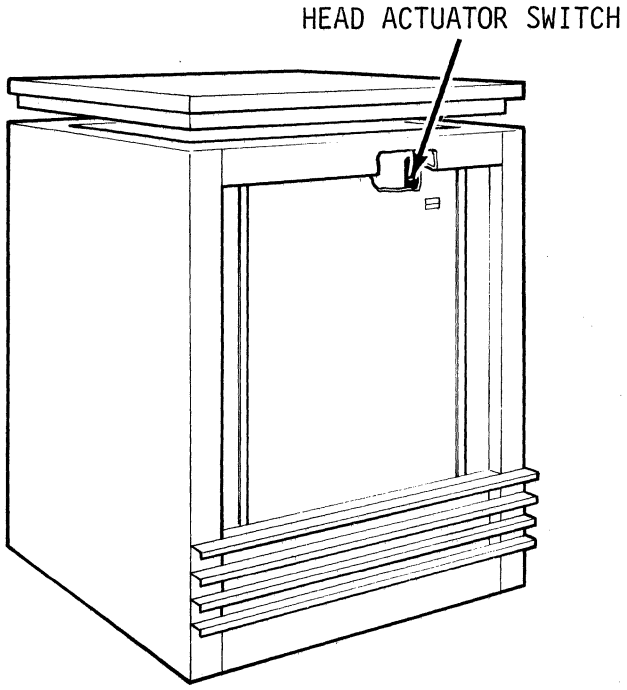


Figure 4-13 Location of Head Actuator Switch

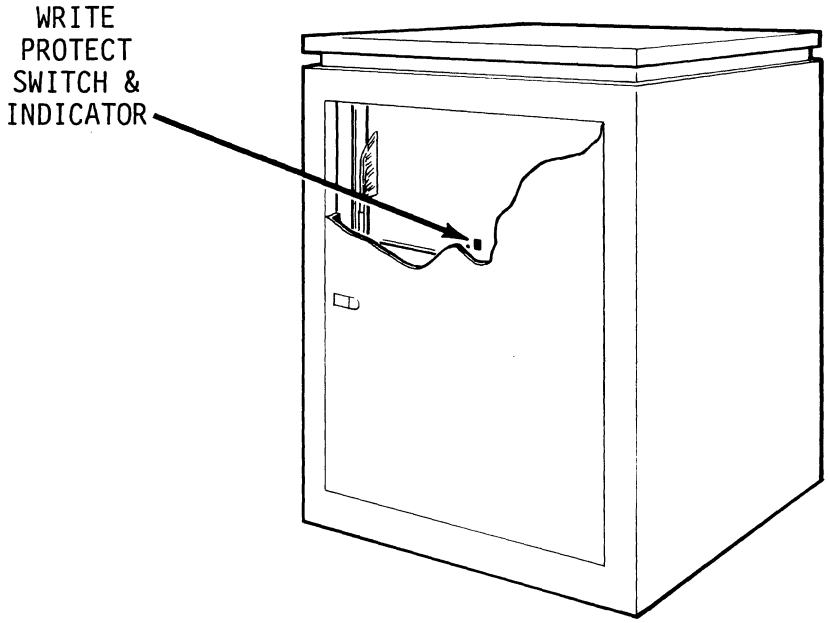


Figure 4-14 Location of Write Protect Switch Indicator

TABLE 4-10 DISC MEMORY UNIT CONTROLS & INDICATORS

See Fig.	Controls/ Indicators	Functions
4-12	AC/READY Pushbutton/ Indicator Switch	When on, applies primary power (AC) to disc power supply circuit. Functions as main ON/OFF control for the disc. The READY indicator is illuminated when the head actuator solenoid drivers are ready for normal operation.
4-13	Head Actuator Toggle Switch	In ON position, allows normal disc head actuation. In OFF position, head actuation and therefore read and write operations are inhibited.
4-14	Write Protect Toggle Switch & Indicator	In ENABLE (left) position, normal write operations are permitted. In the INHIBIT (right) position, all write operations are inhibited. The indicator is illuminated during a write inhibit condition.

4.3.3.2 POWER UP PROCEDURE

The steps required to prepare the disc memory unit for use are:

1. Remove top of disc memory cabinet by lifting firmly at each corner to release the four spring latches and lifting top from cabinet. Open rear panel door to provide access to internal controls.
2. Set Head Actuator switch (on solenoid driver unit) to its ON position (located at top of unit).
3. Set Write Protect switch located inside rear of unit to the left (ENABLE position). Verify that Write Protect indicator is extinguished.
4. Reinstall cabinet top and close rear panel door.

CAUTION

The disc drive motor must be stopped before power is applied. When an operating disc memory unit is powered down, inertia causes the disc to continue spinning for 3 minutes (approximately).

5. On front panel, press AC READY switch to ON (illuminated) position.

NOTE

Wait 30 seconds before attempting to use the disc memory. This period of time is required to allow the disc to reach operating speed.

6. The command to go on line and the write and read data commands are supplied by the system.

   When a disc memory unit is powered down using the procedure described in paragraph 4.3.3.3, the following simplified power up procedure may be used.

   a. Press fron panel AC READY pushbutton. The switch indicator is illuminated if switch is in the ON position.

   b. Do not attempt to access disc until 30 seconds after applying power. This wait period is needed to permit disc to reach operating speed.

CAUTION

Ensure that the disc is no longer spinning before applying power. Inertia causes the disc to continue spinning for 30 seconds (approximately) after power is removed from drive motors.

4.3.3.3 POWER DOWN PROCEDURE

The alternate procedures provided for removing power from the disc memory are:

1. To remove power temporarily, press the AC READY switch to its OFF (indicator extinguished) position.
2. A complete power down procedure is:
   a. Press AC READY switch to its OFF (indicator extinguished) position.
   b. Remove top of disc memory cabinet by lifting firmly at each corner to release the four spring latches and lifting top from cabinet.
   c. Set Head Actuator switch to its OFF position.
   d. Reinstall cabinet top.
   e. Open rear access door of cabinet and set Write Protect switch to its ON position (write protect indicator is illuminated).
   f. Close rear access door.

4.3.4 Card Reader

The card reader provided with a SENTRY VII test system (see Figure 4-14) is a fast, flexible, and convenient means of entering test programs into the system. The characteristics of the card reader include:

Card Storage:	600 cards maximum
Card Reading Rate:	318 cards/minute
Time Between Cards:	60 msec
Time Between Columns:	2 msec

4.3.4.1 CONTROLS AND INDICATORS

The card reader controls and indictors are shown in Figure 4-14 and are described in Table 4-11.

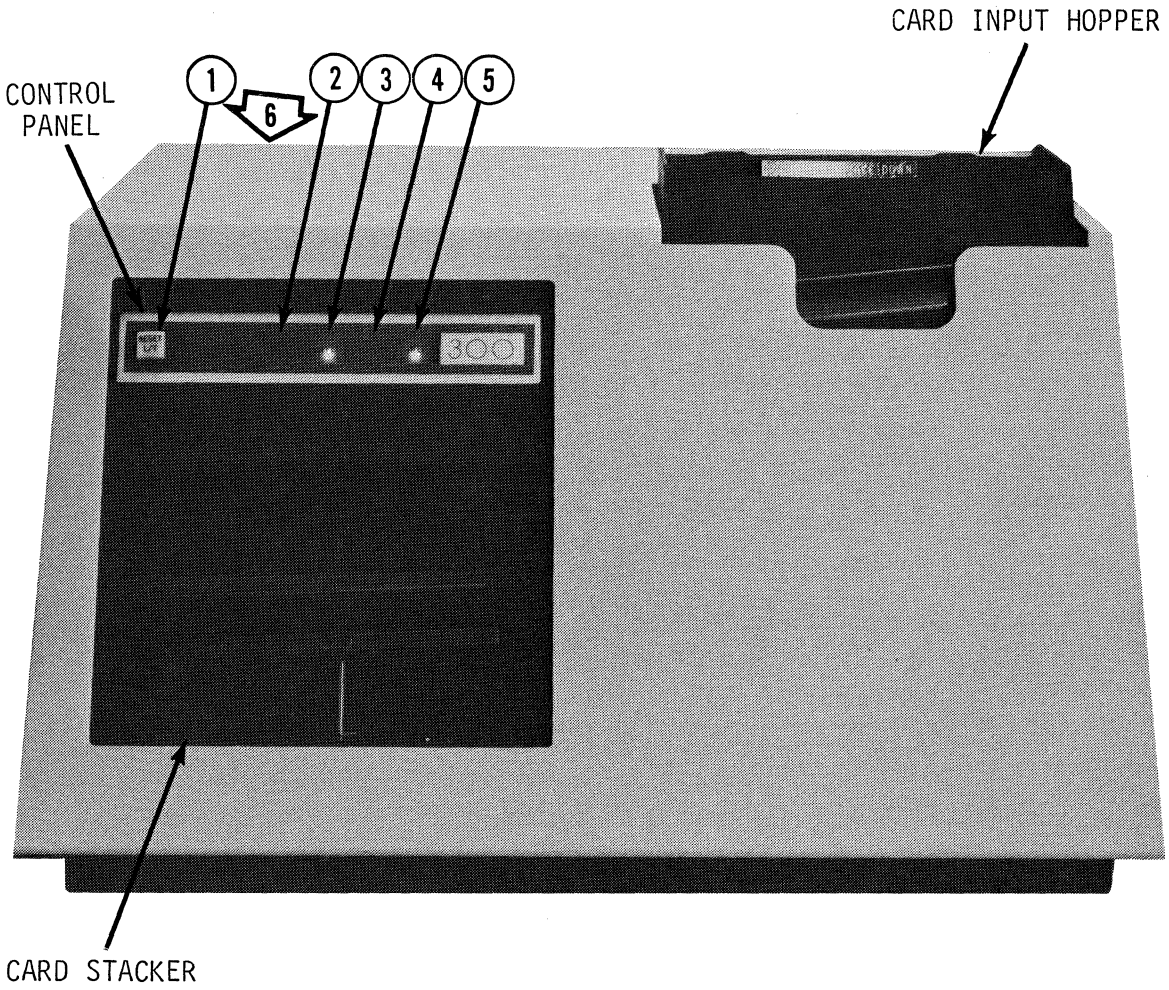


Figure 4-15 Card Reader

TABLE 4-11 CARD READER, CONTROLS & INDICATORS

Fig. 4-15 Item	Controls/ Indicators	Functions
1	RESET L/T Pushbutton switch, alternate action w/indicator	First activation resets card reader, selects the ready (on line) condition, and illuminates the ERROR indicator. Second activation resets card reader, selects the not-ready (off line) condition and turns off the ERROR indicator.
2	ERROR Rear-Illuminated Indicator	Illuminated when card reader electronics detect any condition that causes read errors and when card read is on line.
3	HOPPER Rear Illuminated Indicator	Illuminated when card input hopper is empty.
4	STACK Rear Illuminated Indicator	Illuminated when card output hopper is full.
5	POWER REAR Illuminated Indicator	Illuminated when power is applied to card reader circuits
6	ON/OFF* Toggle Switch	When on, applies primary AC power to card reader power supply. Functions as main ON/OFF control for the card reader.

*Switch is located at the rear of the card reader.

4.3.4.2 POWER UP AND USE

Power up, operating and power down procedures for the Model 8426 Card Reader are given by the following steps.

1. Place ON/OFF toggle switch (on rear panel) in ON position. Observe that POWER indicator is illuminated.
2. Remove input hopper card weight from hopper.
3. Prepare cards by flexing, ruffling and tamping them square on the rocking plate; check card edges for damage. Replace damaged cards before loading hopper.
4. Place cards in input hopper in their proper order, printed side down and column one to the left. For optimum use, cards can be loaded or unloaded continuously if at least 50 cards remain in the input hopper and the output stacker is not full.

5. To prevent feed errors, place input hopper card weight on top of the cards. The card weight must be in place when less than 50 cards are in the input hopper.

6. Press RESET L/T pushbutton to its illuminated (ready) position. (If RESET is pressed while the indicator is illuminated, the indicator goes out and the not ready condition is selected.

7. The command to start reading cards is supplied by the system. The card reader automatically stops when all cards have been read or when the output stacker is full.

NOTE

To manually stop the card reader, press the RESET L/T pushbutton a second time.

8. Error conditions are identified by the card reader panel indicators.

Indicator Illuminated	Identified Error
ERROR	Card feed or a read error
HOPPER	Empty input hopper or feed error in hopper.
STACKER	Full output hopper or stacking error.

The operation of the card reader is stopped when any of the above errors is detected. To continue the read operation, correct the indicated malfunction and press the RESET pushbutton twice to select the reader ready state.

4.3.4.3 POWER DOWN PROCEDURE

To power down the card reader, place the rear panel power switch in its OFF position. Verify that the front panel POWER indicator is not illuminated.

4.4 OPTIONAL PERIPHERALS

A second magnetic tape unit and/or a medium speed line printer (see Figure 4-16) may be added to the basic SENTRY VII test system.

The magnetic tape unit was described previously in this section (paragraph 4.3.2).

The line printer controls, indicators and operating procedures are described in this subsection.

4.4.1 Medium Speed Line Printer

The addition of a line printer to a SENTRY VII system enables the user to obtain high quality hard copy (printouts) of test programs, test results, error messages and the contents of any desired unprotected file.

The basic characteristics of the line printer include:

Print Rate:	300 LPM for standard sized characters. 170 LPM for double-height characters, 240 LPM when underlining or printing lower-case characters with descenders (tails below the line).
Character Format:	132 characters per line, 10 characters per inch horizontal, six or eight characters per inch vertical.
Character Set:	Standard set 64-character ASCII.
Character Registration:	0.005 in. horizontal or vertical.
Paper Type:	Pin feed, continuous fanfold. Single-part 15-pound to 100-pound. Up to six-part NCR or carbon forms of average quality, eight-part forms of premium quality.
Paper Width:	4 1/2 to 16 inches.
Advance Speed	Six lines per inch, 33 msec. Eight lines per inche, 25 msec.

Figure 4-16 Medimum Speed Line Printer

4.4.1.1 OPERATOR CONTROLS AND INDICATORS

The line printer operator controls and indicators are shown in Figure 4-17 and are described in Table 4-12.

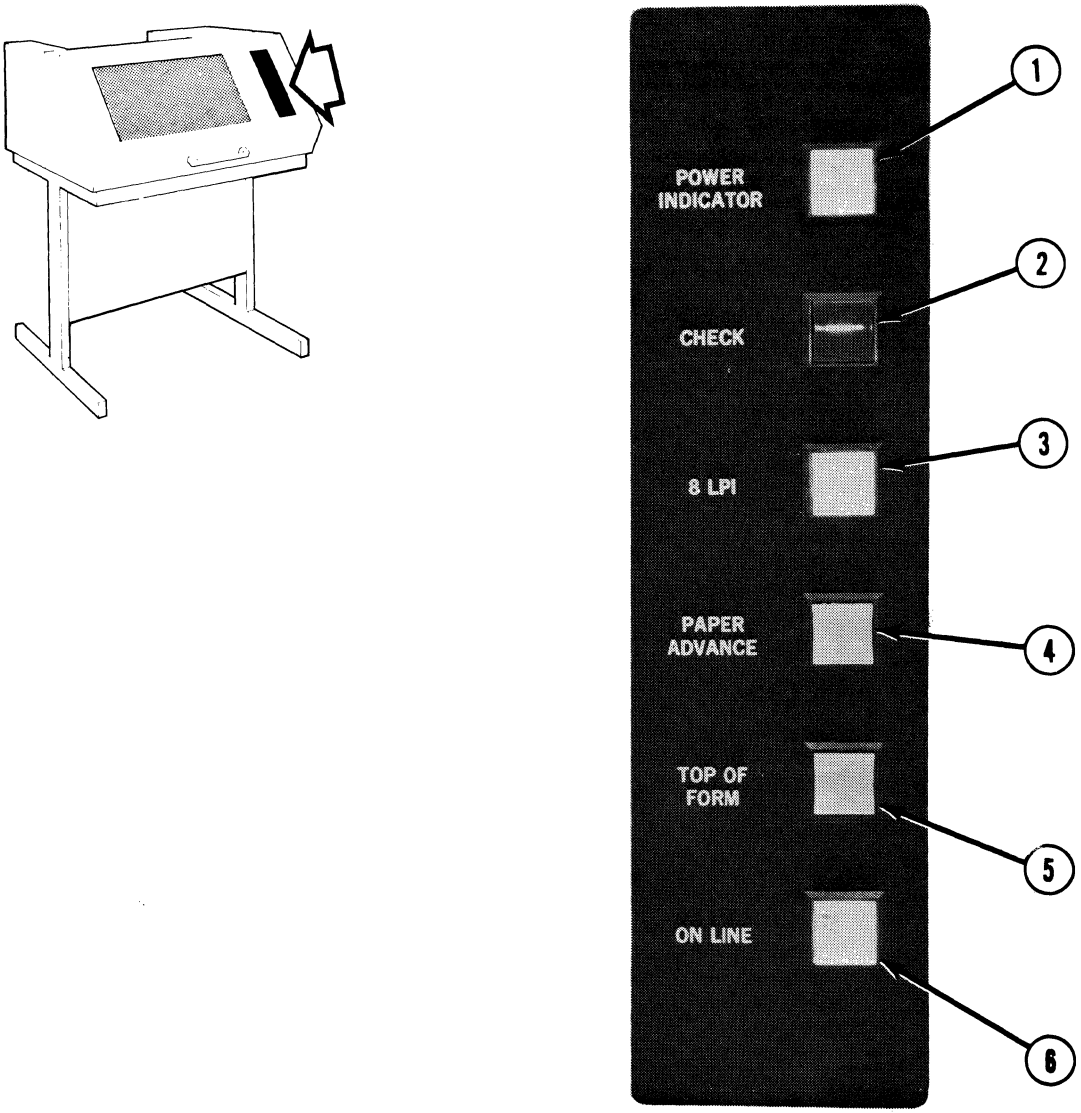


Figure 4-17 Line Printer Operator Control Panel

TABLE 4-12
OPERATOR CONTROL PANELS, CONTROLS & INDICATORS

Fig. 4-17 Item	Control/ Indicators	Function
1	POWER Indicator	Illuminated when AC power source is connected and power switch is turned on.
2	CHECK Pushbutton/ Indicator	Illuminated when paper is not loaded or has run out or is torn below the print station, or is jammed, or supply voltages are abnormal. Light goes out when fault is cleared, except for paper motion detector; then press CHECK.
3	8.LPI Pushbutton/ Indicator	Momentary-action switch selects line spacing of either eight lines per inch (illuminated), or six lines per inch (unlighted). Operational only when printer is off-line. If 8 LPI is selected off-line, interface cannot select 6 LPI on-line. But if 6 LPI is selected off-line, interface can select either 8 LPI or 6 LPI on-line.
4	PAPER ADVANCE Pushbutton	While depressed, causes paper to advance at slew rate.
5	TOP OF FORM Pushbutton/ Indicator	Momentary-action switch causes paper to advance to top of next form. Operational only when printer is off-line. Illuminated only when electronic VFU is loaded, or when a tape is installed on the optional mechanical VFU.
6	ON LINE Pushbutton/ Indicator	Momentary-action switch enables printer control through the interface (illuminated), or disables the interface (unlighted). Printer cannot go on-line unless READY indicator is illuminated.
*	Power on/off Toggle switch	Turns on AC power to printer

*The ON POWER OFF control switch is not shown in Figure 4-17; it is located at the lower left side of the printer.

4.4.1.2 POWER UP PROCEDURE

To power up and ready the line printer for use:

1. Set AC POWER switch to the ON position. POWER indicator should light.
2. If paper is not already in the printer, load paper following instructions in paragraph 4.4.1.3 and then close the front cover.

NOTE

The READY indicator will not light and the printer will not operate unless the front cover is closed and PAPER FAULT indicator is off.

3. If READY indicator is illuminated, press TOP OF FORM pushbutton to set top of the next form at the print station.
4. Use 8 LPI pushbutton to select line spacing. Indicator is ON for 8 LPI, OFF for 6 LPI. Rember that if 8 LPI is selected, interface cannot select 6 LPI when printer is on-line. Select 6 LPI if interface is to control line spacing.
5. Press ON LINE pushbutton. The shuttle drive motor starts and the printer waits for data. The printer is now ready to respond to incoming data through the interface. If data is not received for six seconds, the shuttle is automatically turned off. The next data received turns the shuttle on again within 500 milliseconds.

   The line printer operates unattended for as long as the paper supply lasts.

4.4.1.3 PAPER LOADING

To load paper into the line printer:

1. Place a stack (or box) of the desired paper under the front of the line printer. Position the stack (or box) so that it is in-line with the paper loading slot (see Figure 4-16 and 4-18).

NOTE

Refer to Figure 4-18 for the location of the controls referenced in stps 2 through 12.

2. Open front cover.
3. Lift Form Thickness Adjustment lever to LOAD position to move platen away from ribbon and hammer bank.
4. Insert top edge of paper through slot in printer bottom and pass it past the print station until it can be grasped by the fingers above the print station. (When loading multipart forms it is helpful to fold over the first set at the perforation so that the fold is inserted.)
5. Open the tractor gate on each paper tractor to expose the feed pins.

6. Adjust tractors to provide very slight tension across the form. Too little tension may result in wavy printed lines. Too much tension may distort sprocket holes in the paper and cause problems in later handling by decollators and bursters. When paper is correctly positioned and tensioned, lock knurled nuts.

NOTE

Be sure that paper is positioned on the platen so that its left-hand side covers all the paper-out detector surface. The printer will not go READY if paper does not cover the paper-out detector.

7. Use the left-hand Vertical Form Positoner knob to set the first line of perforations opposite the top-of-form indicator on the left-hand tractor.

8. Rotate Vertical Form Positioner Disc to align its paper indicator mark with the fixed pointer, then rotate the knob exactly one revolution to lower the paper and leave the paper indicator mark again aligned with the fixed pointer. This locates the top-of-form line on the paper at the print station. Subsequent operation of the TOP OF FORM pushbutton will always advance the paper to the same line relative to the perforated line.

9. Grasp the paper at both sides below the paper entrance and pull downwards to make the paper taut in the printer.

10. Move Form Thickness Adjustment lever down to the position suitable for the paper or form in the printer. That is, to 1 (single sheet), 3(3-part), 6 (6-part), or an appropriate intermediate position.

NOTE

If the Form Thickness Adjustment lever is inadvertently left in the load position or is positioned incorrectly for thickness of the form, printing may not occur and the ribbon may be destroyed.

11. Close front cover, turn-on power to the printer, and then press TOP OF FORM pushbutton to advance paper to the next top-of-form. PAPER FAULT indicator should be off if paper is correctly loaded.

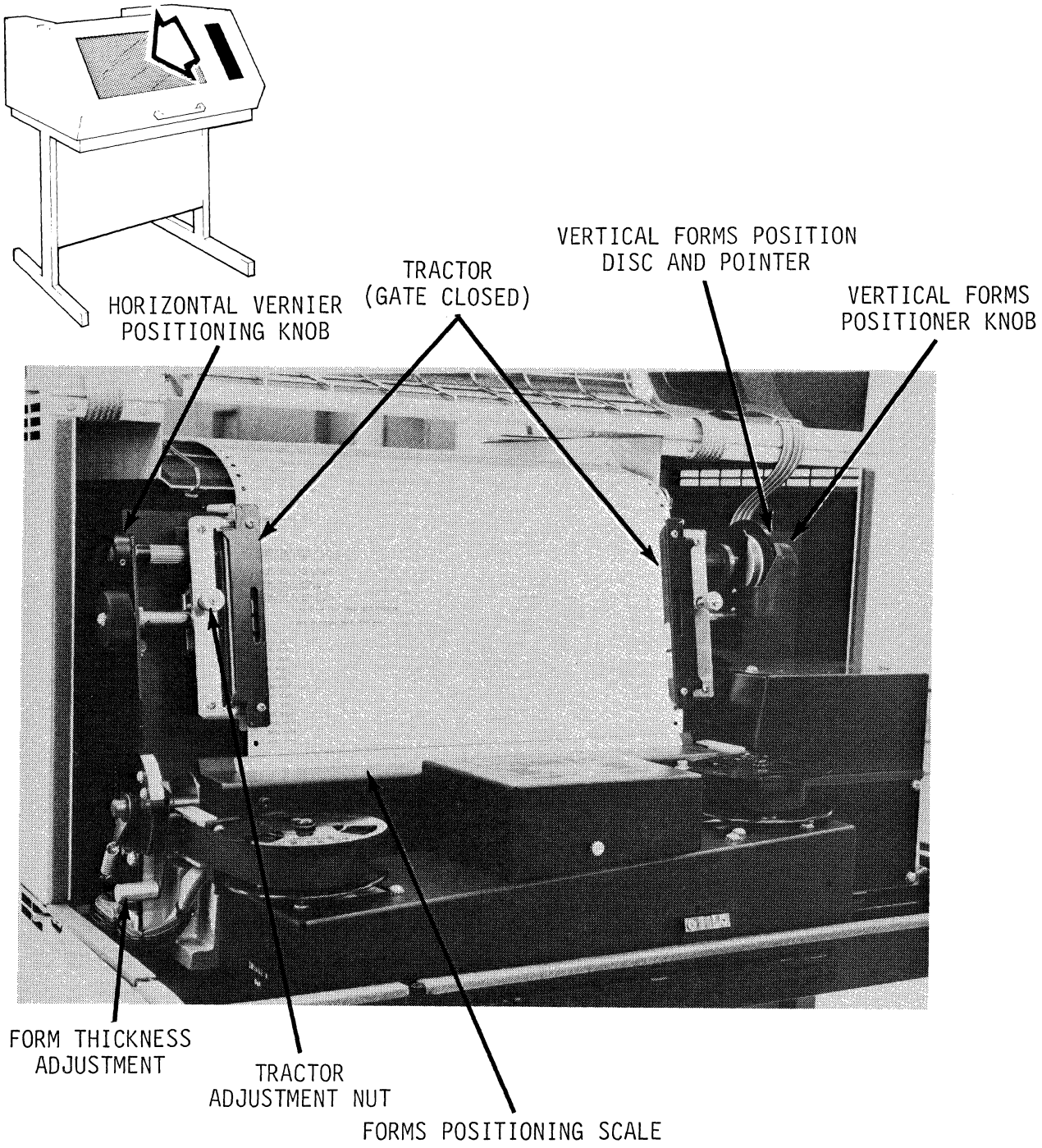


Figure 4-18 Line Printer Paper Loading Controls

4.4.1.4 RIBBON REPLACEMENT

To replace the line printer ribbon:

NOTE

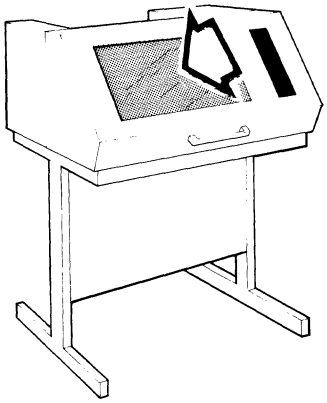
Refer to Figure 4-19 for the location of the controls referenced in the following steps.

1. Open front cover.
2. Set Form Thickness Adjustment level to LOAD position.
3. Rotate either ribbon reel to obtain some slack in the ribbon and lift bottom hub reel release/hold levers.
4. Lift both reels from their hubs, clearing loose ribbon from the guides near either end of the shuttle. Discard old ribbon and reels. Check for ribbon chaff build-up around guides and ribbon slot, and clean if necessary.
5. Install reels of new ribbon on the hubs with the name PRINTRONIX visible on both reels, and with ribbon running off the reels as shown in figure 4-19. Place both hub reel release/hold levers in the down (hold) position.
6. Rotate either reel to obtain enough slack to permit running ribbon over the ribbon guides and across the front of the shutle between hammer bank and paper ironer.

CAUTION

Be sure that end-of-reel sensor wires are not on the hammer bank side of the guides with ribbon installed. This would cause ribbon to wear out very quickly.

7. Rotate either reel to take up slack, and make sure that the ribbon runs smoothly over the guides. A twisted ribbon will cause missing characters, shorten ribbon life, and create paper jams.
8. Turn on AC Power switch to tension the ribbon.
9. Set Form Thickness Adjustment level to the position suitable for the paper or form in the printer. The new ribbon is now ready for use.



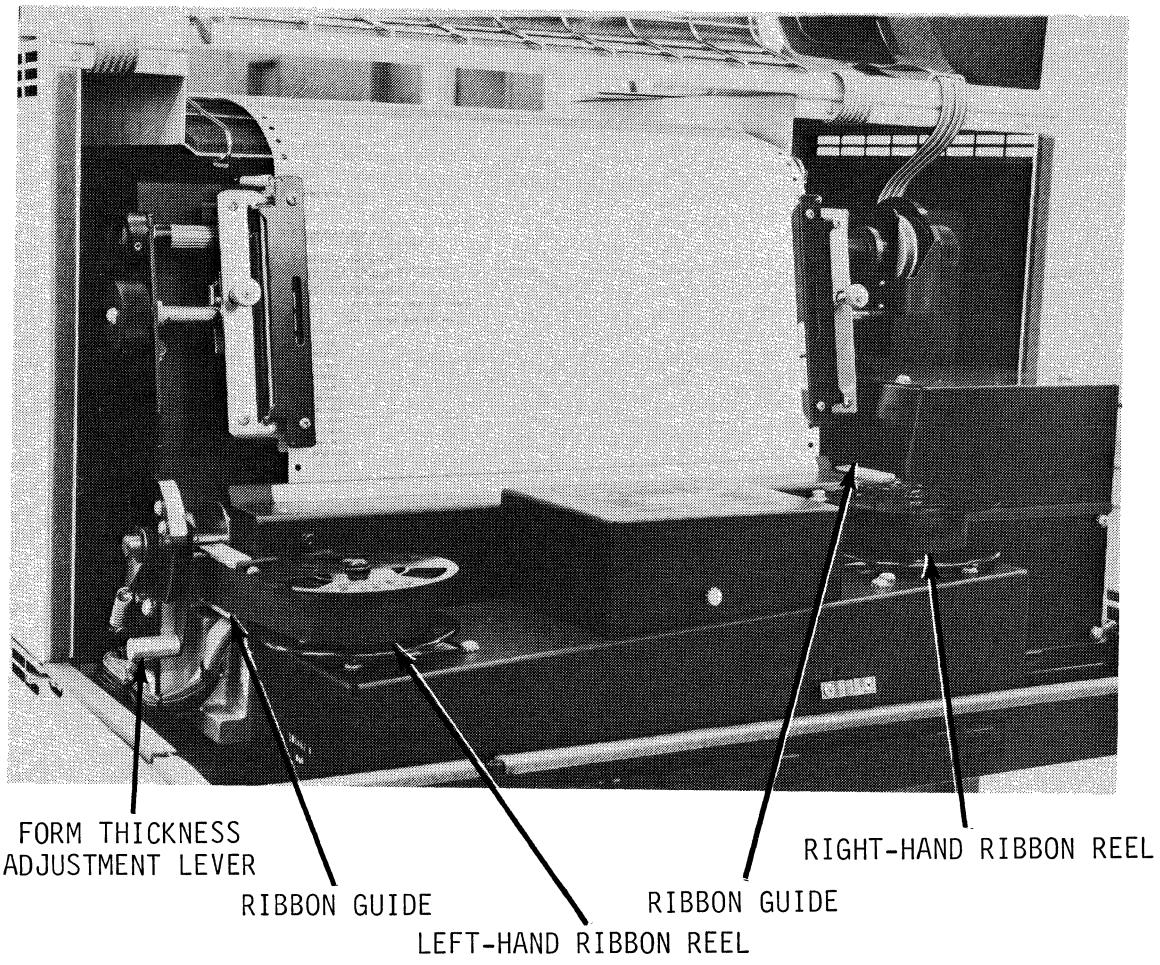


Figure 4-19 Line Printer Ribbon Replacement Facilities

4.5 TEST STATION

A Sentry VII test system may include from one to four test stations. Each test station (see Figure 4-19) is provided with an operator's control/display unit. The controls and indicators contained by a test station control/display unit are described in this subsection.

4.5.1 Control/Display Unit

The controls and indicators contained by a control/display unit are shown in Figure 4-20 and are described in Table 4-13.

Figure 4-20 Test Station

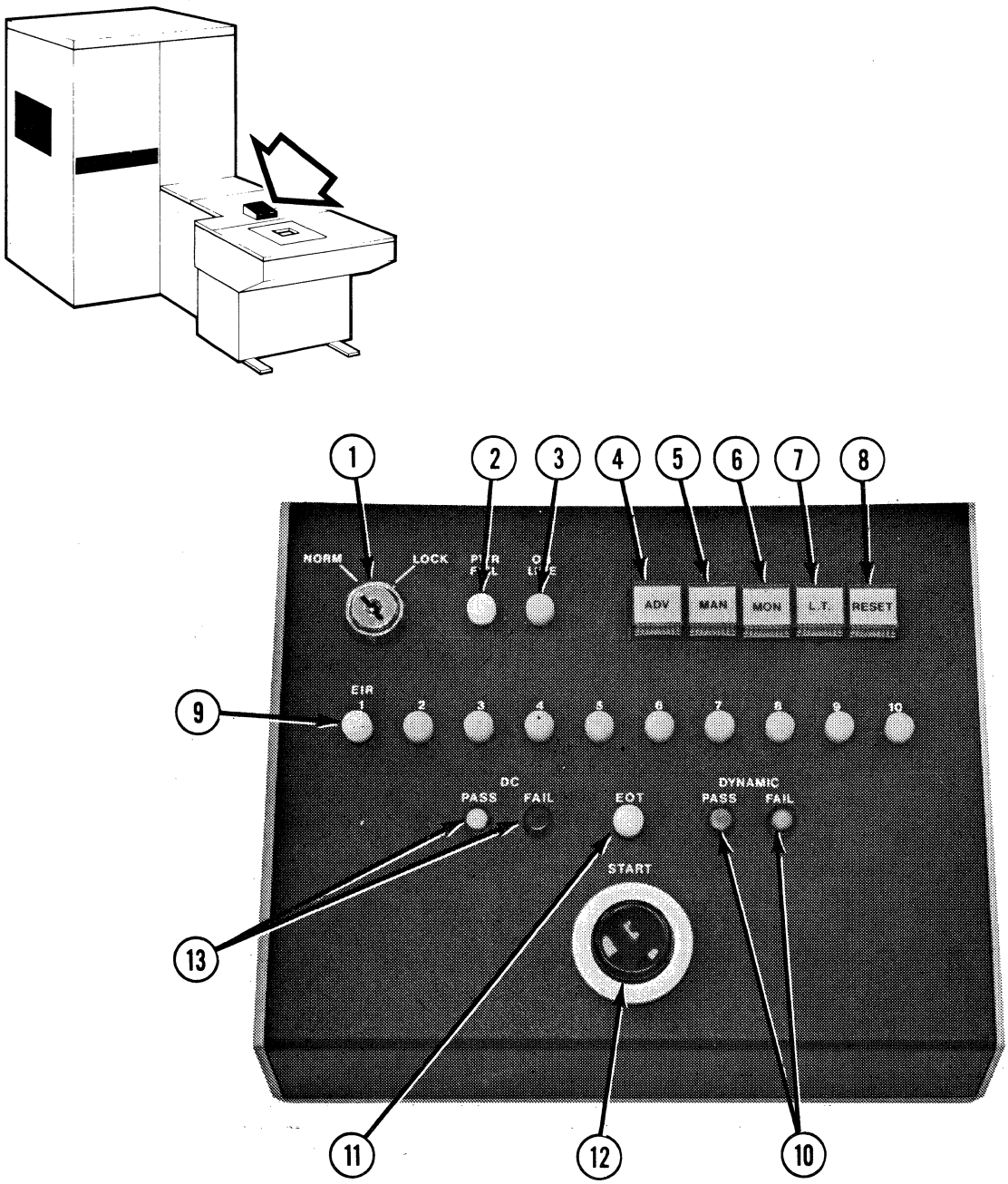


Figure 4-21 Test Station Control/Display Unit

TABLE 4-13 CONTROL/DISPLAY UNIT, CONTROLS & INDICATORS

Item	Controls/ Indicators	Functions
1	NORM/LOCK Key Switch	Function not implemented
2	POWER FAIL Indicator	When the test station and controller power is ON, this indicator goes ON. It flashes OFF and ON in conjunction with an audible alarm when a power failur occurs (varies + 5% from nominal) in any of the controller power supplies.
3	ON LINE Indicator	When illuminated, indicates that particular station has control of the Sentry VII system as a result of pressing the station START pushbutton.
4	ADV Pushbutton Switch	When pressed with the system in the manual test mode, this momentary switch causes start pulses to be generated at a repetition rate of three per second. This switch allows an operator to perform such operations as verification of the test program currently stored in the memory. Also allows an operator to advance the test program to a specific function test statement number of interest, for the purpose of varying the programmed voltage parameters normally applied to the DUT, while observing the results. The START pushbutton should be pressed once before using the ADV pushbutton.
5	MAN Pushbutton Switch with System Controlled Latching	This switch is used to request a manual mode of operation for the test station and to indicate the current mode of operation (automatic or manual). Depressing the MAN switch causes a "manual mode request" to be transmitted to the system controller. If the request is accepted, the system causes the MAN switch to be latched in the down (depressed) position before the switch can be released by the operator. If the request is rejected, the MAN switch is permitted to return to its raised (automatic mode) position when it is released by the operator. When the test station is in a manual mode, it can be returned to the automatic mode by depressing the latched MAN switch to release the latch to permit the switch to return to raised (automatic mode) position when it is released by the operator.
6	MON Pushbutton Switch	Function not implemented

TABLE 4-13 CONTROL/DISPLAY UNIT, CONTROLS & INDICATORS
(Continued)

Item	Controls/ Indicators	Functions
7	L.T. Pushbutton Switch	Lamp test switch. When pressed, this pushbutton causes all station control indicator lamps to be illuminated for test purposes.
8	RESET Pushbutton Switch	When pressed, this momentary switch stops program execution, resets the program to the beginning for the next execution, and resets most of the tester registers.
9	EIR 1 thru 10 Indicators (White)	Provides a display of the ten least significant bits of the external interface register (EIR).
10	DYNAMIC PASS/FAIL Indicators (Green/Red)	At the completion of a function test, the appropriate indicator is illuminated to signify the pass or fail status of the device for that test, or sequence.
11	EOT Indicator (White)	The EOT indicator is illuminated after the last statement of a test program has been executed.
12	START Pushbutton Switch	When pressed, this pushbutton produces a start pulse that initiates active testing of the DUT. In the manual mode, one tester statement or instruction is executed each time the station START pushbutton is pressed until all statements have been executed.
13	DC PASS/FAIL Indicators (Green/Red)	At the completion of a DC parameter test, the appropriate indicator is illuminated to signify the pass or fail status of the DUT for that test, or sequence.

APPENDIX A

CHARACTER CODING (TRASCII)

Code	Char.	029 Special Character	Code	Char.	029 Special Character
00	SPACE	BLANK	40	@	4-8
01	!	11-2-8	41	A	12-1
02	"	7-8	42	B	12-2
03	#	3-8	43	C	12-3
04	$	11-3-8	44	D	12-4
05	%	0-4-8	45	E	12-5
06	&	12	46	F	12-6
07	'	5-8	47	G	12-7
10	(	12-5-8	50	H	12-8
11	)	11-5-8	51	I	12-9
12	*	11-4-8	52	J	11-1
13	+	12-6-8	53	K	11-2
14	;	0-3-8	54	L	11-3
15	-	11	55	M	11-4
16	.	12-3-8	56	N	11-5
17	/	0-1	57	O	11-6
20	0	0	60	P	11-7
21	1	1	61	Q	11-8
22	2	2	62	R	11-9
23	3	3	63	S	0-2
24	4	4	64	T	0-3
25	5	5	65	U	0-4
26	6	6	66	V	0-5
27	7	7	67	W	0-6
30	8	8	70	X	0-7
21	9	9	71	Y	0-8
32	:	0-8-2	72	Z	0-9
33	;	11-6-8	73	[	12-4-8 <
34	<	12-0	74	\	11-7-8 ¬
35	=	6-8	75	]	0-6-8 >
36	>	11-0	76	↑	12-7-8 |
37	?	0-7-8	77	←	0-5-8 —

APPENDIX B

INSTRUCTIONS FOR LOADING MEMORY USING THE SWITCH REGISTER

Instructions for loading Switch Register Programs.

1. Press 'SMC' 'SIC' switch up.

2. Turn indicator selection switch to 'S' position and check for 'TOF' indicator light.

NOTE

If 'TIF' indicator is lighted instead of 'TOF' place 2 0 0 0 0 0 0 0 in switch register and press LDC (Load Command Register) button, the 'TOF' should light.

3. Load switch register with address of starting location and press 'LDP' (load 'P') button.

   Verify the program counter is pointing to the location you specified by examining the P counter (turn selection switch to 'P' position).

4. Load switch register with data to be entered into memory. Press 'STW' (store) button. The program counter ('P' REG) should increment by 1.

   Reload switch register with the next instruction and press STW button. Continue this until last instruction is loaded.

5. To examine what has been entered into memory, load the P register with the starting location of the program (place this location in the switch register and press the LDP button) then press the EXM (examine) button. The data is displayed in the buffer register (B register). Turn the indicator selection switch to B to read the buffer register.

6. Upon verification of the loading of the program, load 0 1 X X X X X X 'Branch Unconditional' to the starting address of the program and press the LDC (Load Command Register) button. (This branches to the start of the program.)

7. Press the 'SIC' 'SMC' switch down and press the START button.

   The computer now executes the program.

8. Entering 01000100 in the switch register and pressing the LDC button returns the computer to DOPSY.

Example: This is a sample program to load into the computer using the switch register. Upon successful loading of this program a continuous display of A's should appear on the TTP.

Location	Switch Register Setting	Command	Description
1000	24001004	LDA	Load Accum. Reg.
1000	06421430	SPU	Write TTP
1002	03141001	BOI	Branch to 1001
1003	01001000	BRU	Branch to 1000*
1004	00000301	DATA	'A'

*Due to the unconditional branch to location 1000 this program will continue displaying a screen full of A's. To stop the display push the SMC and SIC switches up.

APPENDIX C

LOADING AND SYSTEM RECOVERY PROCEDURES*

C.1 PROCEDURE TO LOAD OPERATING SYSTEM SOFTWARE FROM MAGNETIC TAPE ONTO THE DISK MEMORY SYSTEM

The following are the procedures needed to load system software from a magnetic tape unit and put the data onto the disk.

1. Mount the magnetic tape containing the operating system on the tape unit. (Refer to Section 4.3.2 for mounting procedures or refer to loading diagram on inside of cover.)

2. Advance the magnetic tape to the BOT marker by pressing the LOAD button.

3. Place the magnetic tape on-line by pressing the ON-LINE button.

4. On the computer control panel ensure that the switch register is set to 01000100 and that the SMC and SIC switches are in the down position.

5. Insure that the disc write-inhibit switch is in the left most position to allow writing to the disc. (Refer to Section 4.3.3 for exact location.)

6. On the computer conrol panel press the STOP, RESET and LOAD MT buttons. This procedure reads a bootstrap procedure from the magnetic tape and transfers it to the computer.

7. To start reading the tape press the START button. The computer starts transferring the contents of the tape onto the disc. A header is displayed (if one was originally placed on the tape) when the START button is pressed. Loading continues until all information is transferred onto the disc.

8. As soon as the loading operation is successfully completed the tape is automatically rewound and a checksum number followed by an asterisk appears on the VKT as a visual indicator that the DOPSY monitor has been loaded and that the operator can communicate with the system.

9. It is recommended that the magnetic tape be either removed from the unit or that the ON-LINE button be pressed to take the tape off-line, thus removing any accidental writing to the tape.

C.2 PROCEDURE TO LOAD DOPSY MONITOR INTO COMPUTER MEMORY FROM DISC MEMORY USING CARD READER BOOTSTRAP

The FST-2 memory - being a volatile semiconductor memory - contains random data, including wrong parity, when it is powered up. Each location in memory has to be written into at least once, before the parity bits are guaranteed to contain correct parity (to determine the location of a parity error refer to Appendix E.) This leads to the following rules:

1. DO NOT USE THE OLD (FST-1) ONE CARD BOOT. (It does not clear memory and could cause parity halts.)

2. When using the new (FST-2) one card boot a parity error may occur during the BRU 100 (because B Memory accesses location 1, uncleared, at the same time) or it may occur at location 37777B (location does not get cleared). These are expected halts. Just push START to continue.

3. Whenever memory is read (for example with DEBUG) which was not written before, a parity halt may occur. Push START to continue.

The DOPSY BOOTSTRAP ROUTINE is a one card routine of 40 instructions (Table C-1) which is used to load from disc the ARR (Automatic Restart Routine). The ARR loads the Disc Operating System (DOPSY from the disc and initialize the system.

The Bootstrap routine is loaded into memory starting at location 100B and ending at 147B. The first 6 instructions of the 40 instruction routine have the function of relocating the remaining instructions. Starting at location 107B, each instruction is relocated starting at location 0. After relocating the 40 instrucions, the program branches to location 0 and starts execution. The ARR is read from disc followed by the restart message. Refer to table C-1.

1. Turn the card reader power on, if not already on.

2. Place the DOPSY bootstrap card into the card reader input hopper face down with the top edge towards the operator. Place the card reader weight on top of the cards in the hopper.

NOTE

It is not necessary to follow the Bootstrap card with a blank card as with normal operation.

3. Press the card reader START pushbutton. The READY indicator lights immediately if the card reader power has been on for at least one minute; otherwise, there is a delay of up to one minute before the light comes on.

4. At the computer maintenance control panel place the Switch Register switches to the octal value of 01000100.

5. At the system control panel press the computer STOP, RESET and LD control set panel buttons, in that order, or from the maintenance set the SIC (single instruction cycle) to the up position. Depress the STOP, RESET, LDC, LDP buttons.

NOTE

Before doing step 6 ensure that the magnetic tape is not on line.

6. Press the computer LOAD button and observe that the DOPSY bootstrap card has been read by the card reader.

7. Press the computer START button. The DOPSY Monitor is now automatically loaded into the computer memory and an asterisk is printed on the VKT display along with the following informational message:

JOB?

8. Initialize the desired "job identification" by typing the DOPSY command:

// JOB 'xxxx'

9. Communication with DOPSY may now be made using keyboard commands.

10. If the above procedure does not give DOPSY Monitor control as specified in step 7, then the DOPSY software system is not residing on the disc. It is then necessary to load the system software using the procedure described in C.1.

TABLE C-1 FST-2 ONE-CARD BOOTSTRAP ROUTINE

```
00000 00000100            ORG     100B
                          ABS
      00000003  BUSY      EQU     3
      00000006  X6        EQU     6
      00000007  X7        EQU     7
      00000030  TTP       EQU     30B
      00000070  DISC      EQU     70B
      00000000  LOC0      EQU     0
                *  RELOCATE BOOT TO LOC 0
00100 07044000  LOC100    DATA    07044000B     SST PD - SET PARITY DISABLE
00101 05700000            LDX     X7,0
00102 05600040            LDX     X6,40B
00103 24700110  GET       LDA     FIRST,X7
00104 14700000            STA     0,X7
00105 11700001            ATX     X7,1
00106 03100103            BL      GET
00107 01000000            BRU     LOC0
                *  CLEAR FIRST 16K of MEMORY
00110 05637777  FIRST     LDX     X6,37777B
00111 07022030            LS      24
00112 14700000  CLEAR     STA     0,X7
00113 11700001            ATX     X7,1
00114 03500002            BNE     CLEAR-FIRST
00115 07052000            DATA    07052000B   RST PD - RESET PARITY DISABLE
                *  LOAD FIRST 3 SECTORS OF ARR FROM DISC
00116 06611470  LOAD      RDS     DISC
00117 24000027  B         LDA     A-FIRST
00120 06401470            RD      DISC
00121 03140007            BOI     BUSY,B-FIRST
00122 06000070  F         SPU     DISC
00123 03140012            BOI     BUSY, F-FIRST
00124 03340006            BOI     &,LOAD-FIRST
                *  PRINT MESSAGE - JOB '?'
00125 05700000            LDX     X7,0
00126 05600004            LDX     X6,4
00127 24700033  GETMSG     LDA     MSG-FIRST,X7
00130 11700001            ATX     X7,1
00131 03400100            BG      LOC100
00132 06421430  D         WRIT    TTP
00133 03140022            BOI     BUSY, D-FIRST
00134 07022010            LS      8
00135 02500022            BNEZ    D-FIRST
00136 01000017            BRU     GETMSG-FIRST
                *  DISC DCB
00137 00000030  A         DATA    E-FIRST       ADDR OF DCB
```

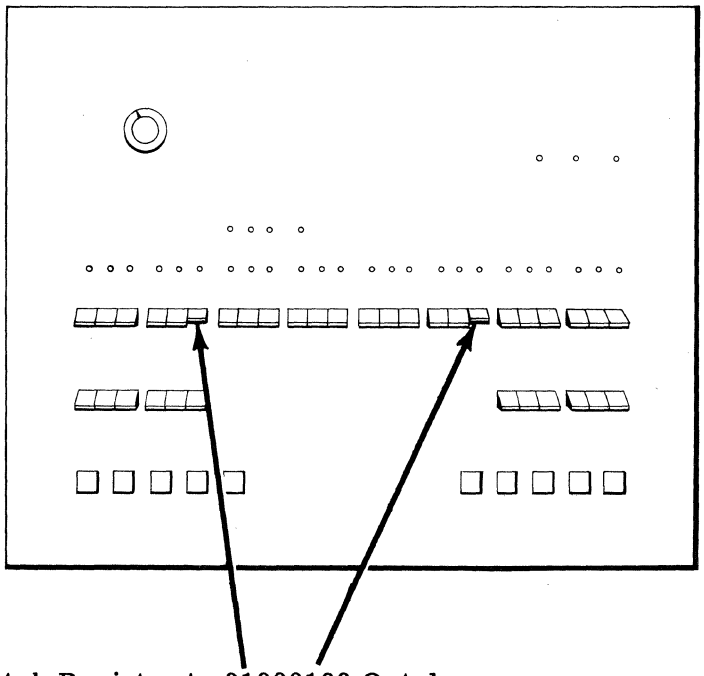
TABLE C-1 FST-2 ONE-CARD BOOTSTRAP ROUTINE (Continued)

```
00140 00000140  B       DATA    140B        NO. OF WORDS = 96
00140 00000060          DATA    60B         START LOAD ADDRESS
00142 00001021          DATA    1021B       DISC ADDRESS
                                                  S = TRACK 2, SECTOR
                *  RESTART MESSAGE                                    //
00143 02405015  MSG     DATA    02405015B   012-012-015   LF LF CR
00144 23645012          DATA    23645012B   117-112-012   O  J  LF
00145 17620102          DATA    17620102B   077-040-102   ?  BL B
00146 00005015          DATA    000050156   000-012-015      LF CR
00146 00000000          END
```

C.3 SYSTEM RECOVERY PROCEDURES

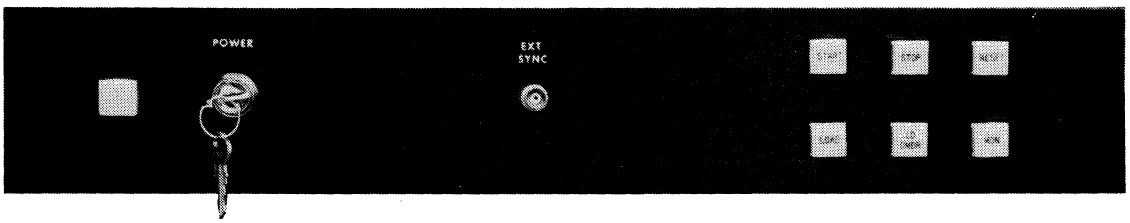
The following procedures can be used to recover from system errors which stop the system.

1. At the FST-2 COMPUTER CONTROL AND INDICATOR PANEL



Set the Switch Register to 01000100 Octal.

2. At the OPERATOR CONTROL PANEL



press STOP then RESET then LD CMDR.

C.3 SYSTEM RECOVERY PROCEDURES (Continued)

If the above procedure doesnot work, chances are that the DOPSY monitor no longer exists on the disk. In this case the procedures described in Section C.1 should be performed.

C.4 MAGNETIC TAPE RECOVERY IN TOPSY

If a 'catastrophic' error occurs during mag tape operation and the user desires to make some attempts to recover then the following courses of action are recommended.

Error during Write Operation

Go back to DOPSY and execute two tape mark writes as follows:

```
/. DOPSY
// MTAP TMARK
// MTAP TMARK
```

FOLLOWED BY:

```
// MTAP SKIP BACK 1 RECS
```

Error during Read Operation

Go back to DOPSY (/.DOPSY). Rewind the tape via the tape transport REWIND switch and restart TOPSY (//TOPSY).

WARNING

THE USER SHOULD BE AWARE THAT THESE RECOVERY ACTIONS BYPASS THE NORMAL TOPSY-DOPSY RETURN AND, CONSEQUENTLY, DO NOT UPDATE THE PRESENT STATE OF TOPSY. WHEN TOPSY IS REENTERED, IT IS INITIALIZED TO THE STATE PRIOR TO THE LAST RETURN TO DOPSY.

APPENDIX D

FACTOR STATEMENT LIST

The following statement forms are allowed in programming the SII or SVII.

D.1 BASIC STATEMENT FORMS

BLOCK

Creates groups of program statements.

SUBR identifier;
SUBR identifier (parameters);
FUNCT identifier (parameters);

Delineates a group of statements which can be repeated with a CALL statement.

END;

Closes BLOCK or subroutine or BEGIN.

CALL identifier;
CALL identifier (parameters);

Subroutine is executed and at completion control is returned to the calling routine.

INSERT filename;

Allows inclusion and compilation of the named source file at point specified.

NOISE xxx, xxx, -----;

Words listed as noise may be used in any statement but are ignored by the compiler. (Must not include reserved words.)

REM ------;

Allows user to give documentation which is ignored by the compiler.

PAGE;

Ejects paper to top of form if listing to line printer.

LIST;
NOLIST; Controls listing.

EXEC identifier (parameters);

DCL V1, V2, Vn;
DCL V1/value1/, V2/value2/, . . . Vn/value n;
DCL V1 asize1 , . . . Vn asize n ;

Declares variables and arrays which may be assigned values.

GOTO label;
GOTO (label1, label2, . . ./labeln) expression;

Causes unconditional branch.

LABEL: - - -;

An address is assigned to label to allow branching to label.

IF relation THEN statement;
IF relation THEN BEGIN - - - - - END;
IF relation THEN statement1 ELSE statement2;

Statements are executed if the 'if' condition is met.

FOR variable = expression THRU expression
BY increment DO statement;

Allows looping under control of a variable.

PAUSE expression;

Program pauses -- value of expression printed on POD

FORMS OF ARITHMETIC STATEMENTS

variable = integer/integer- expression
variable = expression;
Variable is assigned a value.

ARITHMETIC EXPRESSIONS:

With parenthetical expressions:
Read from left to right only:

Arithmetic replacement statements may use the following operators:

+ADDITION
- SUBTRACTION
* MULTIPLICATION
/ DIVISION
↑EXPONENTIATION
Neg / U nary negate

Boolean replacement statements may use the following operators:

Relational

LT	LESS THAN
EQ	EQUAL TO
LEQ	LESS THAN OR EQUAL
GT	GREATER THAN
NEQ	NOT EQUAL

Logical

GE	GREATER THAN OR EQUAL
OR	INCLUSIVE OR
EOR	EXCLUSIVE OR
AND	LOGICAL AND
NOT	NEGATION

D.2 INPUT/OUTPUT STATEMENT FORMS

READ ((CR)/(TTK)/(MTR) "name"/(FDIF) V1, V2, . . . Vn, &V1, &V2, . . &Vn;

Read numerical and literal data from specified device and assign to variables.

WRITE ((FDOF)/(TTP)/(LP)/CLO)) (MTW 'name") (POD) expression, Vi, 'Si', &Vj, 'Sj', /col/V1,/col/'S1', . . . Vn;

Write variable (Vi, Vm, Vn), strings of alphanumeric data (Si, Sj, Sn) literal variables (&Vj) to specified device (column formatted).

NOTE

When reading data, literal variables may be specified freely mixed with numeric variables. When writing, alphanumeric strings may also be included (enclosed in quotes), and any variables and strings may be column-formatted.

ON DIFEOF, label;

Causes program branch to label when disc EOF (end of file) is read.

RESET DIF;

Re-opens disc input file (DIF), i.e., resets pointer to beginning of file.

WRITE (XXXXB) expression;

Write to long or short register.
WRITE (EIR) expression;
Write to EIR register
READ (XXXXB) variable;
Read long or short register.
READ (EIR) variable;
Read EIR register

D.3 TESTER STATEMENTS

SET FORMS

SET DELAY expression, DC;

Time delay register is loaded with value.

SET PERIOD expression (,RNG0/,RNG1/,RNG2/,RNG3);

Defines functional test rate.

SET CLAMP [POS/NEG/SYM] number;

SET CLAMP OFF;

Sets limit on voltage allowed when current is forced.

SET LOGIC [POS/NEG] ;

Initializes functional test comparator logic for either positive or negative logic.

SET [S1/S0/SA1/SA0] expression (,RNG2/,RNG3);

Reference supplies are set to value specified.

SET PMU [SENSE/FORCEV/FORCEI] (, RNG0/,RNG1/,RNG2/,RNG3 /RNG4/ ,AUTO);

Initializes PMU.

SET INVERT binary-pattern;

Provides the ability to invert the F-data for selected pins.

SET STROBE binary-pattern;

Selects one or both of two possible strobes.

SET IOMODE [OFF/pin list];

Allows ability to select tester pins to provide I/O definition for each SET F.

SET CHAIN [TWO/FOUR] pin list;

SET CHAIN OFF:

Allows 2 or 4 test patterns to be generated for each SET F. 'OFF' restores non-chaining mode.

SET [D/M/S/R/F] (*) binary-pin-pattern;

Definition, mask, select, relay, or function registers are set to pattern.

SET SI binary-pattern;

Similar to set S, but generates interpretive code.

SET FI binary-pattern;

Selectively changes specific bits in local memory.

SET [M/MA/MB] binary-pattern;

Sets primary or alternate pin mask register.

SET [D/DA/DB]binary-pattern;

Sets either primary or alternate I/O pin definition register.

SET RZ binary-pattern;

Sets any pin (Data or Clock) to be either NRZ (0) or RZ (1).

SET PAGE integer (,SPM);

Indicates to compiler and TOPSY that program is for hi-speed station, specifies size of a local memory load, and selects SPM option.

SET TGx [DELAY/WIDTH] expression (,RNG0/,RNG1/,RNG2/,RNG3);

Sets delay and width of timing generators 1-8.

SET MPIN integer;

Defines maximum pin count allowed.

SET VOFFSET number;

Specifies an offset voltage to be added to all tester statements which control a voltage level.

SET DCT [LT/GT] expression (,RNG0/,RNG1/,RNG2/,RNG3/,RNG4);

Sets a hardware passfail limit for one DCT threshold at a time, for MEASURE PIN.

D.4 ENABLE FORMS

ENABLE [ILO/IHI/VLO/VHI] [GT/LT] number;

Enables limit comparisons to be made on all programmed current/voltage operands prior to an instruction execution.

ENABLE [TRIPV1/TRIPV2/TRIPV3] [LT/GT] expression (,RNG2/,RNG3);

Enables the voltage-trip detector of the corresponding current forcing unit.

ENABLE [TRIPI1/TRIPI2/TRIPI3] [LT/GT] expression (,RNG2/,RNG3);

Enables current-trip detector of the corresponding voltage forcing unit.

[ENABLE/DISABLE] LATCHES;

Determines if C register is to be cleared prior to strobing functional test comparators.

ENABLE ACCESS;

Forces a disc access to reload the memory buffer.

[ENABLE/DISABLE] RELAY;

Determines if voltage conditioner remains connected to a pin when the PMU is connected.

DISABLE TRIPS;

Clears trip limits set up with Enables.

ENABLE [DCT0/DCT1] [LT/GT] expression;

Forms a software pass-fail threshold, or if both DCT0 and DCT1 are specified, a pass-fail window, for 'MEASURE VALUE'.

DISABLE [DCT0/DCT1] ;

Disables comparison limits.

[ENABLE/DISABLE] DOUBLE STROBE:

Pins indicated by a 0 in 'SET STROBE' will be strobed by both TG7 and TG8.

ENABLE [MA/MB/DA/DB] (,MA/MB/DA/DB);

Specifies which I/O definition and/or mask register is to be used.

D.5 FORCE FORMS

FORCE [VF1/VF2/VF3] expression (,RNG2/,RNG3);

Forces DPS voltage supply to value specified.

FORCE [IF1/IF2/IF3] expression (,RNG2/,RNG3);

DPS unit is to force current specified.

FORCE [E0/E1/EA0/EA1/EB0/EB1/EC0/EC1] expression (,RNG2/,RNG3);

Forces voltage conditioner reference supplies to programmed value.

FORCE PMU expression;

Forces output of PMU to value specified.

FORCE VOLTAGE expression (,RNG1/,RNG2/,RNG3/,RNG4);

Forces PMU to voltage specified.

FORCE CURRENT expression (,RNG0/,RNG1/,RNG2/,RNG3);

Forces PMU to current specified.

FORCE RESET;

Clears all programmable test conditions and causes a hardware reset.

FORCE DELAY;

Forces the time delay to occur and to wait until tester not busy.

FORCE WAIT;

Forces tester to wait until 'tester not busy'.

D.6 MISCELLANEOUS FORMS

ON [DCT/FCT/TRIP] , label;

Causes program branch to label on failure.

XCON [VF1/VF2/VF3] ;

Specified voltage forcing unit is disconnected from the test head.

CPMU PIN expression;

XPMU PIN;

Disconnects PMU.

MEASURE PIN ;

Pass-fail comparison is made with programmed limit. No floating point conversion.

MEASURE [VALUE/NODE number] (,LOG);

Measurement is made and a software analog-to-digital conversion takes place, with result stored in global variable 'VALUE'.

MEASURE VARIABLE variable (,LOG)

Similar to MEASURE VALUE except that no measurement is made but the value of the variable is used and compared against the enabled DCT0/1 limits.

CLEAR FAIL [DCT/FCT/TRIP];

Previous fail indicator is cleared.

CLEAR [DCT/FCT/TRIP] ;

Clear previous ON fail-type, label instruction.

CONN [DPS1/DPS2/DPS3/TCOM/CLK] pin list;

Connects listed pins to power supply or to tester common or defines them as clock pins.

XCON PIN pin list;

Reconnects pin to selected data reference.

CGEN [TG1/TG2/TG3/TG4/TG5/TG6/TG12] pinlist;

Connects listed pin to specified timing generator

D.7 LOCAL MEMORY MANAGEMENT

In the following instructions, addresses refer to locations in local memory and are of the following form:

label/constant/variable/label+-constant/label+-variable

SET START test-start-address ;

Specifies functional test start address.

AT memory-address ;

Designates memory address at which it is desired to make modifications.

SET MAJOR major-loop-count, major-loop-end-address;

Defines major loop within local memory. (Also used to redefine (L), test end).

SET MINOR minor-loop-count, minor-loop-start-address, minor-loop-end-address;

Defines minor loop within local memory.

ENABLE TEST [NORMAL/CONTINUOUS/MOMENTARY/IFAIL] (,EXT/,EXTA);
ENABLE TEST MATCH (,EXT/,EXTA/,IMMED);

Initiates testing in mode specified.

SET IFAIL memory-address (,COUNT);

Sets local memory address or step count up to which fails will be ignored.

KEY

X/Y/Z	one of options is required.
(X/Y/Z)	one of options may be used but none is required.
integer	user must select appropriate expression or number.
number	any floating point number but may not be a variable.
expression	any floating point number or variable or arithmetic combination of numbers and variables.

D.8 STATEMENT LIST, REGISTERS WRITTEN, CODE TYPE AND TIME DELAY

Statement and Options	Registers Written	DMA/ITNTPR	TD*
AT	MCS	D/I (503)	0
BRANCH UNLESS/TO/RESET	PG-MIL	D	
CGEN TGn	TG1,TG2,TG3	D	0
CONN CLK	PPA	D	2
CONN DPS1/DPS2/DPS3/TCOM	PPA	D	2
CPMU PIN	PA	D/I (612)	2
DISABLE TRIPS	SR	I (646)	0
ENABLE/DISABLE DCT0/DCT1	none	I (631,632)	0
ENABLE/DISABLE DOUBLE STROBE	SAMB	I (521)	0
ENABLE/DISABLE LATCHES	SR	I (640/641)	0
ENABLE/DISABLE RELAY	PA	D	2
ENABLE/DISABLE SPLIT/RTO/ MUX/IMASK	SAMD	D	
ENABLE DA/DB	F-RANK1		0
ENABLE ILO/IHI/VLO/VHI	none	I (632, 635)	0
ENABLE MA/MB	F-RANK2		0
ENABLE PPM	SAMB	D	0
ENABLE TEST (no SET START)	S (W)	D	0
(no SET MAJOR)	L	D	
	MCS, SAMA	D	
	SAMA,IF,LRAX,IF2 (AB)	I (521)	
EXTA	SAMB	I	
LOOP	SAMC	I	
MATCH	SR (if time out fail)	I	
AMATCH	SAMD, SR (if time out fail)		
ENABLE TRIPI1/TRIPI2/TRIPI3	SR, DPT1/2/3/, DPS1/2/3	I (601-603)	6
ENABLE TRIPV1/TRIPV2/TRIPV3	SR, DPT1/2/3, DPSI1/2/3	I (613-615)	6
FORCE CURRENT VOLTAGE	PPS	D/I (605)	4
FORCE DELAY	TD (special)	I (642)	9
FORCE E0/E1/.../EC1	E0/E1/.../EC1	I (620-623)	7
FORCE IF1/IF2/IF3	SR, DPT1/2/3, DPS1/2/3	I (647-651)	6
FORCE PMU	PPS	D/I (605)	4
FORCE RESET	DPS1/2/3. DPT1/2/3, PPS	I (640)	6
	RVS's, all registers on hardware reset line, MR, DA, DB, MA, MB, SR, SAMA, EIR, TD These registers are restored: bits 1,2,7, SAMB, all bits except 4 and 5 MR, bit 0 SR,		

D.8 STATEMENT LIST, REGISTERS WRITTEN, CODE TYPE AND TIME DELAY (Continued)

Statement and Options	Registers Written	DMA/ITNTPR	TD*
	bit 11 SAMC, SPM mode bit in SAMD, and IND, INC, EIR		
FORCE VF1/VF2/VF3	SR, DPT1/DPT2/ DPT3, DPS1/DPS2/DPS3	I (625-627)	6
FORCE WAIT	None	I (642)	10
label:	IND	I (645)	0
LCGEN TG1/TG2/TG3	F	D	0
LSET IX/STROBE/RZ/INVERT/ DA/DB/MA/MB	F	D	0
LSUBR	F	D	0
MEASURE NODE	SAMA,PA,PSL, DCT, SR on failure	I (616)	
MEASURE PIN (no ENABLE DCT1/DCT0)	DCT, SAMA	D	
(ENABLE DCT1/ DCT0)	SAMA,PSL if AUTO specified, SR on failure	I (616)	
MEASURE PIN #1,2,6.10	PA, PPS, SAMA, SR on failure	I (616)	
5,7,9	PA,PPS,SAMA,DCT,SR on failure		
MEASURE VARIABLE	SAMA,SR on failure	I (616)	0
PGEN LOAD	PG-PCNTR	D	
RD/WR ONE/ZERO/CHECK/ NCHECK	PG-MIL	D	
SET APERIOD	SAMD,TR	I (507)	0
SET ATG4 DELAY	SAMD,PDV,PD, PWV, PW	I (523)	0
WIDTH	SAMD, PWV, PW		
SET CHAIN TWO/FOUR	SAMB, CH	I (521), D	0
OFF	SAMB	I (521)	
SET CLAMP	PSL (Called SPSL in Analysis)	D/I (624)	2
SET CRO	LRAX, CRO (AB)	D	
SET DA	DA	D	2
SET DB	DB	D	2
SET DCT	PSL, DCT	D/I (652)	8
SET DELAY	TD	I (611)	0
SET F	F	D	0
SET FC	F	D	0
SET FI	SAMA,F	I (520)	0
SET IFAIL	IF,SAMC	I (502)	0
COUNT	IF,LRAX,IF2 (AB), SAMC		

D.8 STATEMENT LIST, REGISTERS WRITTEN, CODE TYPE AND TIME DELAY (Continued)

Statement and Options		Registers Written	DMA/ITNTPR	TD*
SET INVERT		INVERT (W)	D	0
SET IOMODE	pin list	SAMD,SAMB,CH	I (501),D	0
	OFF	SAMD,SAMB	I (521)	
SET IOMODE	pin list	SAMB,CH	I (521),D	0
	OFF	SAMB	I (521)	
SET LOGIC		SR	I (640,641)	0
SET MA		MA	D	0
SET MAJOR	loop count	N	D/I (506)	0
	last address	L	D/I (504)	
SET MB		MB	D	0
SET MINOR	loop count	M	D/I (506)	0
	start & end	J,K	D/I (505)	
		SAMB,SAMA,S,N, MCS,J,K,M,TR,F,DA, DB,MA,MB,IND,SAMD	I (501)	0
	SPM	SAMD		
SET PERIOD		TR	I (507)	0
SET PGEN1		PG-PS,PG-SIZE, PG-XSIZE	D	
SET PGENA/PGENC/PGENCN/ PGEND/PGENDN		PG-PS	D	
SET PMU	SENSE	PSL	I (617)	5
	FORCEV	PPS		4
	FORCEI	PSL		4
SET PPM		SAMD	I (524)	0
SET Q		LRAX, QL, Q	I (522)	0
SET R		R	D	3
SET RZ		RZ	D	0
SET S1/S0/SA1/SA0		S1/S0/SA1/SA0	I (630,654)	7
SET S		S	D	1
SET SI		SAMA, S	I (520)	0
SET START		S	D/I (502)	0
SET STROBE		ST	D	0
SET TG	DELAY	PDV,PD,PWV,PW	I (510-517)	0
	WIDTH	PWV, PW		
SET TEST #		PPS,PA	I (655)	
SET XOR		LRAX, XOR (AB)	D	
WRITE (register)		(register)	I (605)	0
XCON PIN		PPA	D	2
XCON VF1/VF2/VF3		PA	I (612)	6
XLPMU PIN		PA	D	2

***Time Delay Generated**

TD	Description
0	no delay
1	0.28 millisecond
2	0.56 millisecond
3	1.75 millisecond
4	Programmed DC Time Delay or 0.56 millisecond with no current range change or 4 millisecond (+1 millisecond) with current range change, whichever is greater.
5	0.56 millisecond with no current range change or 4 millisecond with current range change.
6	Programmed DC Time Delay or 5.37 milliseconds, whichever is greater.
7	Approximately 300 microseconds per volt of change or 0.56 millisecond, whichever is greater.
8	56 microseconds
9	Programmed DC Time Delay
10	The time required for the tester to become not busy.

APPENDIX E

PARITY ERROR DETERMINATION (FST-2)

The following procedure is for determining if any word in memory contains a parity error and its location. This procedure may be used if any program halts with the parity error light on.

loc	contents	instruction
0	24100000	LDA 0, X1
1	11100001	ATX X1, 1
2	01000000	BRU 0

Procedure for entering the above program through the switches:

1. Set SIC switch in up position and press RESET button
2. If IER Light is ON, depress START
3. Place FST-2 and PD switches in the down position
4. Place 1000 000 in switch register press LDP and LDC buttons
5. Place 2410 0000 in switch register and press STW button
6. Place 1110 0001 in switch register and press STW button
7. Place 0100 0000 in switch register and press STW, LDP, and LDC buttons
8. Place SIC switch in down position
9. Press the START button
10. If a parity halt had occurred the data is in the A register and the address is in the X1 register.

APPENDIX F

SENTRY UTILITIES

The SENTRY operating system provides utility programs to assist in organizing and maintaining data, and to aid in the development of FACTOR test programs. This appendix lists the utilities, their function, and where called from. For complete information refer to the Sentry Utilities Reference Manual, manual part number 67095661.

Each utility program described in this appendix falls into one of five general classes of programs:

1. General purpose system utility programs (Table F-1)
2. Analysis, characterization and datalogging utility programs (Table F-2)
3. Debugging aid utility programs (Table F-3)
4. FACTOR enhancement utility programs (Table F-4)
5. Pattern generation utility programs (Table F-5)

Within each class, programs are further categorized by the type of distribution which they receive. There are two distribution types:

1. System utilities included in standard revision level releases.
2. Special utility programs designed for a specific function available at extra cost.
   (The distribution type for each program is listed)

Of major importance to the user is how each utility program is called - that is, whether it is an "operator" or a "programmer" utility. The operator utilities are implemented by either a DOPSY or TOPSY command, as required, from the VKT keyboard. Programmer utilities are known as "assembly language linkage" routines which are called and executed from a user written FACTOR language program using the FACTOR "EXEC" statement.

The following tables list the five classes of utility programs, the utility name, where callable from, the type of program and a brief description of what each utility does.

TABLE F-1 GENERAL PURPOSE SYSTEM UTILITY PROGRAMS

Utility Name	Callable From	Type	Descriptions
FCOMP	DOPSY	1	Compare two disc files
LISTC	DOPSY	1	List card images on line printer
CRDTAP	DOPSY	1	Write card images on magnetic tape
TAPLP	DOPSY	1	List tape records on line printer
FINDJOB	DOPSY	1	Display job numbers on VKT
DELJOB	DOPSY	1	Delete files by groups from disc storage
COPJOB	DOPSY	2	Copy groups of files from disc to magnetic tape
CHANGE	DOPSY	2	Multiple occurrence character string editor
EDIT	DOPSY	1	General purpose disc file string and character editor
PATCH	DOPSY	1	Modify words in disc files
DBUP	DOPSY	1	Disc to magnetic tape backup and bootload program.
TDX	DOPSY	1	Tape to disc and disc to tape fast transfer
BMT	DOPSY	1	Blocked file transfer between tape and disc
INIT	DOPSY	1	Reconfigure test station assignments
INSERT	DOPSY	1	Edits FACTOR source files and permanently inserts INSERT files in new composite file.
NOTE	DOPSY	1	Prints a message to an output device and allows operator control of a disc command file execution.
LABEL	DOPSY	1	Prints a message to an output device in large block letters.
XMIT	DOPSY or TOPSY	1	Dumps contents of VKT screen to line printer.

TABLE F-2
ANALYSIS CHARACTERIZATION AND DATALOGGING UTILITY PROGRAMS

Utility Name	Callable From	Type	Descriptions
XGRAPH	FACTOR	1	X-Y and shmoo plotting on a specified output device
TTIME	FACTOR	1	High-speed time measurement algorithm
SPLOT	TOPSY or FACTOR	1	X-Y sensititvity plot routine
PGLOG	FACTOR	2	Plots RAM test pattern fail-maps on specified output device. For use with Hardware Pattern Generator (HPG).
PPLOG	TOPSY	2	Plots RAM test pattern fail-maps on specified output device. For use with Pattern Processor Module (PPM).

TABLE F-3 DEBUGGING AID UTILITY PROGRAMS

DEBUG	DOPSY or TOPSY	1	General purpose debugging aid
PSCAN	TOPSY or FACTOR	1	Analysis aid which displays status of programmed pins and power supplies at time of execution.
LMIO	TOPSY	1	Dumps Local Memory contents in various formats to specified output device. Loads Local Memory from a disc file.

TABLE F-4 FACTOR ENHANCEMENT UTILITY PROGRAMS

Utility Name	Callable From	Type	Description
LMMOD	FACTOR	1	Modification of local memory from FACTOR program
LMTSF	FACTOR	1	Generates string files of functional data from local memory.
LPLF	FACTOR	1	Program control of line printer in FACTOR program
LMLOAD	FACTOR	2	Transfer functional test data between local memory and disc files in FACTOR program
LMSAVE	FACTOR	2	Microprocessor test generation aid
LOGREG	FACTOR	2	Long register reading and writing routine
FMTAP	FACTOR	2	Magnetic tape control within a FACTOR program

TABLE F-5 PATTERN GENERATION UTILITY PROGRAMS

CSETF	FACTOR	2	Algorithmetic pattern generator of SET F string files
ROMPAT	FACTOR	2	Functional pattern generator for ROM testing
RAMPAT	FACTOR	2	RAM test pattern generator
ROMPONG	FACTOR	2	ROM access time testing aid

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