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A SOFTWARE SYSTEM ORIENTED TO FUZE TESTING (SOSOFT)

by

Donald A. Link

David J. Buscher

June 1970

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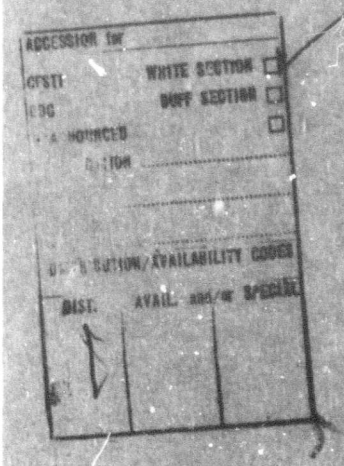

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ABSTRACT

Software techniques used in an automated real-time fuze testing system are discussed. Most of the techniques are independent of the electrical circuit being tested and the computer controlling the system. Although the software described was initially designed for testing the XM596 proximity fuze, only the actual fuze testing programs need be specifically designed for a given testing system. The programs comprising SOSOFT are functionally organized into eight major subsystems--real-time priority scheduling system, interrupt servicing system, input/output control system, executive utility system, basic testing system, data-display system, conversational control system, and reliability monitoring system.

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1. INTRODUCTION

The Software System Oriented to Fuze Testing (SOSOFT) is a collection of computer programs designed to provide a real-time capability for in-line and final testing of fuzes built on an automated assembly line. The system considered here was prepared specifically for the XM596 proximity fuze, employing a Varian Data 620/i digital computer.

The programs comprising SOSOFT are functionally organized into the eight major subsystems listed below.

(1) Real-Time Scheduling System--monitors time sharing of the computer's central processor on the basis of a user-defined priority scheme.

(2) Interrupt Servicing System--services hardware interrupts on a priority basis.

(3) Input Output Control System--monitors all input and output operations involving computer peripherals.

(4) Executive Utility System--provides various services required by more than one program, such as input/output operations involving non-computer hardware.

(5) Basic Testing System--conducts the individual fuze tests, processes the results, and makes decisions as to the immediate and long-term success of the assembly operation.

(6) Data-Display System--provides formatted output of statistical data and test results.

(7) Conversational Control System--monitors system communication with the operator on a real-time basis, allowing him to display and change many system parameters.

(8) Reliability Monitoring System--monitors conditions capable of decreasing system reliability and takes appropriate action when such conditions occur.

Except for subsystems 5, 6, and 8, SOSOFT is a generally applicable real-time data acquisition system. The following discussion keeps SOSOFT divorced from the Varian 620/i and the XM596 as much as possible. The techniques employed could easily be reproduced for a different digital computer; systems 5, 6, and 8 could easily be adapted to test a different fuze or a different electrical circuit. In addition, most of the hardware designed for the XM596 automatic fuze testing system could easily be adapted to another computer and testing of a different circuit.

Specific nomenclature used in this report is defined in appendices A through D--computer science terminology (p. 43), SOSOFT terminology (p. 47, abbreviations (p. 49), and SOSOFT program names (p. 51).

2. FUNCTIONAL DESCRIPTION OF SUBSYSTEMS

2.1 Real Time Scheduling System (RETI)

RETI serves as a programmed "answering service" and "traffic controller" for SOSOFT, servicing all calls made by other system programs which have requested control or release of control of the computer's central processing unit (CPU), and controlling the order in which these requests are honored. This order is dictated by a programmed-priority scheme designed by the system's user, whereby each of his programs is separately assigned a software priority, and control is allocated among these programs by applying this simple rule: the program of highest priority desiring control is given control of the CPU until (1) it releases control, or (2) it is no longer of highest priority. Programs of equal priority are given control on a first-come first-served basis.

The capability of scheduling programs subject to conditions existing apart from the computer (e.g., assembly line) is provided by a system of hardware priority interrupts. These interrupts provide the system with a real-time clock and a means for externally cueing programs into activity. These interrupts are serviced by the interrupt servicing system, but cognizance of their existence is essential in understanding RETI functioning.

The RETI can be separated into three main parts: (1) the active list, (2) the waiting list, and (3) the program information block.

2.1.1 Active List (AL)

The AL is a list of programs desiring control of the CPU, ordered according to program priority. The program of highest priority is first on the list, thus, referred to as head of the list.

2.1.2 Waiting List (WL)

The WL is a list of programs desiring control of the CPU after a specified delay time. The list is ordered on a first-come basis. The first and last programs on the list are of special importance and are referred to as the head and the end of the list, respectively.

After the specified delay has elapsed for a program, it is removed from the WL and placed on the AL commensurate with its priority.

2.1.3 Information Block (IB)

Each user-supplied program contains an ordered set of data required by RETI. This block of data is called its information block (IB) and contains the following:

(1) Program Number, a non-negative integer less than 32,768 assigned by the user as the program's reference number. Each program is assigned a unique program number.

(2) Program Priority, a non-negative integer less than 32,768 assigned by the user as the program's software priority, with a priority of 0 being lowest and 32,767 being highest.

(3) Initial Entry Point, the address where execution of the program initially begins. This entry point remains constant.

(4) Current Entry Point, the address where execution of the program will continue the next time the program is given control.

(5) Next AL Pointer, containing the first word address (FWA) of the IB of the next program on the AL--next, meaning of less than or equal priority. A value of -1 indicates that this program is last on the AL.

(6) Previous AL Pointer, containing the FWA of the IB of the previous program on the AL--previous, meaning of greater than or equal priority. A value of -1 indicates that this program is first on the AL.

(7) AL Entry Time, the time at which the program was added to the AL.

(8) Next WL Pointer, containing the FWA of the IB of the next program on the WL. A value of -1 indicates that this program is last on the WL.

(9) Previous WL Pointer, containing the FWA of the IB of the previous program on the WL. A value of -1 indicates that this program is first on the WL.

(10) Recall Time, the time at which the program is to be removed from the WL and returned to the AL.

(11) Stack, a contiguous group of memory locations where the contents of the computer's hardware registers and overflow (OF) indicator are saved upon interruption of the program's execution so that when execution continues at a later time, the hardware state of the CPU can be restored. This area is also called the program's STAK.

The location of each program's IB is contained in the information block entry table (IBET). IBET is ordered by program number, so that entry i is the first word address of program i's IB.

RETI has three pointers--HAL, HWL, and EWL--that contain the FWA's of the IB's of the programs occupying the head of the AL, the head of the WL, and the end of the WL. A value of -1 for any of these pointers indicates that the corresponding list is empty.

2.1.4 Sequence of Execution

RETI provides the following three basic schedular entry points that permit the system user to control program execution:

(1) $EXIT*--terminates calling program's execution,

(2) $AAL- adds a specified program to the AL, and

(3) $ALWL--transfers calling program from the AL to the WL with a specified delay.

These routines require four basic operations:

(1) Add a program to the AL (fig.1).

(2) Remove a program from the AL (fig. 2).

(3) Add a program to the WL (fig. 3).

(4) Remove a program from the WL (fig. 4).

Detailed flow charts showing how each of these operations is performed are shown in figures 1 through 4.

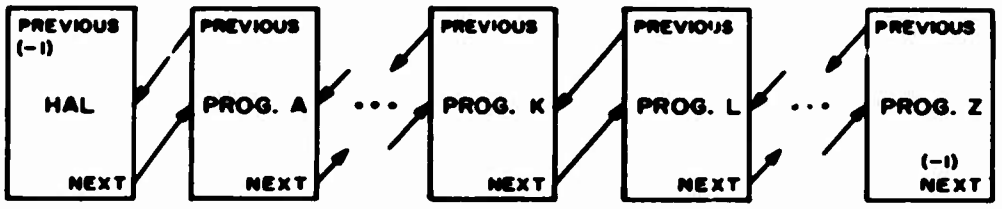
The normal sequence of execution for a user's program is as follows. The program is given control at its initial entry point. Every millisecond its control is temporarily interrupted by the hardware clock. During this interruption, the hardware state of the CPU is saved in the program's STAK, its current entry point is set to the point of interruption, the software system clock is incremented, and the WL is scanned, at periodic clock interrupts, for any programs whose requested delay has elapsed. If any such program is found, it is removed from the WL and placed on the AL, commensurate with its priority. If this program's

(continued on p. 17)

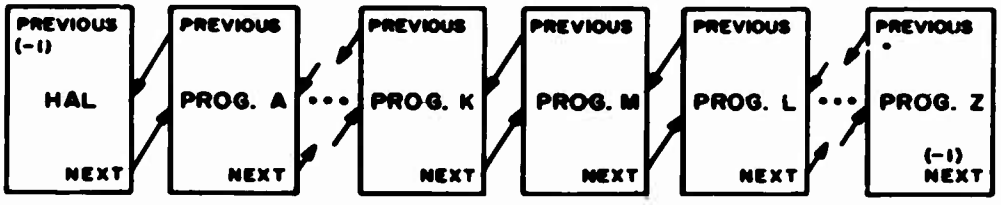
*To distinguish between SOSOFT executive programs and user-written programs, the names of executive programs are preceded by a $.

The following four diagrams illustrate the effect of adding programs to the Active List.

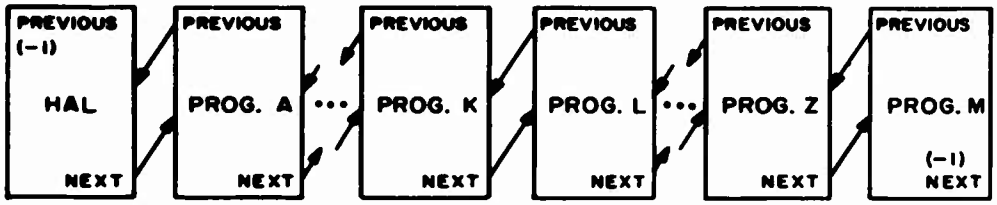
Assume that the AL appears as follows:



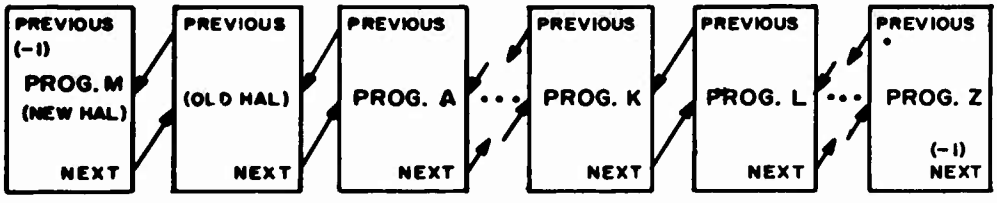
If program L is the first program on the AL whose priority is less than that of program M, program M's addition to the AL would change the AL as follows:



If program M's priority is less than or equal to the priorities of all programs on the AL, its addition to the AL would change the AL as follows:



If program M's priority is greater than HAL's priority, its addition to the AL would change the AL as follows:



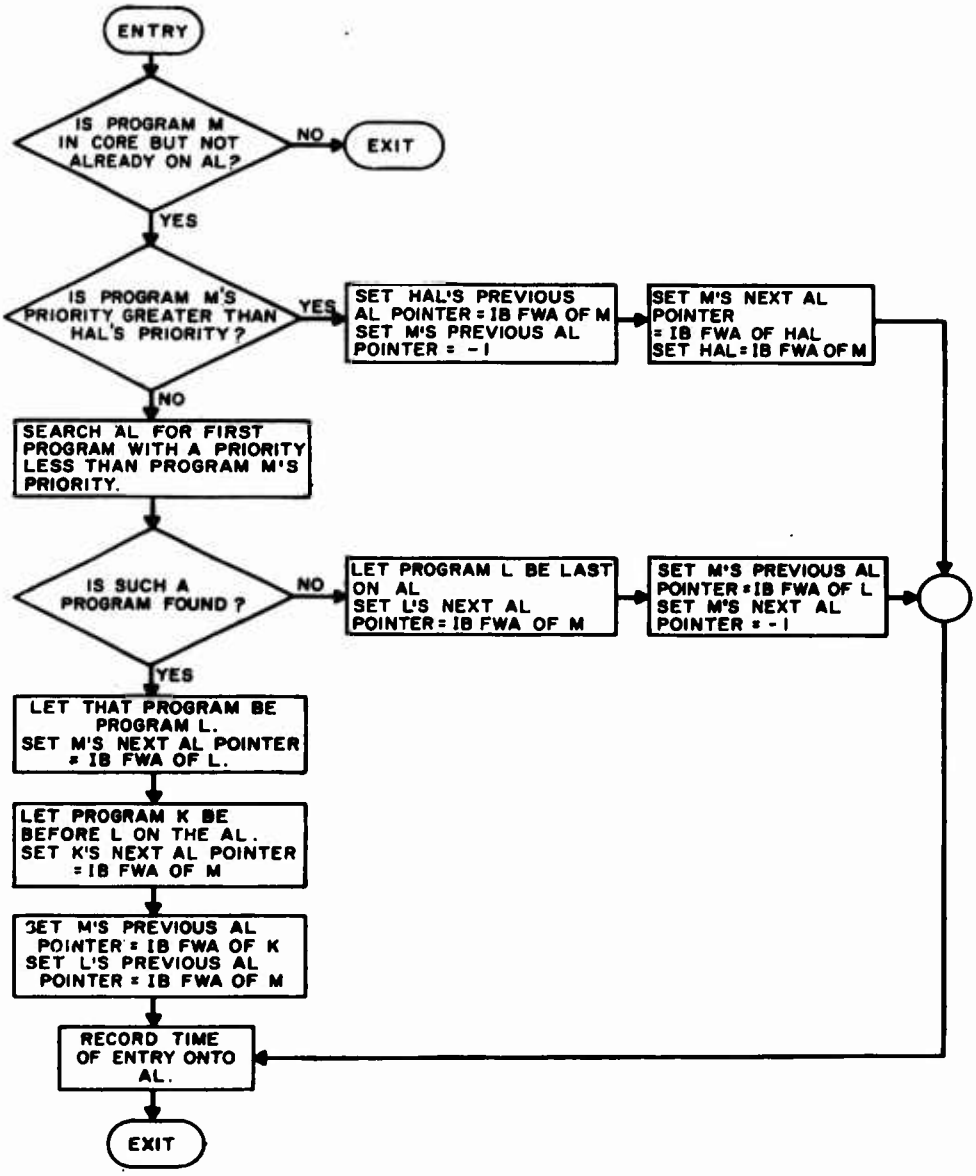


Figure 1. Addition of program M to active list.

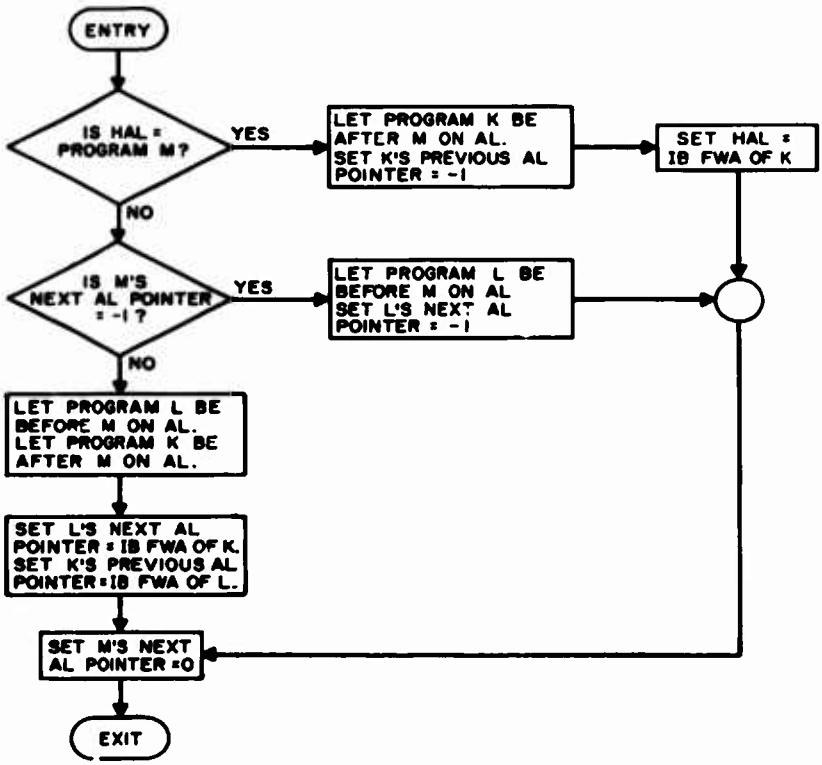


Figure 2. Removal of program M from active list.

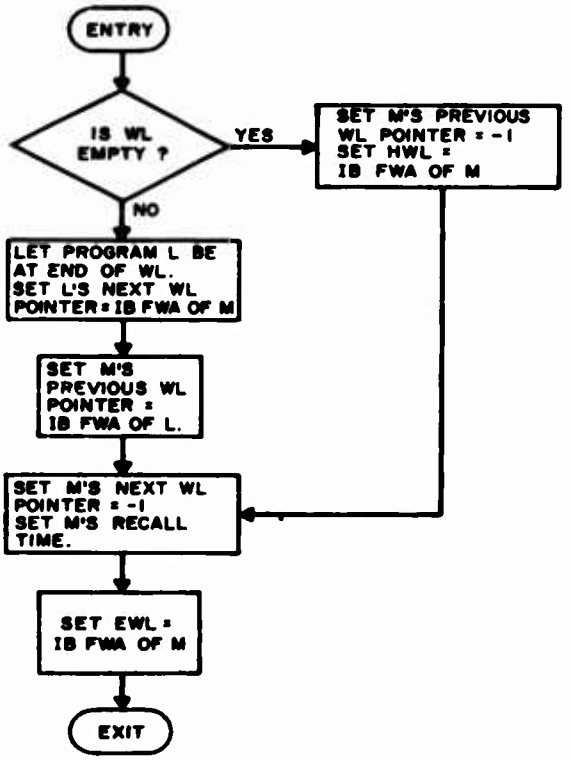


Figure 3. Addition of program M to waiting list.

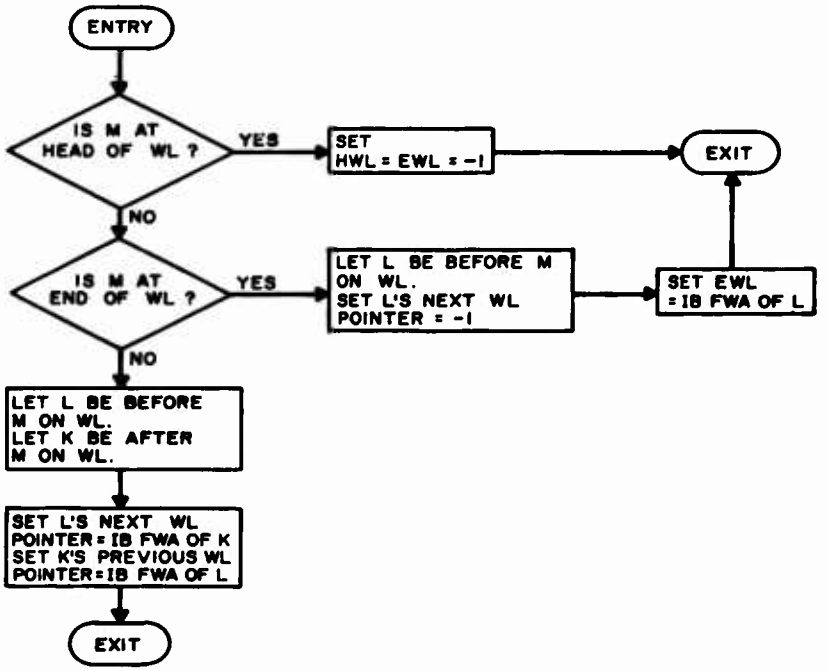


Figure 4. Removal of program M from waiting list.

priority is less than or equal to that of the interrupted program, control is returned to the interrupted program at the exact point of interruption with the registers and OF indicator reset as they were.

When the program has finished its execution, it executes an EXIT call to the system and is removed from the AL. Then control is given to the next program on the AL.

However, if the priority of the program being added to the AL is greater than that of the temporarily interrupted program, the new program will take control until it is finished, or until it loses control to another program of still higher priority.

If a program wishes to keep control unconditionally, it can increase its own priority, so that no other program in the system has a greater priority. Then as programs are added to the AL, they will necessarily be added after the program of highest priority. After the time for unconditional control has elapsed, the program can again lower its priority to the original value, allowing other programs to get control.

The exact manner in which the clock and other hardware interrupts are serviced is discussed in detail in section 2.2.

2.2 Interrupt Servicing System (ISSY)

ISSY is designed to service all hardware interrupts being employed by SOSOFT. The Varian 620/i is equipped with a set of eight priority interrupts in a single module called the PIM, and an independent power fail/restart interrupt. SOSOFT employs three of these nine interrupts for the following function in order of priority: (1) power fail/restart, (2) real time clock, and (3) test station scanner.

2.2.1 Power Fail-Safe Interrupt Processor ($PFL)

$PFL is designed to react to power failures in a manner that minimizes the amount of information lost or distorted. Immediately upon receiving a power-fail interrupt, $PFL saves the present hardware status and halts the computer. When a continue signal is received, the system programs are adjusted so that only the information concerning the fuzes being tested at the time of the power failure is lost, the hardware status is restored, and testing continues normally with the next fuze at each test position.

2.2.2 Real-Time Clock Interrupt Processor ($CIP)

$CIP processes clock interrupts which occur once every millisecond. Time is kept by incrementing a two-word counter in the computer's memory at each interrupt. At a specified time interval (specified by a system parameter), $CIP also searches the waiting list (WL) for any programs whose specified delay time has elapsed. If any such program is found, it is removed from the WL and added to the active list (AL), commensurate with its priority.

2.2.3 Test Station Scanned Interrupt Processor ($SIP)

The test station scanner periodically examines each test point on the assembly line to determine whether or not a new fuze has been automatically positioned there. If one has, the scanner stops, containing a count equivalent to the test point address and produces a priority interrupt. $SIP then inputs this count, converts it into the program number of the test program associated with that test point, and adds the associated program to the AL. In this way, test programs are externally queued onto the AL by way of the scanned interrupts.

When an interrupt is received, the associated processing program saves the status of the CPU and the address of the next instruction to be executed at the instant of the interrupt. Upon completion of processing, each routine restores the CPU status and returns control to the proper point in the interrupted program. Effectively, the interrupted program has no indication that it actually temporarily lost control of the computer.

Since most functions of system programs (those not assigned a program number and not containing an IB) are of high priority, these programs always disable the priority interrupts upon start of execution and reenable them upon completion of execution. For this reason, system programs have been designed to execute as rapidly as possible, to minimize the noninterruptible execution time of the system. As presently designed, all interrupts are acknowledged in less than 1 msec.

2.3 Input/Output Control System (IOCS)

IOCS is designed to provide SOSOFT users with a flexible, efficient means for accomplishing various input/output (I/O) tasks involving the 620/i computer peripheral equipment. This equipment consists of an ASR-35 teletype (TTY), a high-speed paper tape reader (PTR), a high-speed paper tape punch (PTP), and a line printer (LPR). For each type of I/O operation to be performed, IOCS provides a separate I/O driver. The available drivers are:

No. 0. TTY Character Input Driver ($TTI)

No. 1. TTY Character Output Driver ($TTO)

No. 2. PTR Character Input Driver ($PTI)

No. 3. PTP Character Output Driver ($PTO)

No. 4. LPR Character Output Driver ($LPO)

No. 5. Binary Input Driver ($BIN)

No. 6. Binary Output Driver ($BOT)

Character mode transfers involve 8-bit words in ASC II code. Binary-mode transfers involve 8-bit words in binary form.

Drivers are designed to perform complete I/O transfers of any length for the user. This frees the user's programs from the worry of controlling I/O devices and saves considerable memory by allowing many different programs to share the same drivers. The user needs only to specify the type of transfer to be performed and provide either the data to be output or a reserve buffer area into which data will be input. The driver will then independently perform the operation and notify the user when it has been completed. The user may elect to wait for completion, or to continue to run during the actual transfer.

IOCS provides a software interface between the user's programs and the I/O drivers, called the I/O controller ($IOC). $IOC processes all user requests for I/O transfers, determines which driver should be employed, checks that driver's availability, and sees that control is returned to the user at the specified time. To accomplish these functions, $IOC must be provided with two pieces of information:

(1) The logical unit number, and

(2) The recall mode.

2.3.1 Logical Unit Number

Since various devices can perform the same type of data transfer, it is sometimes useful for the user to specify the type of transfer he wishes to do, independent of device. However, in some instances the device used is of great importance. Both situations are serviced by the use of logical unit numbers.

A logical unit is simply a non-negative number to which the system has associated a particular I/O driver. This association is subject

to change by reprogramming or by program alteration during execution. As many logical units as desired can be defined. The actual associations are defined in the logical unit table ($LUT). The nth entry in this table contains the driver number associated with logical unit n. Hence, if entry 4 contains a 1, logical unit (LU) 4 specifies driver #1--the TTY character output driver. A user wishing to always perform character output to the teletype could specify that LU 4 always remain fixed at 1. However, if character output to the line printer would also be acceptable, LU 4 could be set at either a 1 or a 4. Then, depending on exactly how entry 4 in $LUT was set, a request for a data transfer involving LU 4 could result in character output to either the TTY or the LPR.

The logical unit approach to a driver designation also provides for shutdown of a device during execution. For example, if LU 1 is set to the line printer character output driver, and the line printer develops a malfunction, the system could be instructed to temporarily change LU 1 to an alternate driver, like the PTP character output driver, and the line printer develops a malfunction, the system could be instructed to temporarily change LU 1 to an alternate driver, like the PTP character output driver. In this way, output would be saved on an alternate medium, and could be transferred to the line printer at a later time. Alternatively, the LU 1 entry in $LUT could be set negative, which implies that LU 1 is an illegal designation. This would prohibit further outputs to the line printer until it is repaired at which time LU 1 could again be reset to the printer.

2.3.2 Recall Mode

$IOC provides two ways for the user to be recalled after requesting an I/O operation. The first is to activate the driver and immediately recall the user's program. This is called an immediate recall and is specified by a negative recall mode. The second is to wait until the requested I/O transfer has been completed and the driver has terminated its execution before recalling the user's program. This is called a terminate recall and is specified by a positive recall mode.

In addition to the logical unit and recall mode designations needed by $IOC, each driver needs information concerning the nature of the specific I/O transfer to be performed. All this information is stored in a particular order in the user's program and is collectively called a driver parameter block (DPB).

2.3.3 Driver Parameter Block (DPB)

A DPB contains all information needed by $IOC and the indicated driver to perform the specified I/O transfer. Since different

drivers may require different amounts and kinds of information, a DPB can vary in size and content. However, certain information must always be present in all DPB's. For this reason, the first five entries in a DPB are fixed in order and content as follows:

Entry 1--Logical unit number

Entry 2--Recall mode

Entry 3--Driver operation code

Entry 4--Status word

Entry 5--Buffer area FWA

The driver operation code indicates to the driver exactly what kind of transfer to perform. Each driver has its own set of legal operation codes.

The status word is used to indicate to the user's program the status of his requested transfer. Both $IOC and the drivers use this word to communicate with the user's program. The following status codes are currently employed:

0--Driver is busy processing the user's request.

1--Request has successfully been completed.

-1--I/O device involved in transfer has responded busy abnormally; transfer has been aborted.

-2--Indicated operation code (Op Code) is illegal.

-3--Logical unit designation or driver number is illegal.

The buffer area FWA contains the starting address of a storage buffer with data to be output or memory reserved for the input.

To request an I/O transfer the user need only call $IOC, indicating the FWA of the associated DPB, and a busy address to which $OIC will return control if the driver associated with the specified DPB is busy performing some other transfer (either for this or another user's program). In this way, the user's program can respond to a busy driver in any manner it wishes by specifying the required busy address. Figure 5 shows how $IOC processes I/O requests.

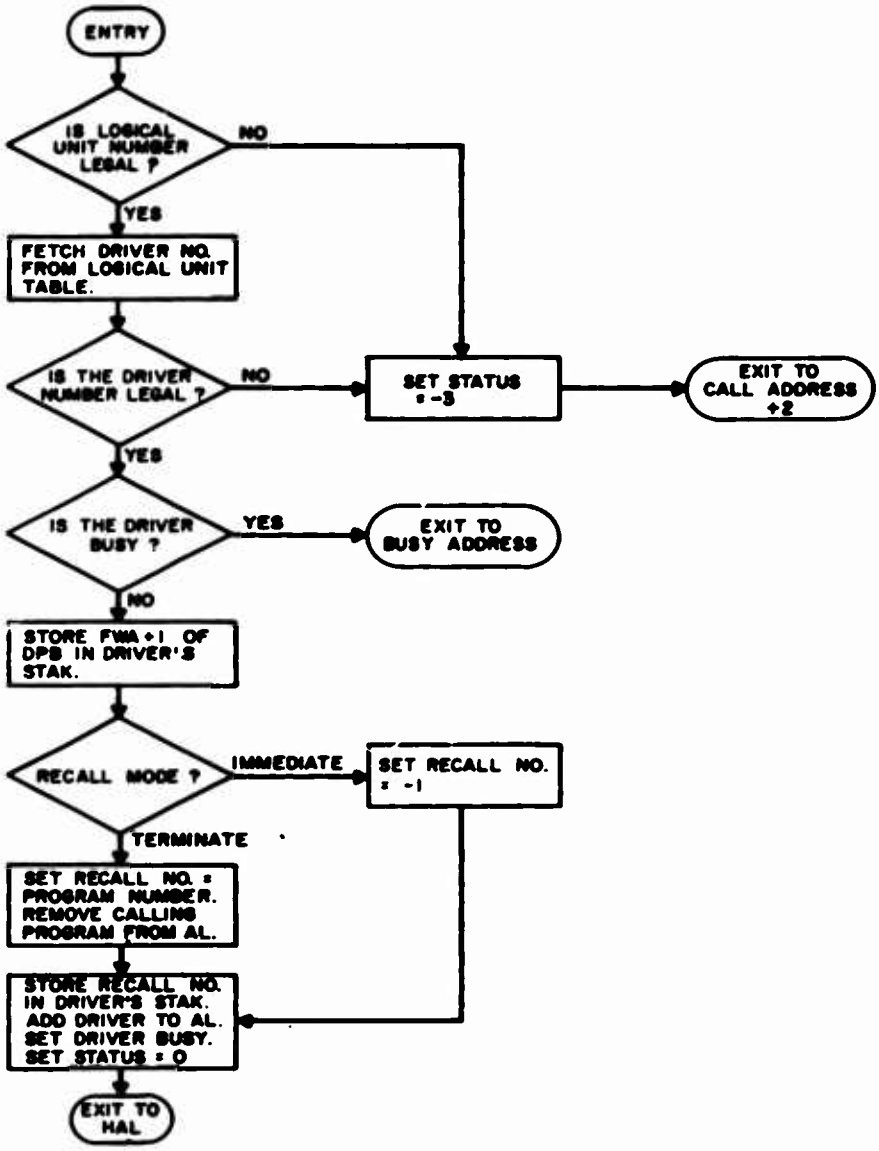


Figure 5. Input/output request processing.

$IOC uses the busy flag table ($BFT) to store the ready/busy status of each driver in order of driver number. When a driver is called into action, its flag is set busy; and when the driver terminates its action, its flag is reset to ready.

It is important to note that $IOC passes two pieces of information to the driver: the DPB FWA + 1, enabling the driver to have access to needed information concerning the requested transfer; and a recall number, which the driver will later return to $IOC. Upon completion of a transfer--successful or not--each driver calls the termination portion of $IOC, called $IOT, specifying its driver number and the recall number for the transfer just completed. $IOT then sets the driver not busy, removes it from the active list, and, if the recall number is positive (say n), recalls program n onto the active list--that is, it performs a terminate recall.

Following is a detailed discussion of each I/O driver currently employed by SOSOFT.

2.3.4 Teletype Character Input Driver ($TTI-#0)

$TTI inputs characters in ASC II code from the teletype keyboard and stores them in a user specified buffer area. On entry into $TTI, two hardware registers contain the recall number and the location of the DPB. These are saved in memory for later use. $TTI assumes that the DPB has the following format:

(1) Logical unit

(2) Recall mode

(3) Op code

(4) Status

(5) Buffer FWA

(6) Maximum number of words to transfer

Entry 6 indicates the maximum number of words the user wants input to his buffer. As soon as that number of words have been input, $TTI will stop the input and exit.

$TTI accepts two op codes. An op code of 1 indicates that the input characters should be stored two per word, with the first character in the left half of the word. An op code of 2 indicates that the input characters should be stored one per word, with the character in the right half of the word and zeros in the left half.

During the input process, certain characters are recognized as control characters and are not stored in the user's buffer; instead, these indicate special actions to the driver, itself. These characters and the associated actions are:

(1) RUBOUT - deletes all previous input, and requests new input.

(2) SEMICOLON - causes a return and line feed to be output to allow the input to continue on a new line.

(3) RETURN - terminates the input and causes the driver to exit.

$TTI always indicates its readiness to accept input by outputting a return, line feed, I, space, and bell to the TTY.

The status word is set as follows:

(1) If the input operation is successful, status = 1.

(2) If the TTY is found to be invalidly busy on output, status = -1.

(3) If the op code is other than 1 or 2, status = -2.

2.3.5 Teletype Character Output Driver ($TTO - #1)

$TTO outputs characters in ASC II code to the teletype from a user-specified buffer area. On entry, the recall number and DPB location are saved. The DPB is assumed to be in the following format.

(1) Logical unit

(2) Recall mode

(3) Op Code

(4) Status

(5) Buffer FWA

(6)*Number words to output

---

*Entry 6 is optional.

$TTO will output either a specified number of words or all words, beginning at the buffer FWA and up to the first word in the buffer containing all zeros. Also, a return, line feed output preceding the output of the buffer is optional. These options are specified by the user's op code as follows:

1 - Indicates to output from buffer until a zero word is found.

2 - Indicates to output the specified number of words from the buffer.

3 - Indicates same as 1, except to precede output with a return, line feed.

4 - Indicates same as 2, except to precede output with a return, line feed.

$TTO will properly output characters stored either 1 or 2 per word.

The status word is set as follows:

(1) If the output operation is successfully completed, status = 1.

(2) If the teletype is found to be invalidly busy. status = -1.

(3) If the op code is other than 1, 2, 3, or 4, status = -2.

2.3.6 Line Printer Character Output ($LPO - #4)

$LPO outputs characters in ASC II code to a line printer from a user specified buffer. On entry, the recall number and DPB position are saved. The DPB is assumed to be in the following format:

(1) Logical unit

(2) Recall mode

(3) Op code

(4) Status

(5) Buffer FWA, or repeat character

(6) Number of words to output, or repeat count (optional)

(7) Column in which to begin output (optional)

$LPO will output either a specified number of words from the buffer or will output until a word containing all zeros is found. If actual character output is specified by the user, the column in which that output should begin also needs to be specified. Output may or may not be preceded by a line feed. These various options and others are specified by the user's op code as follows:

1 - Indicates to output from buffer until a zero word is found, beginning at the specified column.

2 - Indicates to output the specified number of words from the buffer, beginning at the specified column.

3 - Indicates the same as 1, except output is preceded by a line feed.

4 - Indicates the same as 2, except output is preceded by a line feed.

5 - Indicates to output a top of form command to the printer.

6 - Indicates to output the repeat character (DPB entry #5) the specified number of times (repeat count), beginning at the specified column.

$LPO outputs characters stored either 1 or 2 per word. Each output is terminated with a carriage return, causing the printer buffer to be printed.

The status word is set as follows:

(1) If the output is successfully completed, status = 1.

(2) If the printer is found to be invalidly busy, status = -1.

(3) If the op code is other than 1-6, status = -2.

All drivers have been designed to perform data transfer at the maximum possible rate, by utilizing the SOSOFT waiting list to wait the correct time between characters as a function of device speed.

2.4 Executive Utility System (EXUS)

EXUS consists of all programs commonly used by various user programs. These are classified as system programs and, consequently, do not contain an IB or program number. As is true for all system programs, interrupts are also disabled during the execution of executive utility routines. EXUS consists of the following utility routines:

(1) $SAV - Saves CPU status and current entry point of HAL for the calling program.

(2) $RES - Restores CPU status of HAL and jumps to its current entry point.

(3) $TDP - Processes all data for the test system programs.

(4) $ADC - Inputs and processes a single analog-to-digital converter channel.

(5) $CWD - Outputs a control word to the testing system interface.

(6) $DIN - Inputs data from the testing system interface.

(7) $DIC and $SEN - Input data from the testing system's digital input channels and sense lines.

(8) $BUF and $REL - Output data to the testing system's buffered storage registers and reed relays.

(9) $SPO - Provides a software interface between user programs and the data display system.

(10) $TIME - Converts the current time to hours and minutes.

(11) $BCD - Converts binary numbers to ASC II code of any designated radix.

(12) $VCD - Converts an ADC input to ASC II characters representing volts, accurate to 20 mV.

(13) $SGN - Converts a binary number to a signed five-digit decimal number in ASC II code.

(14) $CAT - Performs necessary catastrophic failure procedures.

Following is a detailed discussion of each of these executive utility routines.

2.4.1 Utility Routine Number 1 ($SAV)

$SAV stores the contents of all hardware registers and the overflow indicator in HAL's IB, and sets HAL's current entry point to the contents of the entry point in the routine calling $SAV. Also, $SAV assumes that its caller's entry point is located two memory locations prior to the actual call to $SAV.

2.4.2 Utility Routine Number 2 ($RES)

$RES restores the hardware registers and overflow indicator from HAL's IB, and returns control to HAL's current entry point.

2.4.3 Utility Routine Number 3 ($TDP)

$TDP (test data processor) processes data for the testing system. The calling program must pass certain information to $TDP to aid in this processing. Of most importance is the raw data to be processed. In addition, the location of certain information required by $TDP must be provided. Given this information, $TDP

(1) Linearly calibrates the raw data as follows:

let S = specified system output with a + reference voltage as an input.

B = specified system output with a zero reference voltage as an input.

s = current system output with + reference as input.

b = current system output with zero reference as input.

d = raw data to be calibrated.

c = calibrated data,

then

$$c = \frac{(S-B) \times (d-b)}{(s-b)} + B .$$

(2) Resets certain lot-dependent data if the input represents the beginning of a new sample lot.

(3) Determines which cell within a frequency distribution the calibrated datum falls into, and increments the frequency count corresponding to that cell.

(4) Checks if calibrated datum falls within acceptable test limits--that is, it decides if datum passes or fails.

(5) Updates certain failure data, if the datum fails.

(6) Returns calibrated datum and a pass/fail indicator to the calling program.

2.4.4 Utility Routine Number 4 ($ADC)

$ADC inputs and processes a single reading of an ADC channel at one testing station. This is done by first outputting a control word to the station by calling $CWD, indicating that an analog-to-digital conversion is desired. Then $DIN is called to input the actual $ADC reading. If no processing is desired, $ADC returns the raw data to the calling routine; otherwise, $TDP is called to process the data, and $ADC returns the calibrated data to the calling routine.

If the input from the testing system interface does not occur properly, $ADC will return control to the calling program at a specified location, informing the caller that the ADC channel is responding busy. Also, if the input datum "fails" in $TDP, $ADC will return control to another specified location, informing the caller of this fact.

2.4.5 Utility Routine Number 5 ($CWD)

$CWD outputs control words to the testing system interface if possible. If the interface responds busy for longer than a specified time (presently 100 μsec), $CWD reacts by continually outputting an error signal to the operator. When the operator has taken the necessary corrective action, $CWD calls $CAT which sets all test system programs to restart at a special location, informing them that this catastrophic failure has occurred. If the interface responds ready within the specified time, the control word sent by the calling routine is output, and $CWD returns control to the caller.

2.4.6 Utility Routine Number 6 ($DIN)

$DIN inputs data from the testing system interface when possible. If the interface responds busy for longer than a specified time (presently 100 μsec), $DIN returns control to the calling routine at a special location, informing it of this error. Otherwise, $DIN inputs the data, and returns control to the calling routine.

2.4.7 Utility Routine Number 7 ($DIC or $SEN)

$DIC inputs data from a testing system digital input channel. This is done by outputting a control word via $CWD and inputting the data via $DIN. The testing system sense lines are a particular set of digital input channels.

2.4.8 Utility Routine Number 8 ($BUF or $REL)

$BUF outputs data to a testing system buffered storage register. This is done by outputting a control word containing the data via $CWD. The testing system reed relays are a particular set of buffered storage registers.

2.4.9 Utility Routine Number 9 ($SPO)

$SPO provides the means for user program communication with the data display system. The calling program informs $SPO of the nature of the data display desired. Then $SPO checks the status of the display system. If the system is ready to perform another display, $SPO passes the needed information to the system, and returns control to the calling program. If, however, the display system is busy processing a previous request, $SPO returns control to the calling program at a particular address, informing it that the request can not be processed at this time. The caller can then either continue with some other operation or can continue calling $SPO until the request is accepted.

2.4.10 Utility Routine Number 10 ($TIME)

$TIME converts the master clock (msec counter) into hours and minutes. This time is then added to the time in hours and minutes at which the system was initialized. The result is then returned to the user. The calculation is accurate to within 1 min.

2.4.11 Utility Routine Number 11 ($BCD)

$BCD converts a user-specified binary number to ASC II code. The number of digits and the radix of the result are user specified. The result is stored two digits per word. If the number of digits desired is odd, one word will contain a single digit in one half and zeros in the other half.

Since $BCD is employed by the data display system to convert frequencies, which are biased by -32,768, the user can specify that the number to be converted is so biased. Unbiased numbers can result in values from 0_{10} to $32,767_{10}$. Biased numbers can result in values from 0_{10} to $65,535_{10}$. Unsignificant leading digits are set to zeros.

2.4.12 Utility Routine Number 12 ($VCD)

$VCD is used to convert analog-to-digital converter inputs to ASC II code, representing the input in volts, accurate to 20 mV. The result of the conversion is three words of the form ±DD.DD, where D is a single decimal digit. Positive voltages are preceded by a space. Negative voltages by a minus sign. The range on inputs is 0_8-1777_8; the corresponding range on converted values is -10.24 to 10.22 V.

2.4.13 Utility Routine Number 13 ($SGN)

$SGN is used to convert a user specified binary number to a signed five-digit decimal number in ASC II code. This routine uses $BCD.

2.4.14 Utility Routine Number 14 ($CAT)

$CAT is called to handle any catastrophic failure action. It sets all current entry points of test programs on the Active List to their corresponding fail reentry points.

2.5 Basic Testing System (BATS)

The SOSOFT subsystem that controls the fuze testing operation is BATS. At various points along the assembly line, test points have been set up for in-line testing in addition to the final testing point. Each in-line test position and the final test are controlled by a separate test program. The present system incorporates three in-line test points. The associated programs are called test programs 1 through 3. The final testing program is called test program 4.

Each test program is user defined and, therefore, contains an information block (IB). The program priorities for the test programs have been set to the same value, which is higher than that of any other user program. Thus, the test programs are of highest priority within the SOSOFT system.

A scanned interrupt from a testing station signifies that the next fuze is now in position for testing. In response to this interrupt, the scanned interrupt processor adds the needed test program to the Active List. Once given control, the test program performs the required tests for the fuze at its position.

The basic operations of a test program are to:

(1) Update calibration factors,

(2) Perform required tests, input and process results,

(3) Provide the operator with visual indications of test results,

(4) Reject fuzes under specified conditions, and

(5) Stop the assembly process upon detection of certain errors.

The system operator has some control over which of these operations are performed via the recycle switch located at each test position.

2.5.1 Update Calibration Factors

At the start of each test sequence, the test programs update the calibration factors for each calibrated test parameter. This consists of applying zero and plus reference voltages to the circuit to be tested, and inputting the corresponding output voltages. These outputs, called the current offset and the current plus reference output, are stored in the test-data blocks to be checked against restriction values by the background program. They are also used by $TDP in calibrating analog inputs. Calibration factors are updated regardless of the state of the recycle switch.

2.5.2 Perform Tests, Input and Process Results

In general, tests require the application of various analog signals to the fuze. This is accomplished by certain executive utility routines that allow the test programs to program buffered

storage registers controlling the analog sources. Test results are input in digital form from either a digital input channel or an analog-to-digital converter. This input is accomplished via EXUS. As data is input, test programs may employ $TDP to process it. In most instances, this greatly reduces the burden on the test program. With the recycle switch in the recycle position statistical test data is not accumulated by the program.

To process test results and accumulate statistical data, certain parameters are required by the test programs. These parameters, along with all test statistics, are grouped into data blocks (DB's). Each testing position, as well as each individual test, requires its own DB. These DB's also include information required to perform the remaining three test program basic operations. The DB contents and organization follow:

Test Position Data Block---This DB contains information at the fuze level. It contains both test parameters and statistical data.

Parameters:

(1) Number of fuzes comprising a sampling lot.

(2) Number of rejects allowed per sampling lot.

(3) Real-time data display flag.

Statistical Data:

(1) Total number of fuzes tested.

(2) Total number of fuzes rejected.

(3) Total number of machine stops.

(4) Correlational rejection data.

Individual Test Data Block.---This DB contains information at the individual test level. It contains test parameters and statistical data.

Parameters:

(1) Minimum acceptance limit.

(2) Maximum acceptance limit.

(3) Number of consecutive test failures allowed.

(4) Gain and offset calibration restriction values.

(5) Automatic statistical display frequency.

(6) Number of intervals in each frequency distribution.

(7) Lower limit of each frequency distribution.

(8) Upper limit of each frequency distribution.

(9) Interval width of each frequency distribution.

Statistical Data:

(1) Total number of test failures.

(2) Number of test failures during this sampling lot.

(3) Number of consecutive test failures.

(4) Gain and offset calibration factors.

(5) Frequency distribution for all test results in the previous sampling lot.

(6) Frequency distribution for all test results in the current sampling lot.

(7) Cumulative frequency distribution for all test results.

(8) Individual failing readings for the current sampling lot.

2.5.3 Provide Operator with Visual Indications of Test Results

Visual indications of test results are of two kinds--printed information and indicator lights. The printed information is displayed on either the line printer or the teletype. The indicator lights are part of the basic test station console at each test position.

Indicator Lights--Associated with each fuze test is a single pass/fail indicator, illuminated if the test is passed and extinguished if the test is failed. In addition, each test position has a reject indicator which is illuminated if the fuze just tested

is rejected. The major purpose of these indicators is to serve as error flags for the quality assurance (QA) engineer should the assembly process be stopped due to some error condition. The indicators are activated regardless of the position of the recycle switch.

Printed Information--There are three kinds of printed information that can be provided by a test program. These are:

(1) Statistical display of the test position data.

(2) Statistical display of an individual test's data.

(3) Real-time individual test results.

The statistical data displays are provided automatically at a specified frequency ranging from every 50 fuzes to every 30,000 fuzes as specified by the operator. It is noted here that these displays can be produced upon demand at any time, by using the conversational control system. The details of these displays are discussed in section 2.6.

The real-time test results are a single line of output presenting the test readings in volts on a per fuze basis. For test results not measured in volts, some other indication of the result is presented. This output provides the QA engineer with immediate feedback as to the condition of test results. The output is optional for each test position and can be selectively initiated and terminated by the operator via the conversational control system. Real-time output is produced when requested regardless of the position of the recycle switch.

2.5.4 Reject Fuzes under Specified Conditions

Each test program has the capability of rejecting fuzes under certain specified conditions. Associated with each of the individual tests performed by the program is a pass/fail criterion, which usually means simply a minimum and maximum acceptable reading. In most instances, the failure of any such test indicates that the fuze should be rejected. When the decision to reject a fuze has been made, the program lights the fuze-reject indicator at the test console and activates the fuze-reject punch. This punch physically alters the fuze so that no additional components will be added by other assembly machines. Once rejected a fuze will not be tested at any of the remaining test positions on the line.

2.5.5 Stop-Assembly Process upon Detection of Certain Errors

If certain error conditions are detected by the test program, it can bring the associated assembly machine to a halt. When this is done, a machine-fail light is activated to indicate that the machine has been stopped. In addition, a statistical data display for all failing tests will be published, with an indication of why the machine was stopped. The combination of the printed data and indicator lights affords the QA engineer a powerful diagnostic tool for quickly isolating and remedying the cause of the failures. When the recycle switch is in the recycle position, error conditions are not acted upon.

Presently, four types of errors can produce a machine stoppage:

(1) If the reject rate for a single sample lot exceeds a specified value;

(2) If the number of consecutive failures for any individual test exceeds a specified value;

(3) If a piece of hardware at the basic test station responds busy; and

(4) If the tests to be made are not completed prior to probe opening.

Following is a description of the tests performed at each of the four test positions.

Test Position 1 (Probe 1)---At this position three fuze parameters, current, oscillator emitter voltage, and rf power are measured via an analog-to-digital converter (ADC) at test station one.

Test Position 2 (Probe 2)---At this position three fuze parameters--current, voltage at pin 6 of the integrated circuit, and fuze sensitivity are measured. The current and voltage are obtained via an ADC and the sensitivity is obtained from a digital input channel containing the peak-to-peak voltage that caused a firing pulse in the fuze. A dummy value of 40.96 V is entered into the sensitivity data block if no firing pulse occurs.

Test Position 3 (Probe 3)---At this position three fuze parameters--current, arming time, and modulation amplitude are measured directly; and one parameter, fuze noise rejection, is tested on a go/no-go basis. The current and modulation amplitude are measured via an ADC. The arming time is obtained from a digital input channel containing the time in milliseconds from fuze turn on and application of

a firing signal until the first firing pulse. If the fuze does not fire, a dummy arming time value of 2048 msec is entered into the arming time DB. The noise rejection test is a go/no-go test, but only one signal level is used. A noise signal is coupled to the fuze power supply, and the criterion for passing the test is that the fuze shall not fire. Determination of firing is from a digital input channel.

Test Position 4 (Final Test Chamber)---The final test position consists of two test chambers that test fuzes alternately. One chamber tests a fuze while the other is being loaded with the next fuze to be tested. Fuze current, rf power, and fuze sensitivity are measured on every fuze, and arming time and noise rejection are measured on a sample basis. Current and power are measured via an ADC, and sensitivity, via a digital input channel containing the peak-to-peak amplitude of the fuze firing voltage. A dummy value of 40.96 V is entered into the sensitivity data block if no fire pulse occurs. Arming time and noise rejection are measured at a sampling interval determined by the user and entered into the testing system via the conversational control system. Arming time is obtained from a digital input channel that contains the time in milliseconds from fuze turnon and application of a firing signal until the first firing pulse. If there is no firing pulse, a dummy arming time of 2048 msec is entered into the arming time DB. The noise rejection test is a go/no-go test in which the fuze shall not fire if a given noise signal is coupled to the fuze power supply voltage. Determination of firing is from a digital input channel.

A typical flow chart of a testing system program appears in appendix E. This chart shows the testing and decision sequence of the testing system program, which performs the tests at test position 3.

2.6 Data Display System (DADS)

The data display system (DADS) controls all formatted output of statistical data stored by the basic testing system. The output consists of three major sections: (1) the heading, (2) the station data, and (3) the parameter data.

2.6.1 Heading

The data display heading includes the date and time of output, the number of the probe for which data are being displayed, and a preamble informing the operator of the purpose for the output and the test parameter whose data are being displayed.

2.6.2 Station Data

Three cumulative frequencies are displayed as part of the station data. They are (1) the total number of fuzes tested at the station, (2) the total number of fuzes rejected at the station, and (3) the total number of computer-initiated assembly machine stops at the station. In addition, certain correlation data is displayed. These data are frequencies of occurrence of combinations of test failures. The combinations vary from station to station.

2.6.3 Parameter Data

Three formats are used to display parameter data: (1) for voltage measurements, (2) for time measurements, and (3) go/no-go measurements such as noise immunity.

Voltage Measurement Format---The first part of the output presents failure information--(1) the total number of fuze failures of the test, (2) the number of fuze failures within the present sampling lot, (3) the number of consecutive fuze failures of the test, and (4) the failing readings for the present sampling lot (limited to 20 readings).

The second part of the output presents three frequency distributions of the test readings: (1) for the present sampling lot, (2) for the entire previous sampling lot, and (3) for representing the cumulative distribution over a period of up to a month. Frequency of occurrence and percent of total within each voltage interval are displayed.

The last part of the output presents the acceptance limits presently being used for the test. These consist of a maximum and minimum acceptable voltage reading.

Time-Measurement Format---The time format is much the same as the voltage format except that the unit of measurement is milliseconds rather than volts. However, the calibration factors are meaningless and will always display a gain of +1.000 and an offset of 0.00.

Go/No-Go Measurement---Part I of the data is the same as that for the other two formats, except that failing readings for the present sampling lot are not displayed. Instead, the number of failures of the test are presented for the present sampling lot, the previous sampling lot, and a cumulative total. Where possible, the kinds of failures have been separated into high and low failures. Parts II and III are meaningless; and, hence, are not displayed.

Appendix F contains examples of each of the three types of data display.

2.7 Conversational Control System (CCS)

The conversational control system (CCS) allows an operator with a valid "password" to communicate with SOSOFT on a real-time basis via the teletype keyboard. Through CCS, the operator is able to control certain system functions, and display and change selected system parameters.

2.7.1 Controllable System Functions

The following system functions can be controlled by the operator:

(1) The addition or deletion of test programs from the system by changing the proper entry in the IBET table;

(2) Output of real-time data from each test program independently initiated and terminated;

(3) Output of statistical data displays for individual tests;

(4) Output of the contents of all test station data blocks onto paper tape via the high speed or teletype punch, to permit day-to-day update of data;

(5) Verification of binary tapes via parity and checksum validation on the high-speed or teletype reader;

(6) Resetting cumulative data in the test station DB's to initial values;

(7) Stopping assembly machines under computer control for end-of-day shutdown;

(8) Re-initialization of the system at any time; and

(9) Output of calibrations factors being used for each calibrated parameter.

2.7.2 Displayable Parameters

The system parameters that can be displayed and changed by the operator are:

(1) The size and reject rate of a production sample lot;

(2) The frequency of full tests at the final test station;

(3) The number of consecutive rejects allowed for each parameter tested;

(4) The minimum and maximum acceptance limits for each parameter tested;

(5) The specified system offset and plus reference output for each calibrated parameter.

(6) The interval at which automatic statistical data displays are published for each parameter tested.

(7) The contents of the logical unit table, allowing on-line change of certain I/O device uses.

The fuze testing continues uninterrupted during the request and implementation of any of the above CCS functions.

In addition to the above operator actions, CCS allows the development programmer to cue the system on-line debug program into action, allowing him to selectively execute his program and alter it as needed. This appreciably speeds up the debugging of additions or alterations to the SOSOFT programs.

2.8 Reliability Monitoring System (REMSY)

REMSY, consisting only of the background program, monitors the reliability of analog measurements being made by SOSOFT. This is accomplished by comparing the current calibration factors for each analog channel with their corresponding restrictions. If a factor extends beyond the acceptable range, a calibration failure has occurred. This failure stops the associated assembly machine, illuminates the associated calibration fail light at the test station, and prints a message on the teletype indicating the type and location of the fail.

Each time a test program updates calibration factors, it sets a flag notifying REMSY to check the new factors. As long as the factors remain within the specified limits, the SOSOFT calibration technique employed in $TDP will correct for drifts in the system hardware involved in analog mea.urements.

3. CONCLUSIONS

The software described in this report was initially formulated in conjunction with the testing system for the XM596 40-mm grenade proximity fuze. However, the software has been designed so that only

the actual fuze testing programs need be specifically designed for a given testing system. All executive- and service-type programs in the software are of a general nature and can be used, with little or no modification, in any generalized fuze testing system. For a specific example of the type of software system described herein, see appendix G. This appendix contains a symbolic listing of the software written for the Varian 620/i computer, which is used in the testing of the XM596 proximity fuze.

APPENDIX A

GLOSSARY OF COMPUTER SCIENCE TERMINOLOGY

Address	Numeric representation of the location of a word in memory.
ASC II Code	American Standards 8 bit character coding scheme used for punched paper tape.
Binary	Meaning two, as in the binary number system.
Binary Code	Punched paper tape code consisting of eight binary bits, to be interpreted as a single binary number between 0_8 and 377_8. This code can be used to represent a 16-bit memory word as 2 binary frames.
Bit	A single binary digit, either 0 or 1.
Buffer	Contiguous area in memory either containing data or reserved for incoming data.
Call	The act of temporarily transferring control to another program. The group of operations necessary to do this is termed a "call," also.
Central Processing Unit	The portion of a computer that performs the logical and arithmetic operations necessary to correctly execute each computer instruction.
Checksum	Error detection technique using the arithmetic or logical sums of a group of codes. If the checksum computed for such a group during the load phase is found to differ from that computed during the dump phase, it is said to have a checksum error.
Debug	Process of checking and correcting program execution.
Driver	A special program designed to control the operation of a single peripheral device.
Entry Point	Location at which the execution of a program begins.

Execution	The process of performing the functions necessary to complete a desired operation within the computer. Both single instructions and entire programs are said to be "executed."
First Word Address	The address of the first location of some logical arrangement of memory locations--either a program, or an information table.
Hardware	Any piece of equipment.
In-Line Testing	Testing performed at points along the assembly line without requiring the removal of the object under test from the line.
Interface	Either a hardware or software "go-between" connecting two or more separate modules.
Interrupt	A signal within the computer signifying that the present operation should be temporarily interrupted as soon as possible to allow recognition of some other important occurrence. Interrupts produced within the computer are termed internal interrupts, while those produced apart from the computer are termed external interrupts. Usually, when more than one interrupt can occur within a single computer, each interrupt is assigned a priority, signifying which of a group of simultaneous interrupts should be processed first. This type interrupt structure is termed a priority interrupt structure.
Memory	A collection of binary-state components arranged in a logical fashion and capable of storing binary numbers of fixed length. The memory is organized into words, each word containing a fixed number of binary bits.
Module	An independent piece of hardware or software that becomes an integral part of a system when logically connected with other modules.
Octal	Number system with a base of 8.
Online	Applies to all operator actions performed under computer control.

Overflow Indicator	A binary indicator that signifies whether or not the result of an arithmetic operation was beyond the range of numbers capable of being represented in a single register.
Parity	A single-bit error-detection technique. Usually, a coded word is designed so that the number of binary bits set to 1's is always either odd or even. When this is the case, any code found to deviate from this rule is said to have incorrect parity.
Peripherals	Those pieces of equipment that can operate under computer control but are not physically a part of the computer.
Pointer	A special location in the computer memory containing the address of some other location. The former is said to point to the latter.
Priority	A quantitative assignment of a position within a hierarchical structure.
Program	A set of computer instructions designed to perform a specific task.
Queue	A linear list for which all insertions are made at one end of the list; all deletions (and usually all accesses) are made at the other end.
Real Time	A time measurement with respect to the physical world. In general, the term is used to signify that certain actions taking place within the computer must meet time constraints imposed on them by other actions taking place apart from the computer.
Register	A set of binary-state components capable of storing a binary number of fixed length. Registers are employed to perform most logical and arithmetic operations within the computer's CPU.
Routine	Program.
Scanner	Hardware device for alternately interrogating the status of a group of other hardware devices

Software	Programs used to dictate certain computer functions.
Time Sharing	The simultaneous employment of a single central processing unit by many independent users. The CPU's time is shared among all the users desiring control at any instant.
Word	A collection of binary bits residing at a particular address within the computer's memory. In the case of the Varian 620/i, a word contains 16 binary bits.

APPENDIX B

GLOSSARY OF SOSOFT TERMINOLOGY

1.	Active List (AL)	-	Pointer-linked list of user programs desiring control of the central processing unit.
2.	Busy Address	-	Special return address from a subroutine that is used if the software or hardware to be employed is busy.
3.	Control Word	-	Specially formatted 16-bit data word containing control information for the test station interface.
4.	Data Block	-	Set of information in each test program containing testing parameters and statistical data for each test performed.
5	Data Parameter Block	-	Set of information used by the input/output control system to process I/O requests.
6.	Information Block	-	Set of data containing information for user programs for use by SOSOFT.
7.	Information Block Entry Table	-	Contains first word addresses of each user program in order of program number.
8.	Master Clock	-	Double precision software clock recording number of clock interrupts received.
9.	Scanner	-	Hardware device that interrogates basic test stations as to their fuze-ready status.
10.	STAK	-	Portion of information block containing current hardware status for user program.
11.	System Program	-	A noninterruptible executive routine performing a single function. These programs do not contain an information block and are not handled according to a priority structure.

12. User Program - Independent program prepared for use within the SOSOFT priority structure. These programs contain an Information Block; and each is assigned a unique Program Number.

13. Waiting List (WL) - Pointer linked list of user programs desiring control of the central processing unit after a specified time delay.

APPENDIX C

ABBREVIATIONS

1.	ADC	-	Analog-to-Digital Converter
2.	AL	-	Active List
3.	BATS	-	Basic Testing System
4.	$BFT	-	Busy Flag Table
5.	CCS	-	Conversat'onal Control System
6.	CPU	-	Central Processing Unit
7.	DADS	-	Data Display System
8.	DB	-	Data Block
9.	DPB	-	Driver Parameter Block
10.	EWL	-	End of Waiting List
11.	EXUS	-	Executive Utility System
12.	FWA	-	First Word Address
13.	HAL	-	Head of Active List
14.	HWL	-	Head of Waiting List
15.	IB	-	Information Block
16.	IBET	-	Information Block Entry Table
17.	I/O	-	Input/Output
18.	IOCS	-	Input/Output Control System
19.	ISSY	-	Interrupt Servicing System
20.	LPR	-	Line Printer
21.	LU	-	Logical Unit
22.	$LUT	-	Logical Unit Table

23.	MACK	-	Master Clock
24.	OF	-	Overflow Indicator
25.	PIM	-	Priority Interrupt Module
26.	PTP	-	Paper Tape Punch
27.	PTR	-	Paper Tape Reader
28.	QA	-	Quality Assurance
29.	RELS	-	Reliability System
30.	RETI	-	Real Time Priority Scheduling System
31.	SOSOFT	-	Software System Oriented to Fuze Testing
32.	TTY	-	Teletype
33.	WL	-	Waiting List

APPENDIX D

SOSOFT PROGRAM NAMES

1.	$AAL	-	Adds Programs to Active List
2.	$ADC	-	Analog-to-Digital Converter Input Program
3.	$ALWL	-	Transfers Programs from Active List to Waiting List
4.	$BCD	-	Binary-to-ASC II Converter
5.	$BIN	-	Binary Input Driver
6.	$BOT	-	Binary Output Driver
7.	$BUF	-	Buffered Storage Register Output Program
8.	$CAT	-	Catastrophic Failure Routine
9.	$CIP	-	Clock Interrupt Processor
10.	$CWD	-	Control Word Output Program
11.	$DIC	-	Digital Input Program
12.	$DIN	-	Input from Interface Program
13.	$EXIT	-	Program Termination Processor
14.	$IOC	-	Input/Output Controller
15.	$IOT	-	Input/Output Termination Processor
16.	$LPO	-	Line Printer Output Driver
17.	$PFL	-	Power Fail/Restart Interrupt Processor
18.	$PTI	-	Paper Tape Input Driver
19.	$PTO	-	Paper Tape Output Driver
20.	$REL	-	Reed Relay Output Program
21.	$RES	-	Hardware Status Restore Program

22. $SAV - Hardware Status Save Program

23. $SEN - Sense Line Input Program

24. $SGN - Signed, Decimal ASC II Converter

25. $SIP - Scanned Interrupt Processor

26. $SPO - Summary Printout Program

27. $TDP - Test Data Processor

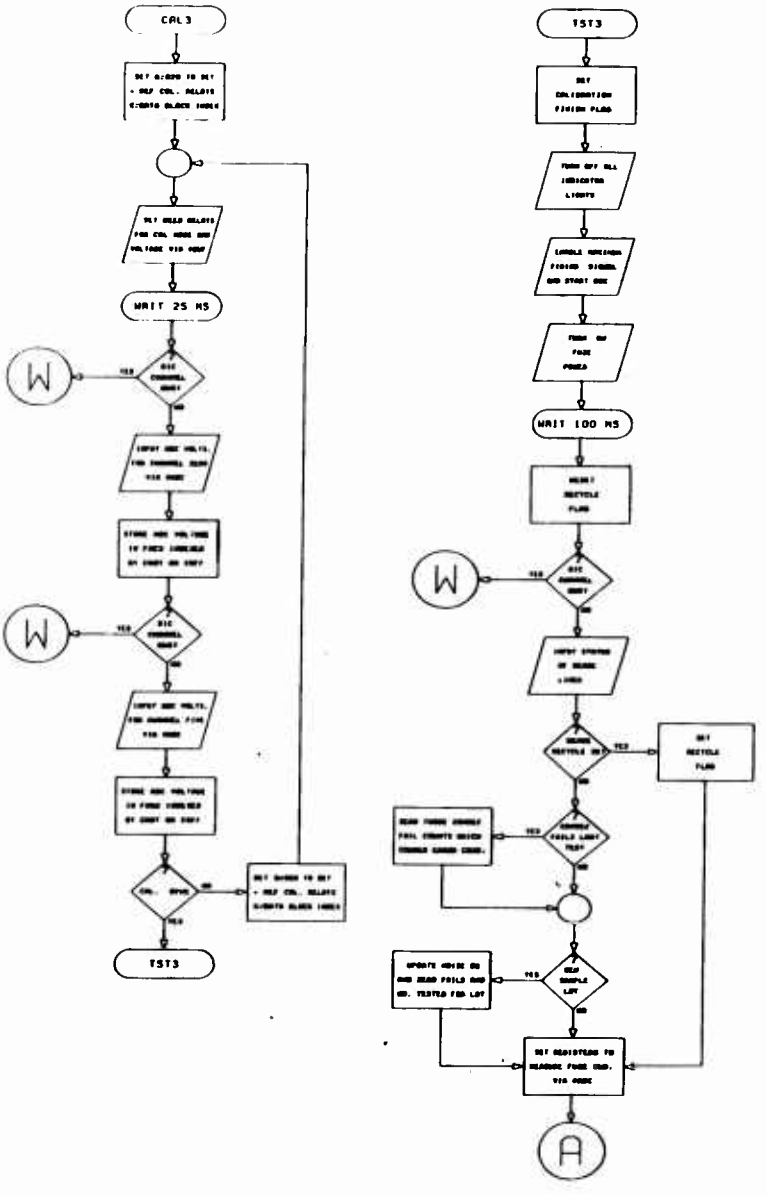
28. $TIME - Current Time Computation Program

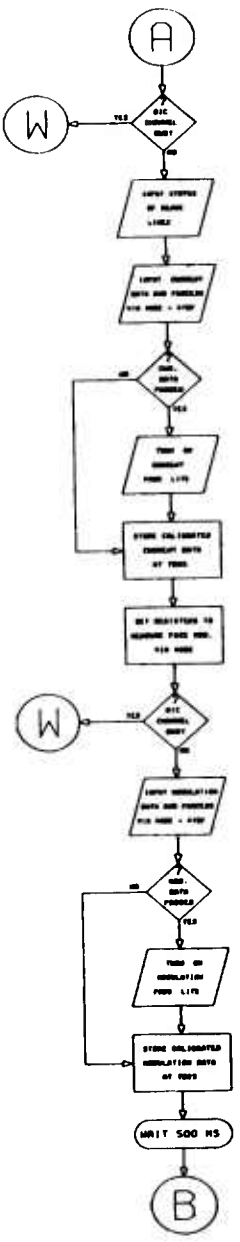
29. $TTI - Teletype Input Driver

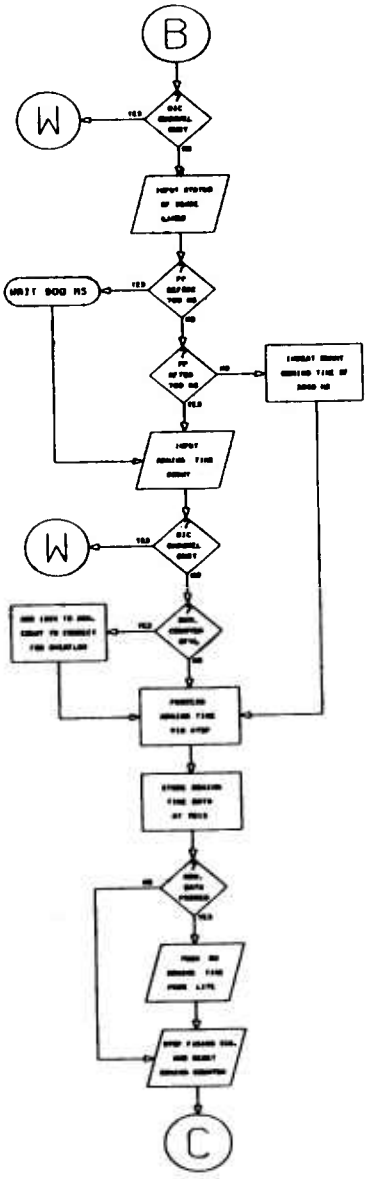
30. $TTO - Teletype Output Driver

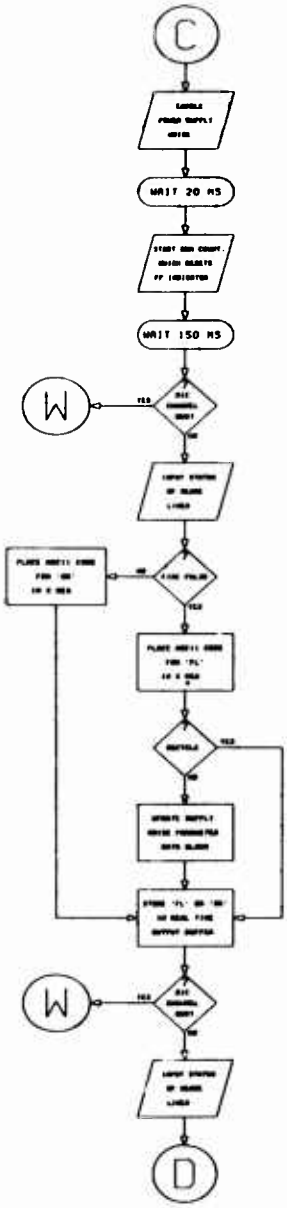
31. $VCD - Voltage-Reading-to-ASC II Converter

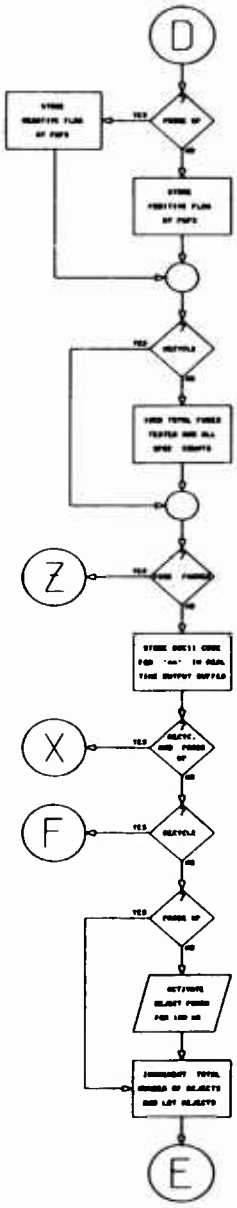
Appendix E. Test Program Flow Chart

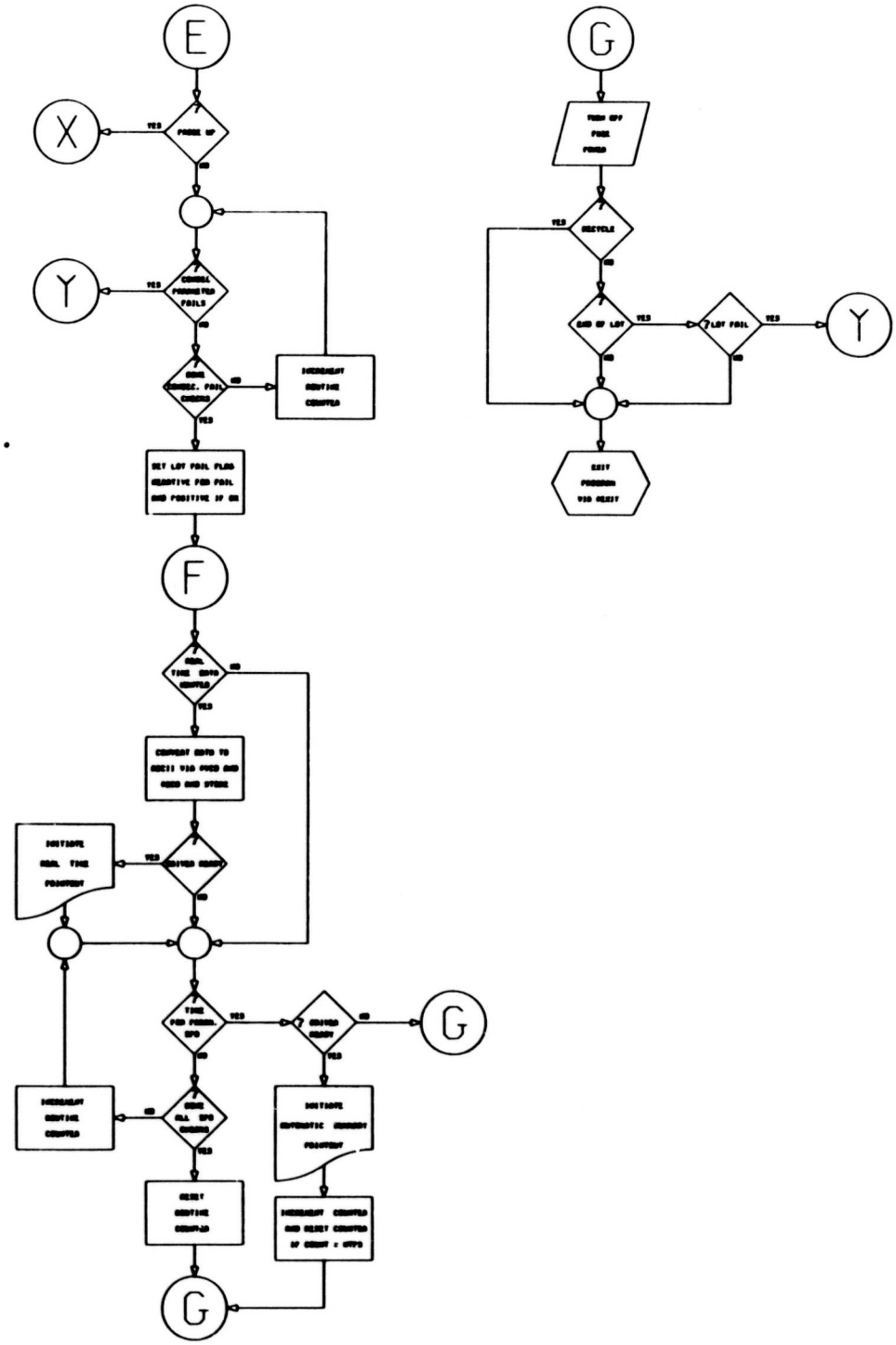


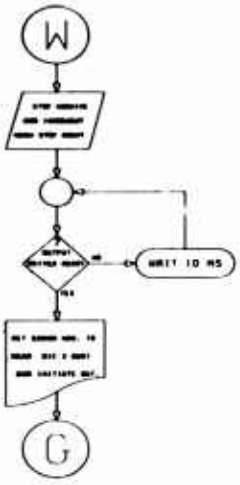

A
W
B

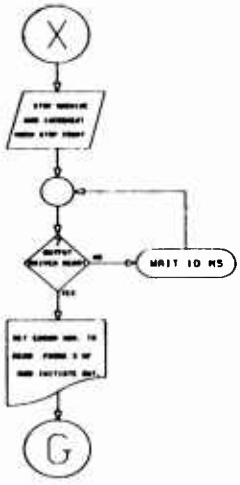

B
W
WAIT 900 MS
W
C

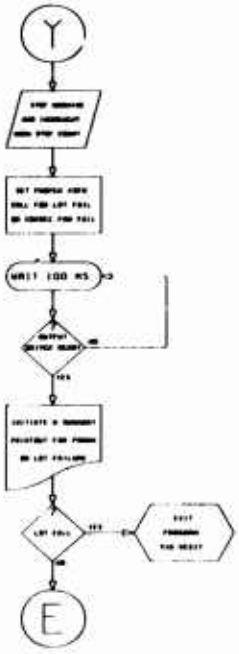

C
WAIT 20 MS
WAIT 150 MS
W
W
D

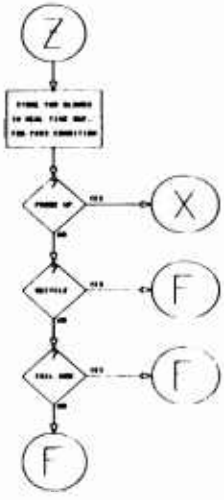

D
Z
X
F
E


E
X
Y
F
G
G
Y


W
WAIT 10 MS
G


X
WAIT 10 MS
G


Y
WAIT 100 MS
E


Z
X
F
F
F

XM-596 FUZE TESTING SYSTEM

DATE = 12/05/69
TIME = 1956
PROBE= 04

CURRENT

STATION DATA

FUZES = 00032
FAILS = 00000
STOPS = 00010

CORRELATION DATA

00000 00000

PARAMETER DATA

FAILURES

TOTAL = 00000
LOT = 00000
CONS. = 00000

RAW DATA NONE

FREQ. DIST. INTERVAL VOLTS	PRESENT LOT FREQ.	%	PREVIOUS LOT FREQ.	%	CUMULATIVE FREQ.	%
. 00.66	00000	000	00000	000	00000	000
00.68, 00.90	00000	000	00000	000	00000	000
00.92, 01.14	00000	000	00000	000	00000	000
01.16, 01.38	00000	000	00000	000	00000	000
01.40, 01.62	00000	000	00000	000	00000	000
01.64, 01.86	00000	000	00000	000	00000	000
01.88, 02.10	00000	000	00000	000	00000	000
02.12, 02.34	00002	006	00000	000	00002	000
02.36, 02.58	00001	003	00000	000	00001	000
02.60, 02.82	00013	041	00000	000	00013	050
02.84, 03.06	00013	041	00000	000	00013	050
03.08, 03.30	00003	009	00000	000	00003	000
03.32, 03.54	00000	000	00000	000	00000	000
03.56,	00000	000	00000	000	00000	000
TOTAL	00032		00000		00024	

ACCEPTANCE LIMITS 00.92 , 03.30

XM-596 FUZE TESTING SYSTEM .

DATE - 12/05/69
TIME - 1957
PROBE- 04

ARM TIME

STATION DATA

FUZES = 00032
FAILS = 00000
STOPS = 00010

CORRELATION DATA 00000 00000

PARAMETER DATA

FAILURES

TOTAL = 00000
LOT = 00000
CONS. = 00000

RAW DATA NONE

FREQ. DIST.	INTERVAL M SEC	PRESENT LOT FREQ.	%	PREVIOUS LOT FREQ.	%	CUMULATIVE FREQ.	%
	.000600	00000	000	00000	000	00000	000
	000601.000690	00000	000	00000	000	00000	000
	000691.000780	00000	000	00000	000	00000	000
	000781.000870	00001	003	00000	000	00001	000
	000871.000960	00004	013	00000	000	00004	020
	000961.001050	00009	028	00000	000	00009	040
	001051.001140	00006	019	00000	000	00006	020
	001141.001230	00004	013	00000	000	00004	020
	001231.001320	00002	006	00000	000	00002	000
	001321.001410	00002	006	00000	000	00002	000
	001411.001500	00002	006	00000	000	00002	000
	001501.001590	00000	000	00000	000	00000	000
	001591.001680	00002	006	00000	000	00002	000
	001681.	00000	000	00000	000	00000	000
	TOTAL	00032		00000		00020	

ACCEPTANCE LIMITS 00450 .01500

8

DATE - 12/05/69
TIME - 1958
PROBE- 04

NOISE REJ

STATION DATA

FUZES = 00032
FAILS = 00000
STOPS = 00010

CORRELATION DATA

00000 00000

PARAMETER DATA

FAILURES

TOTAL = 00000
LOT = 00000
CONS. = 00000

RAW DATA

L CUR = 00000
L PRV = 00000
L TOT = 00000

H CUR = 00000
H PRV = 00000
H TOT = 00000

Best
Available
Copy

Appendix G. SOSOFT Program Listing

```
(PAGE 001)

        .SNRY  .
        .EJEC  .
*****************************************************************
*****************************************************************
***                                                           ***
***       A SOFTWARE SYSTEM ORIENTED TO FUZE TESTING          ***
***                          (SOSOFT)                         ***
***                                                           ***
***       DEVELOPED AT HARRY DIAMOND LABS. WASH. DC.          ***
***                        JUNE 1969                          ***
***                                                           ***
***       CHIEF PROGRAMMER - D.A. LINK  (BRANCH 270)          ***
***                                                           ***
*****************************************************************
*****************************************************************
        .EJEC  .
***
***
***  USER ASSIGNMENT TABLES
***
***      1. PRIORITY INTERRUPT ROUTINES
***      2. SYSTEM PARAMETERS
***      3. PROGRAM NUMBERS
***      4. I/O LOGICAL UNITS
***
***
        .EJEC
***
***
***  PRIORITY INTERRUPT ROUTINE ASSIGNMENT
***
***
$PI0   .SET   .($DUM)          LEVEL 0 = UNUSED
$PI1   .SET   .($CIP)          LEVEL 1 = CLOCK PROCESSOR
$PI2   .SET   .($SIP)          LEVEL 2 = SCANNER PROC.
$PI3   .SET   .($DUM)          LEVEL 3 = UNUSED
$PI4   .SET   .($DUM)          LEVEL 4 = UNUSED
$PI5   .SET   .($DUM)          LEVEL 5 = UNUSED
$PI6   .SET   .($DUM)          LEVEL 6 = UNUSED
$PI7   .SET   .($DUM)          LEVEL 7 = UNUSED
$PDN   .SET   .($PFL)          POWER DOWN
$PUP   .SET   .($PRS)          POWER UP
        .EJEC  .
***
***
***  SYSTEM PARAMETER ASSIGNMENT
***
***
NSTA   .SET   .4               * TEST STATION PROGRAMS
UNIT   .SET   .8               SYSTEM TIME UNIT IN MILLISECONDS
IBSY   .SET   .100             * MU SEC. INTERFACE ALLOWED BUSY
IODN   .SET   .9               PROGRAM NO. OF DRIVER 90
```

```
(PAGE 0001)

SPRG  .SET   .15                 PROGRAM NUMBER OF SUMMARY PG
VIRT  .SET   .14                 # FREE VIRT. ENTRYPOINTS
LOGU  .SET   .7                  # LOGICAL UNITS
      .EJEC  .
...
...  PROGRAM NUMBER ASSIGNMENT
...
ID0   .SET   .(ID0)              00 = UNKNOWN
ID01  .SET   .(ID01)             01 = TEST 1
ID02  .SET   .(ID02)             02 = TEST 2
ID03  .SET   .(ID03)             03 = TEST 3
ID04  .SET   .(ID04)             04 = TEST 4
ID05  .SET   .-1                 RESERVED FOR TEST 5
ID06  .SET   .-1                 RESERVED FOR TEST 6
ID07  .SET   .-1                 RESERVED FOR TEST 7
ID08  .SET   .-1                 RESERVED FOR TEST 8
ID09  .SET   .(ID09)             09 = UNUSED
ID10  .SET   .(ID10)             10 = UNUSED
ID11  .SET   .-1                 RESERVED FOR UNUSED
ID12  .SET   .-1                 RESERVED FOR UNUSED
ID13  .SET   .(ID13)             13 = UNUSED
ID14  .SET   .-1                 RESERVED FOR UNUSED
ID15  .SET   .-1                 RESERVED FOR UNUSED
ID16  .SET   .(IDSP)             16 = SUMMARY PROGRAM
ID17  .SET   .(IDSC)             17 = DIAGNOSTIC INITIALIZE & RESET, LOOPS
ID18  .SET   .(ID18)             PATTERN/MARK ROUTINE
ID19  .SET   .-1                 UNUSED
ID20  .SET   .(ID20)             20 = EMULATOR/DIAGNOSTIC ROUTINE
      .EJEC  .
...
...
...  I/O LOGICAL UNIT ASSIGNMENTS
...
...
LU01  .SET   .(TTY)              TELETYPE INPUT
LU02  .SET   .(TTY)              TELETYPE OUTPUT
LU03  .SET   .(PTRD)             PAPER TAPE READER INPUT
LU04  .SET   .(PTPU)             PAPER TAPE PUNCH OUTPUT
LU05  .SET   .(LPR)              LINE PRINTER
LU06  .SET   .(BIN)              BINARY INPUT
LU07  .SET   .(BIN)              BINARY OUTPUT
      .EJEC  .
...
...
...  SUBSET DATA SECTION
...
...
      .EJEC
...
...
...  I/O DRIVER NUMBERS
...
```

```
;***
TTYI  .SET   .0
TTYO  .SET   .1
PTRI  .SET   .2
PTPO  .SET   .3
LPRO  .SET   .4
BINI  .SET   .5
BINO  .SET   .6
DUMY  .SET   .-1
      .EJEC  .
;***
;***
;***  SYSYTEM PARAMETER TABLE
;***
;***
PIN   .SET   .040          PIA ADDRESS
EPIN  .SET   .0240         ENABLE PIA
DPIN  .SET   .0440         DISABLE PIA
SRYO  .SET   .0100         SENSE INTERFACE
SRYI  .SET   .0200         SENSE INTERFACE
SINT  .SET   .070          INTERFACE ADDRESS
SCAN  .SET   .071          ADDR. OF SCANNER
;***
;***
      .ORG   .024
SNIN  .DATA  .NINT
SNI2  .DATA  .2-NINT
TIME  .DATA  .-UNIT        NL ENABLE TIMER
TUNIT .DATA  .-UNIT        CONSTANT
SNST  .DATA  .NSTA         # TEST PROGRAMS
SPDB  .DATA  .0            SUMMARY PRINT
SDUM  .DATA  .0            # ILLEGAL INTERRUPTS
SISC  .DATA  .0            # ILLEGAL SCANNER
TEMP  .DATA  .0            TEMPORARY
TMP1  .DATA  .0
TMP2  .DATA  .0
TMP3  .DATA  .0
TMP4  .DATA  .0
SNIT  .DATA  .IBSY/10      NO. ITERATIONS
SDATE .BSS   .7            DATE AND TIME
      .EJEC  .
;***
;***
;***  SYSTEM CONSTANT TABLE
;***
;***
SNFS  .DATA  .0100000      MINUS FULL SCALE
SN3   .DATA  .-3
SN2   .DATA  .-2
S2    .DATA  .2
S3    .DATA  .3
S4    .DATA  .4
```

```
$240   .DATA  .0240
$252   .DATA  .0252
$254   .DATA  .0254
$255   .DATA  .0255
$256   .DATA  .0256
$260   .DATA  .0260
$261   .DATA  .0261
$274   .DATA  .0274
$304   .DATA  .0304
$310   .DATA  .0310
$311   .DATA  .0311
$323   .DATA  .0323
$400   .DATA  .0400
$401   .DATA  .0401
$523   .DATA  .0523
$6FS   .DATA  .8192
D100   .DATA  .100
D120   .DATA  .120
D200   .DATA  .200
D300   .DATA  .300
D400   .DATA  .400
D500   .DATA  .500
D512   .DATA  .512
D600   .DATA  .600
D700   .DATA  .700
D800   .DATA  .800
D900   .DATA  .900
D999   .DATA  .999
$B10   .DATA  .1024
$B11   .DATA  .2048
$IK    .DATA  .1000
$10K   .DATA  .10000
$30K   .DATA  .30000
MSK1   .DATA  .077777
MSK2   .DATA  .0376
MSK3   .DATA  .0377
MSK4   .DATA  .01777
$CRLF  .DATA  .0106612
$PDPD  .DATA  .0100624
       .EJEC  .
***
***
***  ALPHABETIC CONSTANTS
***
***
$FM    .DATA  .'FM'
$FL    .DATA  .'FL'
$OK    .DATA  .'OK'
$AA    .DATA  .'**'
$BB    .DATA  .'  '
$N     .DATA  .'N'
$1BB   .DATA  .'1 '
```

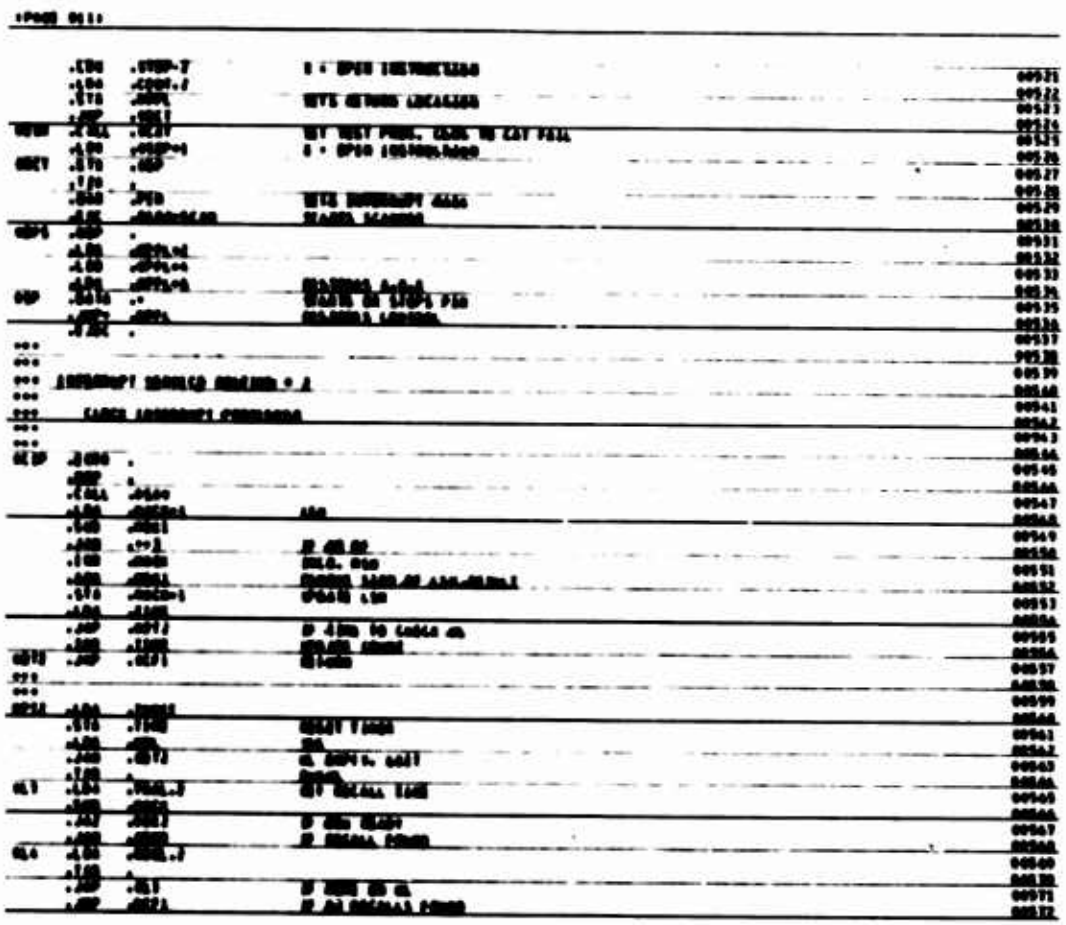
(PAGE 006)

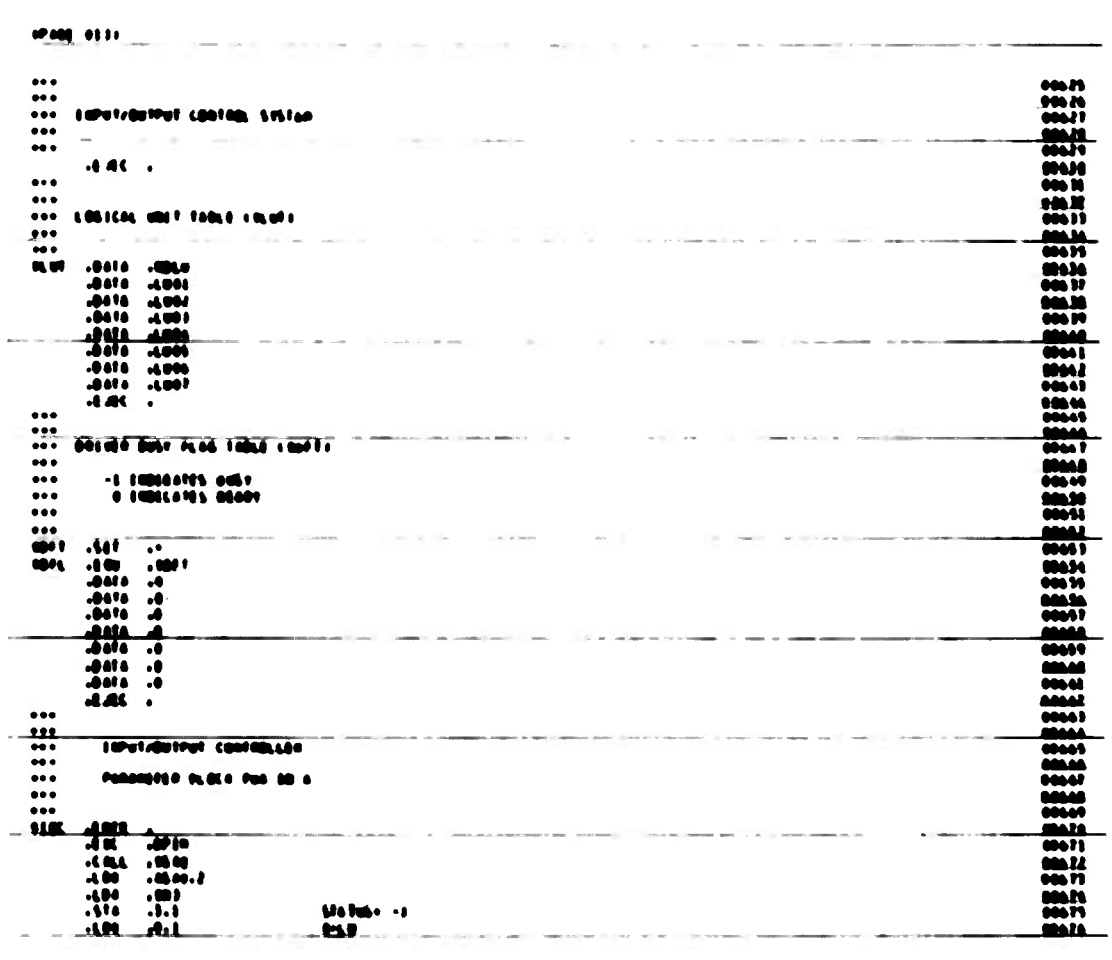
```
$2BB  .DATA  .72
$3BB  .DATA  .73
$4BP  .DATA  .74
      .EJEC  .
...
...
...  EXTERNAL INSTRUCTION TABLE.
...
...
$UF1  .RUF   .
$T2A  .T2A   .
$T2B  .T2B   .
$IAR  .IAR   .
$IBR  .IBR   .
$IXR  .IXR   .
$LD2  .LDA   .$2
$LD4  .LDA   .$200
$SOF  .SOF   .
$IR1  .INCR  .01
$DR1  .DECR  .01
$SU4  .SUB   .$4
$LD1  .LDA   .$100
      .EJEC  .
...
...
...  INDIRECT POINTERS AND PATCH SPARES
...
...
IADR  .BEGIN .*                    ORIGIN OF DAS DEFINED INDIRECTLY
$IPR  .BSS   .70
      .EJEC  .
...
...
...  REAL-TIME SCHEDULING SYSTEM (RETI)
...
...
RETI  .SET   .*
      .EJEC  .
...
...
...  PRIORITY INTERRUPT TRAPS
...
...
      .ORG   .0
      .INRE  .SP10
      .JMPM  .SP11
      .JMPM  .SP12
      .INRE  .SP13
      .INRE  .SP14
      .INRE  .SP15
      .INRE  .SP16
      .INRE  .SP17
```

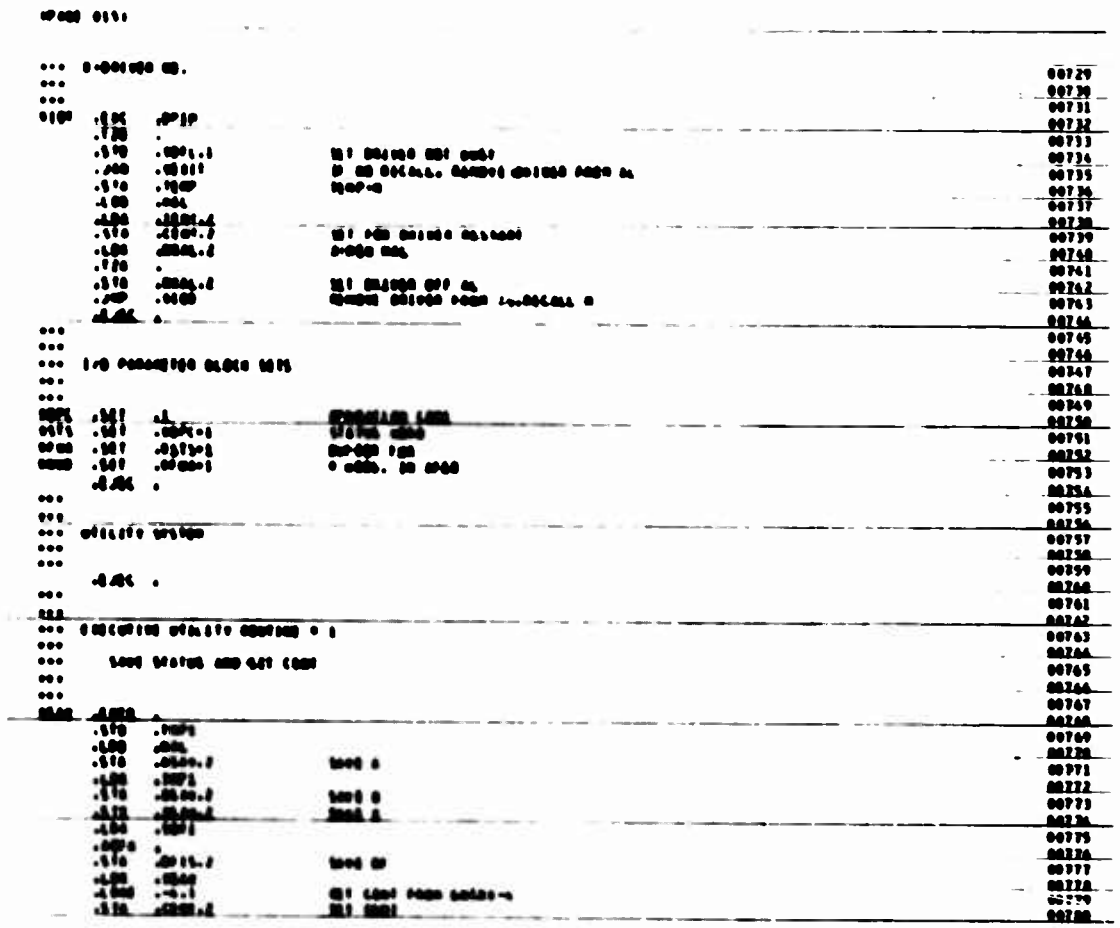
```
      .JMPM  .SPDN
      .JMP   .WRUP
      .EJEC  .
***
***
***  INFORMATION BLOCK ENTRY SETUP
***
***
PN    .SET   .0I                 PROGRAM NUMBER
PP    .SET   .PN+1               PROGRAM PRIORITY
IENT  .SET   .PP+1               INITIAL ENTRY POINT
CENT  .SET   .IENT+1             CURRENT ENTRY POINT
NXAL  .SET   .CENT+1             AL LINK TO NEXT PROG.
PRAL  .SET   .NXAL+1             AL LINK TO PREVIOUS PROG.
TOAL  .SET   .PRAL+1             TIME ON AL
NXWL  .SET   .TOAL+2             WL LINK TO NEXT PROG.
PRWL  .SET   .NXWL+1             WL LINK TO PREV PROG.
TRAL  .SET   .PRWL+1             TIME FOR RECALL UNTO AL
ASAV  .SET   .TRAL+2             A REG. SAVE
BSAV  .SET   .ASAV+1             B REG. SAVE
XSAV  .SET   .BSAV+1             X REG. SAVE
OFIS  .SET   .XSAV+1             OVERFLOW INDICATOR SAVE
      .EJEC  .
***
***
***  LIST POINTERS
***
***
      .ORG   .RETI
HAL   .DATA  .(IBBK)             HEAD OF AL LIST TO BACKGROUND
HWL   .DATA  .-1                 HEAD OF WL (EMPTY)
EWL   .DATA  .-1                 END OF WL (EMPTY)
      .EJEC  .
***
***
***  INFORMATION BLOCK ENTRY TABLE
***
***
IBET  .SET   .*
      .DATA  .IB00
      .DATA  .IB01
      .DATA  .IB02
      .DATA  .IB03
      .DATA  .IB04
      .DATA  .IB05
      .DATA  .IB06
      .DATA  .IB07
      .DATA  .IB08
      .DATA  .IB09
      .DATA  .IB10
      .DATA  .IB11
      .DATA  .IB12
```

(PAGE 008)

```
      .DATA  .IB13
      .DATA  .IB14
      .DATA  .IB15
      .DATA  .IB16
      .DATA  .IB17
      .DATA  .IB18
      .DATA  .IB19
      .DATA  .IB20
      .EJEC  .
...
...
...  SCHEDULER ENTRIES -
...
...
...   1. PROGRAM EXIT            JMP   [illegible]
...   2. ADJ PROG. M TO AL     - JMPM  [illegible]
...   3. MAL FROM AL TO AL     - JMPM  [illegible]
...
...
      .EJEC  .
...
...
...  SCHEDULER ENTRY NO. 1
...
...     PROGRAM EXIT
...
...
SEXIT .EXC   .OPIM                [illegible]
      .LDA   .MAL
      .LDA   .IENT.1
      .STA   .LENT.1              [illegible]
      .LDA   .NAAL.1
      .TZA   .
      .STA   .NAAL.1              [illegible]
      .STA   .MAL                 [illegible]
      .COMPL .1
      .STA   .PRAL.2              [illegible]
      .JMP   .SCF1                [illegible]
      .EJE   .
...
...
...  SCHEDULER ENTRY NO. 2
...
...     ADJ PROGRAM M TO AL
...
...
.AAL  .ENTR  .                    [illegible]
      .EXC   .OPIM
      .LALL  .[illegible]
      .LDA   .[illegible]         [illegible]
      .LDA   .[illegible]
      .JMP   .[illegible]         [illegible]
```







```
***
***  SPECIAL GO/NO GO FORMAT
***
***
FLTL  .SET   .SAMP+1          LOW FAILS THIS LOT
FLPL  .SET   .FLTL+1          LOW FAILS PREVIOUS LOT
FLCT  .SET   .FLPL+1          CUMULATIVE LOW FAILS
FHTL  .SET   .FLCT+1          HIGH FAILS THIS LOT
FHPL  .SET   .FHTL+1          HIGH FAILS PREVIOUS LOT
FHCT  .SET   .FHPL+1          CUMULATIVE HIGH FAILS
      .EJEC  .
***
***
***  STATION DATA STORAGE SETS
***
***
SIZE  .SET   .0               SAMPLE LOT SIZE
NREJ  .SET   .SIZE+1          # REJECTS ALLOWED PER LOT
RTDF  .SET   .NREJ+1          REAL-TIME DATA FLAG
NOFT  .SET   .RTDF+1          # FUZES TESTED
NOFR  .SET   .NOFT+1          # FUZES REJECTED
NOMS  .SET   .NOFR+1          # MACHINE STOPS
NTTL  .SET   .NOMS+1          # FUZES TESTED THIS LOT
NRTL  .SET   .NTTL+1          # REJECTED THIS LOT
CORF  .SET   .NRTL+1          CORRELATION DATA FLAG
CORR  .SET   .CORF+1          CORRELATIONAL DATA
      .EJEC  .
***
***
***  EXECUTIVE UTILITY ROUTINE # 3
***
***     TEST DATA PROCESSOR
***
***     A = RECYCLE FLAG (0=RECYCLE)
***     B = RAW DATA
***     X = FWA OF DATA AREA
***     OF= LOT FLAG (00=NEW LOT)
***
***
SUB   .LDB   .TEMP            B=CALIBRATED DATA
      .LDA   .TMP4            RESTORE A
      .EXC   .EPIN
      .JMP   .+               EXIT
STOP  .EQU   .+-1
      .EXC   .DPIN
      .STA   .TMP4            SAVE A
***
***  LINEAR CALIBRATION
***
      .TBA   .
      .SUB   .COFF,1
      .STA   .TMP3
```

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```
                .LDA    .SROT.1                                                 00885
                .SUB    .SOFF.1                                                 00886
                .TAB    .                                                       00887
                .LDA    .CROT.1                                                 00888
                .SUB    .COFF.1                                                 00889
                .STA    .TEMP                                                   00890
                .TZA    .                                                       00891
                .MUL    .TMP3                                                   00892
                .DIV    .TEMP                                                   00893
                .TBA    .                                                       00894
                .ADD    .SOFF.1         CALIBRATION ALGORITHM COMPLETE          00895
                .STA    .TEMP           CALIBRATED DATA                         00896
                .LDA    .TMP4                                                   00897
                .JAZ    .SU6            IF RECYCLE                              00898
***                                                                             00899
***                                                                             00900
***  CHECK FOR NEW LOT                                                          00901
***                                                                             00902
***                                                                             00903
                .JOF    .SU30           IF NEW LOT                              00904
                .JMP    .SU34           IF NOT                                  00905
SU30            .STX    .TMP3           SAVE X                                  00906
                .TZA    .                                                       00907
                .STA    .FLOT.1         FLOT=0                                  00908
                .LDBI   .NBRT-1                                                 00909
SU31            .LDA    .CURR.1                                                 00910
                .STA    .PREV.1         MOVE CURR. TO PREV.                     00911
                .LDA    .HIFS                                                   00912
                .STA    .CURR.1         RESET CURR. TO -32768                   00913
                .IXR    .                                                       00914
                .DECR   .023                                                    00915
                .JAP    .SU31           CONTINUE FOR NBRT INTERVALS             00916
                .LDX    .TMP3           RESTORE X                               00917
***                                                                             00918
***                                                                             00919
***  UPDATE FREQUENCY DISTRIBUTIONS                                             00920
***                                                                             00921
***                                                                             00922
SU34            .LDA    .TEMP           A=DATA                                  00923
                .SUB    .UPPH.1                                                 00924
                .JAN    .SU1            IF NOT IN LAST INTERVAL                 00925
                .LDA    .NUMI.1                                                 00926
                .DAR    .               SET TO INCREMENT LAST INTERVAL          00927
                .JMP    .SU2                                                    00928
SU1             .LDA    .TEMP                                                   00929
                .SUB    .LOWH.1                                                 00930
                .DECR   .013            A-1 TO A.B                              00931
                .JAN    .SU2-1                                                  00932
                .TZA    .                                                       00933
                .DIV    .WIDH.1         COMPUTE INDEX                           00934
                .INCR   .021            B+1 TO A                                00935
                .JMP    .SU2                                                    00936
```

```
                .TZA    .                       SET FOR FIRST INTERVAL                  00937
SU2             .ADDI   .CUMM                   COMPUTE INTERVAL ADDR. REL TO R1        00938
                .STA    .+5                                                             00939
                .SUBI   .2+NINT                                                         00940
                .STA    .+4                                                             00941
                .IMRE   .+.1                    INCR. CUMMULATIVE FREQ. DIST.           00942
                .IMRE   .+.1                    INCR. CURRENT LOT FREQ. DIST.           00943
***                                                                                     00944
***  CHECK FOR FAIL                                                                     00945
***                                                                                     00946
SU6             .LDA    .MAXA,1                 GET MAX ACCEPTABLE                      00947
                .SUB    .TEMP                                                           00948
                .JAN    .SU5                    IF FAIL                                 00949
                .LDA    .TEMP                                                           00950
                .SUB    .MINA,1                 GET MINIMUM ACCEPTABLE                  00951
                .JAN    .SU5                    IF FAIL                                 00952
                .LDA    .TMP4                                                           00953
                .JAZ    .SU5-3                  IF RECYCLE                              00954
                .TZA    .                                                               00955
                .STA    .CONF,1                 UPDATE CONSECUTIVE FAILS                00956
                .SOF    .                       SET PASS FLAG                           00957
                .JMP    .SU0                    EXIT                                    00958
SU5             .LDA    .TMP4                                                           00959
                .JAZ    .SU7+3                  IF RECYCLE                              00960
                .LDA    .FLOT,1                 FAILS THIS LOT                          00961
                .SUB    .020                                                            00962
                .JAP    .SU7                    IF 20 ALREADY SAVED                     00963
                .TXA    .                                                               00964
                .ADDI   .FALE                                                           00965
                .ADD    .FLOT,1                 A=RAW FAIL DATA ADDR.                   00966
                .TAB    .                                                               00967
                .LDA    .TEMP                                                           00968
                .STA    .0,2                    STORE RAW DATA (CALIB.)                 00969
SU7             .IMR    .FLOT,1                                                         00970
                .IMR    .FAIL,1                 UPDATE FAILURE COUNT                    00971
                .IMR    .CONF,1                                                         00972
                .ROF    .                       SET FAIL FLAG                           00973
                .JMP    .SU0                                                            00974
                .EJEC   .                                                               00975
***                                                                                     00976
***                                                                                     00977
***  EXECUTIVE UTILITY ROUTINE # 4                                                      00978
***                                                                                     00979
***    ANALOG TO DIGITAL CONVERTER INPUT                                                00980
***                                                                                     00981
***    CALL -      .CALL    .SADC,STAN,BUSY,FAIL                                        00982
***    WHERE                                                                           00983
***                STAN = STATION NUMBER                                               00984
***                BUSY = ROUTINE TO HANDLE INTERFACE BUSY                             00985
***                FAIL = ROUTINE TO HANDLE FAILS                                      00986
***                                                                                     00987
***    A = RECYCLE FLAG (0=RECYCLE)                                                     00988
```

```
***     B = CHANNEL ADDRESS                                                     00989
***     X = DATA AREA FWA (-1 INDICATES NO DATA PROCESSING)                     00990
***     OF= LOT FLAG (ON=NEW LOT)                                               00991
***                                                                             00992
***     RETURNS CALIBRATED DATA IN A                                            00993
***                                                                             00994
***                                                                             00995
$ADC  .ENTR  .                                                                  00996
      .EXC   .DPIN                                                              00997
      .CALL  .$SAV                                                              00998
      .LDX   .XSAV,2                                                            00999
      .LDA   .ASAV,2                                                            01000
      .STA   .TMP1           RECYCLE FLAG                                       01001
      .LDA   .BSAV,2         A=CHAN                                             01002
      .LRLA  ,3                                                                 01003
      .ORAE* .$ADC           ADD STATION #                                      01004
      .INR   .CENT,2                                                            01005
      .DAR   .               COMPUTE STATION ADDRESS                            01006
      .LRLA  ,3                                                                 01007
      .LDBI  .0100007        BIT 15=1, FUNCT.=7                                 01008
      .CALL  .$CWD           OUTPUT CONTROL WORD                                01009
      .CALL  .$DIN           INPUT RAW DATA TO A                                01010
      .TXA   .                                                                  01011
      .JAN   .$U10           IF NO PROCESSING                                   01012
      .LDA   .TMP1           RECYCLE FLAG                                       01013
      .CALL  .$TOP           PROCESS DATA                                       01014
      .EXC   .DPIN                                                              01015
      .LDX   .HAL                                                               01016
      .JOF   .$U10+1         IF PASSED, EXIT                                    01017
      .STB   .ASAV,1         CAL. DATA                                          01018
$U9   .LDB   .CENT,1                                                            01019
      .LDA   .0,2            A= RETURN ADDRESS                                  01020
      .STA   .CENT,1         SET RETURN                                         01021
      .JMP   .$CFI+1         RETURN                                             01022
$U10  .LDX   .HAL                                                               01023
      .INR   .CENT,1         SET FOR NORMAL RETURN                              01024
      .STB   .ASAV,1         CAL. DATA TO A                                     01025
      .JMP   .$CFI+1         RETURN                                             01026
      .EJEC  .                                                                  01027
***                                                                             01028
***                                                                             01029
***  EXECUTIVE UTILITY ROUTINE # 5                                              01030
***                                                                             01031
***     OUTPUT TO INTERFACE                                                     01032
***                                                                             01033
***     USED BY OTHER EXEC. UTILITY ROUTINES                                    01034
***                                                                             01035
***                                                                             01036
$CWD  .ENTR  .                                                                  01037
      .MERGE .032            A OR B TO B                                        01038
      .TZA   .                                                                  01039
$U11  .SEN   .$RYO+$INT,$U12 READY?                                             01040
```

```
      .IAR   .                    NO
      .SUB   .$NIT
      .JAN   .$U11                IF STILL CHECKING FOR READY
***
***  CATASTROPHIC FAILURE ACTION
***
      .CALL  .$CAT                SET FAIL REENTRY POINTS FOR TEST PROG.
      .LDA   .$7
$U15  .SEN   .0101.**4            TTY READY ?
      .JMP   .$U15                NO
      .OAR   .01                  YES, RING BELL
      .JSS1  .$CF1                IF SS1 ON, GO TO HAL
      .JMP   .$U15                WAIT FOR RESTART SIGNAL
***
$U12  .OBR   .$INT                OUTPUT B
      .JMP*  .$CWD                NORMAL EXIT
      .EJEC  .
***
***
***  EXECUTIVE UTILITY ROUTINE # 6
***
***     INPUT FROM INTERFACE
***
***     USED BY OTHER EXEC. UTILITY ROUTINES
***
***
$DIN  .ENTR  .
      .TZA   .
$U13  .SEN   .$RY1+$INT,$U14      READY?
      .IAR   .                    NO
      .SUB   .$NIT
      .JAN   .$U13                IF STILL CHECKING READY
      .LDX   .HAL
      .JMP   .$U9                 BUSY EXIT
$U14  .LDB   .HAL
      .INR   .CENT,2
      .CIB   .$INT                INPUT DATA TO B
      .JMP*  .$DIN                NORMAL EXIT
      .EJEC  .
***
***
***  EXECUTIVE UTILITY ROUTINE # 7
***
***     DIGITAL INPUT
***
***     CALL -      .CALL    .$DIC,STAN,BUSY
***                 .CALL    .$SEN,STAN,BUSY
***     WHERE
***                 STAN = STATION NUMBER
***                 BUSY = FWA OF INTERFACE BUSY ROUTINE
***
***     B = CHANNEL ADDRESS
```

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```
***     A = RETURNED DATA
***
***
$DIC  .ENTR  .
$SEN  .EQU   .$DIC          SENSE LINE INPUT
      .EXC   .$PIN
      .CALL  .$SAV
      .IOR   .CENT.2
      .LDB   .$SAV.2
      .LDAE* .$DIC          SET STATION NUMBER
      .DAR   .              COMPUTE STAT. ADDRESS
      .LLRL  .3
      .ADD   .$7
      .LRLD  .3
      .CALL  .$CWD          OUTPUT CONTROL WORD
      .CALL  .$DIN          INPUT RAW DATA TO 0
      .LDA   .$AL
      .STD   .$SAV.1
      .JMP   .$CF1+1        EXIT
      .EJEC  .
***
***
***  EXECUTIVE UTILITY ROUTINE = 0
***
***     OUTPUT TO BUFFERED REGISTER
***
***     CALL -      .CALL    .$BUF.STAN
***                 .CALL    .$REL.STAN
***     WHERE
***                 STAN = STATION NO.
***
***     A = DATA IN BITS 0-9
***     B = REGISTER ADDRESS
***
***
$BUF  .ENTR  .
$REL  .EQU   .$BUF          REED RELAY SET
      .EXC   .$PIN
      .STA   .TMP1          SAVE A
      .STB   .TMP2          SAVE B
      .LRLA  .3             SHIFT DATA
      .ADDE* .$BUF          ADD STATION NUMBER
      .DAR   .              SET STATION ADDRESS
      .LRLA  .3
      .CALL  .$CWD          OUTPUT CONTROL WORD
      .LDA   .TMP2          ADDRESS
      .SUB   .$5
      .JAN   .$RRE          IF NOT RR REG.
      .LDAE* .$BUF
      .ASLA  .1
      .ADD   .TMP2
      .TAB   .
```

```
      .LDA   .TMP1                 OUTPUT DATA
      .STAE  .$RRD-7,2             SAVE CURRENT STATUS
$RRE  .INR   .$BUF
      .LDA   .TMP1
      .LDB   .TMP2
      .EXC   .EPIM
      .JMP*  .$BUF                 EXIT
$RRD  .EQU   .*
      .DATA  .1                    STAT 1, REG 5
      .DATA  .1                    STAT 1, REG 6
      .DATA  .0                    STAT 2, REG 5
      .DATA  .1                    STAT 2, REG 6
      .DATA  .0                    STAT 3, REG 5
      .DATA  .1                    STAT 3, REG 6
      .EJEC  .
***
***
***  EXECUTIVE UTILITY ROUTINE # 9
***
***     INTERFACE TO STATISTICAL DISPLAY PROGRAM
***
***
***     CALL -      .CALL     .$SPD.STAN,BUSY
***
***     WHERE
***                 STAN=STATION NUMBER
***                BUSY=BUSY PROCESSOR
***
***     A= STATION DATA BLOCK FWA
***     B= PREAMBLE FWA
***     X= TEST DATA BLOCK FWA
***
***
$SPD  .ENTR  .
      .EXC   .DPIM
      .CALL  .$SAV
      .TZA   .                     TYPE FLAG=0
$SP3  .STA   .TEMP                 SET FLAG
      .LDA   .CENT,2
      .STA   .$SPD                 SET COMMON ENTRY
      .LDA   .$PDB                 GET BUSY FLAG
      .JAZ   .$U20                 IF READY
      .LDX   .CENT,2
      .LDA   .1,1                  GET BUSY RETURN ADDRESS
      .STA   .CENT,2
      .JMP   .$CF1                 BUSY RETURN
$U20  .INR   .CENT,2
      .INR   .CENT,2               UPDATE RETURN
      .LDA   .$SAV,2
      .LDXI  .SPPN                 GET SPRD PROG. *
      .STX   .$PDB                 SET SPRD BUSY
      .LDX   .IBET,1               GET IB(SPRD)
```

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```
      .STA   .BSAV.1          BSAV=PREAMBLE FWA                    01197
      .LDA   .XSAV.2                                               01198
      .STA   .XSAV.1          XSAV=TEST DB FWA                     01199
      .LDAE+ .SSP0            GET STAT. NO.                        01200
      .STA   .DFIS+1.1        STORE STAT IN IS+1                   01201
      .LDA   .ASAV.2                                               01202
      .STA   .ASAV.1          ASAV=STAT. DB FWA                    01203
      .LDA   .TEMP                                                 01204
      .STA   .DFIS+2.1        PASS TYPE FLAG TO SPR0               01205
      .JMP   .NOTO            ADD SPRO TO AL                       01206
SSP1  .ENTR  .                SENSITIVITY ENTRY                    01207
      .EXC   .OPEN                                                 01208
      .CALL  .SSAV                                                 01209
      .DECR  .01              FLAG=-1                              01210
      .JMP   .SSP3                                                 01211
***                                                                01212
SSP2  .ENTR  .                ARMING TIME ENTRY                    01213
      .EXC   .OPEN                                                 01214
      .CALL  .SSAV                                                 01215
      .INCR  .01              FLAG=+1                              01216
      .JMP   .SSP3                                                 01217
      .EJEC  .                                                     01218
***                                                                01219
***                                                                01220
***  EXECUTIVE UTILITY ROUTINE # 10                                01221
***                                                                01222
***    CONVERTS MASTER CLOCK TO REAL TIME                          01223
***                                                                01224
***    CALL-      .CALL  .STIME                                    01225
***                                                                01226
***    MINUTES RETURNED IN A                                       01227
***    HOURS   RETURNED IN B                                       01228
***                                                                01229
***                                                                01230
STIME .ENTR  .                                                     01231
      .EXC   .OPEN                                                 01232
      .CALL  .SSAV                                                 01233
      .TBX   .                X=MAL                                01234
      .LDA   .MACK            MSW OF CLOCK                         01235
      .LDB   .MACK+1          LSW OF CLOCK                         01236
      .DIV   .8300            CONVERT TO HALF MIN.                 01237
      .TZA   .                                                     01238
      .DIV   .0120            TO GET HOURS                         01239
      .STB   .TEMP            HOURS                                01240
      .TZB   .                                                     01241
      .LLSR  .1               DIV A REG BY 2                       01242
      .JBZ   .RTIM            IF NO REMAINDER                      01243
      .IAR   .                                                     01244
RTIM  .ADD   .MMIN            TOTAL MIN.                           01245
      .TAB   .                                                     01246
      .TZA   .                                                     01247
      .DIV   .060             CHECK FOR MORE THAN 60 MIN.          01248
```

```
      .STA   .ASAV.1          MINUTES RETURNED IN A
      .TBA   .
      .ADD   .TEMP
      .ADD   .$HRS            A = HOURS
      .STA   .BSAV.1          HOURS RETURNED IN B
      .JMP   .$CF1+1          RETURN
***
***   DATA
***
$HRS  .DATA  .0               HRS. AT START OF DAY
$MIN  .DATA  .0               MIN. AT START OF DAY
      .EJEC  .
***
***
***  EXECUTIVE UTILITY ROUTINE = 11
***
***    CONVERTS BINARY NUMBER TO ASC OF DESIGNATED RADIX
***
***         CALL -  CALL.$BCD.BASE.NDIG.DEST
***
***     WHERE
***                BASE = RADIX (2-10)
***                NDIG = # DIGITS (PACKED 2/WORD)
***                DEST = DESTINATION OF ASCII CHARACTERS
***                OF   = 1 FOR BIAS OF -32768
***                A    = DATUM
***
***
$BCD  .ENTR  .
      .EXC   .DPIM
      .STB   .TEMP
      .STX   .TMP2
      .STA   .TMP1
      .LDB   .SDF1
      .AOFB  .
      .STW   .$BCB            SAVE OF
      .LDX   .$BCD
      .LDB   .0,1             B=BASE
      .STB   .$BC3+1
      .LDB   .2,1             B=DEST
      .DBR   .
      .STB   .$BC4+1
      .LDB   .1,1             B=NDIG
      .IBR   .
      .LSRB  .1               B=# WORDS
      .TBX   .
      .TZB   .
      .AOFB  .
      .JRZ   .$BC1            IF NO BIAS
      .JAN   .$BC1-1          IF SING. PREC.
      .TAB   .
      .INCR  .01              A,B=DOUB. PREC.
```

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```
        .JMP   .$BC2
        .ANA   .MSK1                ADJUST FOR BIAS
$BC1    .TAB   .
        .TZA   .
$BC2    .JXZ   .$BC5                IF DONE
        .DIV   .$BC3+1
        .ADD   .$260                TO ASCII
        .STA   .TMP3
        .TZA   .
$BC3    .DIV1  .*
        .ADD   .$260
        .LRLA  .8
        .ORA   .TMP3                CONSTRUCT WORD
$BC4    .STAE  .*.1                 STORE IT
        .DXR   .
        .JMP   .$BC2-1              CONTINUE
$BC5    .LDX   .$BCD
        .LDA   .1.1                 A=NDIG
        .LRLA  .15
        .JAP   .$BC6                IF NDIG EVEN
        .LDB   .2.1                 B=DEST
        .LDA   .0.2                 A=1ST WORD
        .ANA   .MSK3                REMOVE LAST DIGIT
        .STA   .0.2
$BC6    .TXA   .
        .ADD   .$3
        .STA   .$BC7                SET FOR RETURN
        .LDB   .TEMP
        .LDX   .TMP2
        .LDA   .TMP1
$BC8    .NOP   .                    RESTORE OF
        .EXC   .EPIM
        .JMP   .*                   RETURN
$BC7    .EQU   .*-1
        .EJEC  .
***
***
***  EXECUTIVE UTILITY ROUTINE # 12
***
***          CONVERTS ADC INPUT TO ASCII VOLTS
***
***   CALL -      CALL  .$VCD.SRCE.DEST
***
***          WHERE
***                SRCE=SOURCE ADDRESS
***                DEST=DESTIOTION ADDRESS
***
**
$VCD    .ENTR  .
        .EXC   .DPIM
        .CALL  .$SAV
        .LDX   .$VCD
```

```
        .IMR    .CENT.2                                                 01353
        .IMR    .CENT.2                                                 01354
        .LDB    .0.1            B=SRCE ADDR.                            01355
        .LDA    .0.2            A=DATUM                                 01356
        .LRLA   .1                                                      01357
        .SUB    .8810           CONVERT TO VOLTS                        01358
        .LDB    .8240                                                   01359
        .JAP    .SVC0                                                   01360
        .COMPL  .011            A:=-A                                   01361
        .IAR    .                                                       01362
        .LDB    .8255                                                   01363
SVC0    .LDX    .1.1            X=DEST, B=SIGN ASCII                    01364
        .IXR    .                                                       01365
        .ROF    .                                                       01366
        .STX    .**5                                                    01367
        .CALL   .@BCD.10.4.*    TO BCD                                  01368
        .EXC    .DPIN                                                   01369
        .DXR    .                                                       01370
SVC1    .TBA    .               A=SIGN                                  01371
        .LDB    .1.1            B=01.02                                 01372
        .LLRL   .8              A=SIGN.01 B=02.0                        01373
        .STA    .0.1                                                    01374
        .TBA    .                                                       01375
        .ORA    .8256           A=02..                                  01376
        .STA    .1.1                                                    01377
        .JMP    .9CF1           RETURN                                  01378
        .EJEC   .                                                       01379
***                                                                     01380
***                                                                     01381
***  EXECUTIVE UTILITY ROUTINE #13                                      01382
***                                                                     01383
***                                                                     01384
***     CALL -    .CALL  .@SGN.DEST                                     01385
***                                                                     01386
***     WHERE     DEST = DESTINATION FWA                                01387
***                  A = DATUM                                          01388
***                                                                     01389
***     CONVERT + OR - BINARY TO 5 DIGIT DECIMAL NO WITH SIGN           01390
***                                                                     01391
***                                                                     01392
@SGN    .ENTR   .                                                       01393
        .EXC    .DPIN                                                   01394
        .CALL   .@SAV                                                   01395
        .LDA    .@SAV.2         DATUM                                   01396
        .IMR    .CENT.2         UPDATE RETURN                           01397
        .LDXE*  .@SGN           X=DEST FWA                              01398
        .STX    .@SGN                                                   01399
        .LDB    .8240                                                   01400
        .JAP    .@SGP                                                   01401
        .LDB    .8255                                                   01402
        .COMPL  .011            A:=DATUM                                01403
        .IAR    .                                                       01404
```

```
$SGP  .ROF   .
      .CALL  .$DCD.10.5.*        TO DCD
$SGM  .EQU   .*-1
      .EXC   .DPIN
      .TBA   .
      .LDLA  .0
      .DDA   .0.1                SET SIGN
      .STA   .0.1                1ST WORD
      .JMP   .$RES               EXIT
      .EJEC  .
***
***
***  EXECUTIVE UTILITY ROUTINE #14
***     CATASTROPIC ACTION ROUTINE
***
***
***        CALL      .CALL  .$CAT
***
***
***
$CAT  .LDEA  .
      .TZX   .
      .LDA   .$DET+1.1           TEST FWA
      .JAN   .$CT1
      .TAB   .
      .LDA   .$DEAL.2            CHECK IF ON AL
      .JAZ   .$CT1               IF NOT ON AL
      .LDAE  .$FAIL.1
      .STA   .CENT.7             SET FAIL REENTRY
$CT1  .INCR  .045
      .SUB   .$NST
      .JAN   .$CAT+2             IF NONE
      .JMP*  .$CAT
***
***
***  FAIL REENTRY POINTS
***
***
$FAIL .EQU   .*
      .DATA  .CAT1.CAT2.CAT3.CAT4
      .EJEC  .
***
***
***  BACKGROUND PROGRAM
***
***
$DOK  .DATA  .0                  PN
      .DATA  .0                  PP
      .DATA  .BACK               IENT
      .DATA  .BACK               CENT
      .DATA  .-1                 RNAL
      .DATA  .-1                 PRAL
```

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      .DATA  .0.0              DUAL                                    01457
      .DATA  .0                DUAL                                    01458
      .DATA  .0                DUAL                                    01459
      .DATA  .0.0              DUAL                                    01460
      .DATA  .0.0.0            DUAL                                    01461
      .DATA  .07400                                                    01462
...                                                                    01463
...                                                                    01464
BACK  .ELC   .0271             SCANNER OFF                             01465
      .TZA   .                                                         01466
      .DAR   .PIN              ALLOW ALL INTERRUPTS                    01467
      .STO   .DEFL             SET INIT DONE FLAG                      01468
      .LDA   .020                                                      01469
      .CALL  .DAAL             INIT TO AL                              01470
DEND  .LDA   .DEFL                                                     01471
      .BNP   .                                                         01472
      .JAZ   .DEAD             WAIT FOR INIT TO FINISH DMC             01473
      .ELZC  .                                                         01474
...                                                                    01475
...                                                                    01476
...   MAIN LOOP                                                        01477
...                                                                    01478
...     CHECK CALIBRATION RESTRICTIONS                                 01479
...                                                                    01480
...     LISTEN FOR TTY READY                                           01481
...                                                                    01482
...                                                                    01483
MCP1  .SET   .1                                                        01484
MCP2  .SET   .2                                                        01485
MCP3  .SET   .4                                                        01486
MCP4  .SET   .8                                                        01487
MCP   .SET   .MCP1+MCP2+MCP3+MCP4                                      01488
DEOI  .LDXI  .DEND                                                     01489
      .SKR   .0201,DEV3          TTY READY ?                           01490
DEV2  .LDA   .0.1                                                      01491
      .JAZ   .DEV1                                                     01492
      .LDA   .MCP-1.1          SET INPS MODE                           01493
      .STBI  .0                                                        01494
DEV4  .EOM   .0-1                                                      01495
      .LLSR  .12                                                       01496
      .STA   .DEV3             INDICATOR ADDR.                         01497
      .TZA   .                                                         01498
      .LLOL  .3                                                        01499
      .STA   .DEV4             STATION # (1,2,3)                       01500
      .TZA   .                                                         01501
      .LLOL  .3                                                        01502
      .STA   .DEV5             DA ADDR.                                01503
      .TZA   .                                                         01504
      .LLOL  .3                                                        01505
      .STA   .DEV6             DMC CHANNEL ADDR.                       01506
      .LSUB  .13                                                       01507
      .STO   .DEV7             PROBE & PROGRAM #                       01508
```

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```
        .LDA   .IDET.2
        .JAN   .DK04
        .LDAE  .CALF.2          CAL FLAG
        .JAN   .DK04            IF NOT READY
        .INME  .DK00.2
        .LDAE  .DK00.2          COUNTER
        .SUBE  .DK01.2          * PARAMETERS +1
        .JAN   .DK05            IF TIME TO CHECK
DK00    .STAE  .DK00.2          RESET COUNTER = 0
        .DECR  .01
        .STAE  .CALF.2          RESET FLAG
DK04    .IXR   .
        .JMP   .DK01+2          NEXT PARAMETER
***
***  CHECK OFFSET VALUE
***
DK05    .LDD   .0.1             0 = DD FWA
        .LDA   .DRES.2
        .SUB   .COFF.2
        .JAN   .DK45            IF OFFSET > DRES
        .LDA   .COFF.2
        .SUB   .0010
        .ADD   .DRES.2
        .JAN   .DK45            IF OFFSET < 1024-DRES
***
***  CHECK + REF OUTPUT
***
        .LDA   .CROT.2
        .SUB   .LROR.2
        .JAN   .DK40            IF + REF OUTPUT < LOW RESTR.
        .LDA   .HROR.2
        .SUB   .CROT.2
        .JAN   .DK40            IF + REF OUTPUT > HIGH RESTR.
        .JMP   .DK01+2          CONTINUE
DK03    .LDA   .017
        .LDDE  .1000+NXAL
        .JDZM  .NXAL
        .JMP   .DK02
        .EJEL  .
***
***
***  DATA TABLE
***
***
DKFL    .DATA  .0               INIT BUST FLAG
DK93    .DATA  .0               INDICATOR ADDR.
DK94    .DATA  .0               STATION #
DK95    .DATA  .0               RR ADDR.
DK96    .DATA  .0               ADC CHANNEL
DK97    .DATA  .0               PROBE #
***
***
```

```
***   CALIBRATION FLAGS   (-1 = WAIT,  0 = CHECK )                                01561
***                                                                               01562
***                                                                               01563
CALF  .EQU   .+-1                                                                 01564
      .DATA  .-1,-1,-1,-1,-1        PROBES 1-4                                    01565
***                                                                               01566
***                                                                               01567
***   CHECKED PARAMETERS COUNTERS                                                 01568
***                                                                               01569
***                                                                               01570
0K00  .EQU   .+-1                                                                 01571
      .DATA  .0,0,0,0           PROBES 1-4                                      01572
***                                                                               01573
***                                                                               01574
***   * CALIBRATED PARAMETERS                                                     01575
***                                                                               01576
***                                                                               01577
0F..  .EQU   .+-1                                                                 01578
      .DATA  .NCP1+1                                                              01579
      .DATA  .NCP2+1                                                              01580
      .DATA  .NCP3+1                                                              01581
      .DATA  .NCP4+1                                                              01582
      .EJEC  .                                                                    01583
***                                                                               01584
***                                                                               01585
***   DO FHA TABLE                                                                01586
***                                                                               01587
***     1 ENTRY FOR EACH CALIBRATED PARAMETER                                     01588
***                                                                               01589
***                                                                               01590
0K90  .EQU   .+0                                                                  01591
      .DATA  .FNC1,FHV1,FMP1                                                      01592
      .DATA  .FNC2,FHV2                                                           01593
      .DATA  .FNC3,FHV3                                                           01594
      .DATA  .FNC4,FMP4                                                           01595
      .DATA  .0                                                                   01596
***                                                                               01597
***                                                                               01598
***   INFORMATION TABLE                                                           01599
***                                                                               01600
***     DATA   .040CDE                                                            01601
***                                                                               01602
***     A = INDICATOR RA ADDR.                                                    01603
***     B = STATION # (1,2,3)                                                     01604
***     C = CAL. RA ADDR.                                                         01605
***     D = ADC CHANNEL ADDR.                                                     01606
***     E = PROBE #                                                               01607
***                                                                               01608
***                                                                               01609
0K99  .EQU   .+0                                                                  01610
      .DATA  .031501,031511,038521                                                01611
      .DATA  .021642,021672                                                       01612
```

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```
        .DATA   .022603,022653
        .DATA   .023604,023624
        .EJEC   .
***
***
***   CALIBRATION FAIL ROUTINE
***
***
BK40    .LDA    .BKPF                   * REF OUTPUT FAIL
        .STA    .BKER                   SET ERROR TYPE
        .LDA    .BK94
        .STA    .BK42
        .STA    .BK43                   STAT. *
        .ROF    .
        .LDA    .BK97
        .CALL   .$BCD,10,2,BKER+6       PROBE TO BCD
        .LDA    .BK96
        .CALL   .$BCD,10,2,BKER+8       CHAN  * TO BCD
        .LDX    .BK97                   PROGRAM *
        .LDA    .IBET,1
        .JAN    .BK41+4                 IF PROG. DELETED
        .TAB    .
BK41    .LDA    .NXAL,2
        .BAR    .
        .JAP    .BK41                   IF PROG. BUSY
        .LDA    .$2
        .LDB    .BK95                   NR ADDR.
        .CALL   .$REL,*                 STOP MACHINE, ALARM ON
BK42    .EQU    .*-1
        .DECR   .01
        .STA    .IBET,1                 DELETE PROGRAM
        .TXA    .
        .SUB    .$4
        .TAB    .
        .LDA    .D512
        .LDXE   .CHF4                   CHAMBER FLAG (0=CHAN 1)
        .XIF    .D60,$LD1               IF PROBE 4, CHAMBER 1 / LDA $160
        .LDB    .BK93                   INDICATOR ADDR.
        .CALL   .$BUF,*                 CAL FAIL LITE ON
BK43    .EQU    .*-1
BK44    .BOP    .
        .LDAI   .BKPB
        .CALL   .$IOC,BK44              ERROR MESSAGE TO TTY
        .LDA    .BKP2+3                 STATUS
        .JAN    .BK44                   IF ERROR
        .BAR    .
        .LDB    .BK97                   GET PROBE *
        .LDX    .BK06                   GET COUNT
        .JAZ    .BK08                   IF OUTPUT DONE
        .JMP    .*-0                    OUTPUT IN PROGRESS
***
BK45    .LDA    .BKDF                   0 REF OUTPUT (OFFSET) FAIL
```

```
        .JMP   .0K40+1              PROCESS IT
        .EJEC  .
***
***
***  TTY OUTPUT DRIVER PARAM. BLOCK
***
***
0KPB    .DATA  .2,-1.3.0
        .DATA  .0KER
***
***
0KER    .DATA  .'FL CAL FAIL SS /CC'
        .DATA  .0
***
0KPF    .DATA  .'PO'                + REF OUTPUT FAIL
0KOF    .DATA  .'ZO'                0 REF OUTPUT FAIL
        .EJEC  .
***
***
***  INITIALIZATION PROGRAM
***
***
IBIN    .DATA  .20                  PN
        .DATA  .1                   PP
        .DATA  .INIT                IENT
        .DATA  .INIT                CENT
        .DATA  .0                   NBAL
        .DATA  .0                   PBAL
        .DATA  .0.0                 TBAL
        .DATA  .0                   NBUL
        .DATA  .0                   PBUL
        .DATA  .0.0                 TBAL
        .DATA  .0.0.0
        .DATA  .07400               STAK
***
INIT    .LDAI  .0DPB
        .CALL  .SIDC.INIT           REQUEST DATE.TIME
        .LDAI  .IDPB
        .CALL  .SIDC.*-4            INPUT DATE: TIME
        .LDA   .0DATE+5
        .CALL  .BIN0                HRS TO BINARY
        .STB   .0HRS
        .LDA   .0DATE+6
        .CALL  .BIN0                MIN TO BINARY
        .STB   .0MIN
A20     .LDAI  .0DB9
        .CALL  .SIDC.*-4            REQUEST P.T.OR N
        .LDAI  .IDB9
        .CALL  .SIDC.*-4            INPUT CHAR.
        .LDA   .0UF9
        .SUB   .0N
        .JAZ   .020                 IF NO INPUT OF TAPE
```

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```
        .SUB    .S2
        .JAZ    .P20            IF PAPER TAPE INPUT                     01717
        .SUB    .S4                                                     01719
        .JAZ    .T20            IF TTY TAPE INPUT                       01720
        .JMP    .A20            IF BAD CHAR.                            01721
***                                                                     01722
B20     .INCR   .01             *                                       01723
        .STAE   .BKFL           SET I/O FLAG FOR BACK                   01724
        .LDA    .S10K                                                   01725
        .CALL   .SALWL          WAIT 10 SEC FOR CALIBRATION             01726
        .LDB    .S5                                                     01727
        .INCR   .01                                                     01728
        .EXC    .0171           SCANNER ON                              01729
        .CALL   .SREL.1         START MACHINE 1                         01730
        .IBR    .               START MACH 2                            01731
        .CALL   .SREL.1                                                 01732
        .CALL   .SREL.2         START MACH 3                            01733
        .CALL   .SREL.3         START MACH 4                            01734
        .JMP    .SEXIT          EXIT                                    01735
        .EJEC   .                                                       01736
LOAD    .SET    .017630                                                 01737
P20     .TZA    .               LOAD AND HALT                           01738
        .CALL   .LOAD           INPUT TAPE USING BINARY LOADER          01739
        .JBZ    .B20            IF SUCCESSFUL                           01740
        .HLT    .               STOP IF READ FAIL                       01741
        .JMP    .P20            TRY AGAIN                               01742
***                                                                     01743
T20     .JMP    .P20            TEMPORARY                               01744
        .EJEC   .                                                       01745
***                                                                     01746
***  OUTPUT DRIVER PARAM. BLOCK                                         01747
***                                                                     01748
ODPB    .DATA   .2,0,3,0                                                01749
        .DATA   .REQO                                                   01750
***                                                                     01751
***  INPUT DRIVER PARAM. BLOCK                                          01752
***                                                                     01753
IDPB    .DATA   .1,0,1,0                                                01754
        .DATA   .SDATE                                                  01755
        .DATA   .7                                                      01756
***                                                                     01757
REQO    .DATA   .'DATE, TIME=?'                                         01758
        .DATA   .0                                                      01759
***                                                                     01760
***  INPUT OF CODE DPB                                                  01761
***                                                                     01762
IDB9    .DATA   .1,0,2,0                                                01763
        .DATA   .BUF9.1                                                 01764
***                                                                     01765
***  OUTPUT CODE REQUEST DPB                                            01766
***                                                                     01767
ODB9    .DATA   .2,0,3,0                                                01768
```

```
      .DATA  .REQ9                                                    01769
***                                                                   01770
REQ9  .DATA  .'READ TAPE? P.T. OR N'                                  01771
      .DATA  .0                                                       01772
***                                                                   01773
BUF9  .DATA  .0                                                       01774
      .EJEC  .                                                        01775
***                                                                   01776
*** ASCII TO BINARY                                                   01777
***                                                                   01778
BINO  .ENTR  .                    A=2 DIGITS,B=RESULT                 01779
      .LRLA  .8                                                       01780
      .SUB   .$260                                                    01781
      .LLSR  .8                                                       01782
      .SUB   .$260                2ND DIGIT IN A                      01783
      .LSRB  .8                   1ST DIGIT IN B                      01784
      .MUL   .$10                 RESULT IN B                         01785
      .JMP*  .BINO                EXIT                                01786
      .EJEC  .                                                        01787
***                                                                   01788
***                                                                   01789
***   TELETYPE BCD OUTPUT DRIVER                                      01790
***                                                                   01791
***      OP CODES:    1 = OUTPUT FROM BUFFER UNTIL WORD=0             01792
***                   2 = OUTPUT NWRD WORDS FROM BUFFER               01793
***                   3 = SAME AS 1, EXCEPT CR-LF PRECEEDS OUTPUT     01794
***                   4 = SAME AS 2, EXCEPT CR-LF PRECEEDS OUTPUT     01795
***                                                                   01796
***                   ABOVE CODES OUTPUT TO TYPEWRITER ONLY.          01797
***                                                                   01798
***      STATUS   :   00= DRIVER BUSY                                 01799
***                   01= OPERATION COMPLETED SUCCESSFULLY            01800
***                   -1= DEVICE ILLEGALLY BUSY                       01801
***                   -2= ILLEGAL OPCODE                              01802
***                                                                   01803
***                                                                   01804
***                                                                   01805
***        INFORMATION BLOCK                                          01806
***                                                                   01807
IB01  .DATA  .10                  PN                                  01808
      .DATA  .10                  PP                                  01809
      .DATA  .STTO                IENT                                01810
      .DATA  .STTO                CENT                                01811
      .DATA  .0                   NXAL                                01812
      .DATA  .0                   PXAL                                01813
      .DATA  .0,0                 TOAL                                01814
      .DATA  .0                   NXWL                                01815
      .DATA  .0                   PXWL                                01816
      .DATA  .0,0                 TXAL                                01817
      .DATA  .0,0,0               STAK                                01818
      .DATA  .07600               OFIS                                01819
      .EJEC  .                                                        01820
```

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```
STTO  .STA   .STOX          SAVE RECALL NO.                          01821
      .STX   .STOZ          SAVE PARAM. FWA                          01822
      .LDA   .SOPC,I        GET OPCODE                               01823
      .DAR   .              .                                        01824
      .JAN   .STOA          IF BAD OPCODE                            01825
STTP  .SUB   .S4            .                                        01826
      .JAP   .STOA          IF BAD WPC                               01827
      .LDB   .SPOPO         PRINT ON, PUNCH OFF                      01828
      .CALL  .STOW          OUTPUT CONTROL WORD FROM B               01829
      .ADD   .S2            .                                        01830
      .JAN   .STOB          IF OPCODE OF 1 OR 2                      01831
      .SUB   .S2            ADJUST OPCODES                           01832
      .LDB   .SCRLF         CR-LF                                    01833
      .CALL  .STOW          TYPE CRLF                                01834
STOB  .IAR   .              .                                        01835
      .JAN   .STOG          IF OPCODE= 1 OR 3                        01836
***                                                                  01837
***   OPCODE= 2 OR 4                                                 01838
***                                                                  01839
      .LDA   .SWWD,1        A=WD. WORDS                              01840
      .JAP   .**3           .                                        01841
      .TZA   .              MAKE IT 0 IF -                           01842
      .LDX   .SFWA,1        X=BUFFER FWA                             01843
STOW  .JAZ   .STOE          IF DONE OUTPUT                           01844
      .LDB   .0,1           GET NEXT WORD                            01845
      .CALL  .STOW          OUTPUT WORD                              01846
      .IXR   .              .                                        01847
      .DAR   .              .                                        01848
      .JMP   .STOW          CONTINUE                                 01849
***                                                                  01850
***   OPCODE= 1 OR 3                                                 01851
***                                                                  01852
STOG  .LDX   .SFWA,1        X=BUFFER FWA                             01853
      .LDB   .0,1           GET NEXT WORD                            01854
      .JBZ   .STOE          WORD = 0 MEANS DONE OUTPUT               01855
      .CALL  .STOW          OUTPUT WORD                              01856
      .IXR   .              .                                        01857
      .JMP   .STOG+1        CONTINUE                                 01858
      .EJEC  .              .                                        01859
***                                                                  01860
***                                                                  01861
***   OUTPUT 1 WORD TO TTY                                           01862
***                                                                  01863
***                                                                  01864
STOW  .ENTR  .              FROM B                                   01865
      .STA   .STOY          .                                        01866
      .LRLB  .8             .                                        01867
      .CALL  .STOC          CHAR 1                                   01868
      .LRLB  .8             .                                        01869
      .CALL  .STOC          CHAR 2                                   01870
      .LDA   .STOY          .                                        01871
      .JMP*  .STOW          EXIT                                     01872
```

```
      .SPAC                                                                    01873
***                                                                            01874
***                                                                            01875
***   OUTPUT CHAR TO TTY                                                       01876
***                                                                            01877
***                                                                            01878
STOC  .ENTR  .                    FROM A                                       01879
      .TBA   .                                                                 01880
      .LRLA  .8                                                                01881
      .LSRA  .8                                                                01882
      .JAZ*  .STOC                IGNORE 0'S                                   01883
      .LDA   .DIGO                                                             01884
      .CALL  .SALWL               WAIT FOR 100 MS                              01885
      .SEN   .01C1.STOR           READY ?                                      01886
      .COMPL .01                  NO, SET A=-1                                 01887
      .JMP   .STOI                ERROR EXIT, BUSY DEVICE, STATUS=-1           01888
STOR  .OBR   .01                  TYPE CHARACTERS IN B                         01889
      .JMP*  .STOC                EXIT                                         01890
      .EJEC  .                                                                 01891
***                                                                            01892
***                                                                            01893
***   END OF OUTPUT , SET STATUS                                               01894
***                                                                            01895
***                                                                            01896
STOE  .INCR  .01                  A=1 FOR AOK                                  01897
STOI  .LDX   .STOZ                X=PARAM. FWA                                 01898
      .STA   .$STS.1              SET STATUS                                   01899
      .LDA   .STOX                A=RECALL NO.                                 01900
      .LDXI  .TTYO                X=DRIVER NO.                                 01901
      .JMP   .SIOT                TERMINATION ENTRY INTO SIOC                  01902
STOA  .LDA   .SM2                                                              01903
      .JMP   .STOI                SET STATUS=-2 FOR BAD OPCODE                 01904
***                                                                            01905
***                                                                            01906
STOX  .DATA  .0                                                                01907
STOY  .DATA  .0                                                                01908
STOZ  .DATA  .0                                                                01909
      .EJEC  .                                                                 01910
***                                                                            01911
***                                                                            01912
***   LINE PRINTER DRIVER                                                      01913
***                                                                            01914
***      PARAMETER DATA BLOCK FORMAT                                           01915
***            OP CODE                                                         01916
***            STATUS                                                          01917
***            FWA                                                             01918
***            NWRD  (OPTIONAL)                                                01919
***            STRT  (OPTIONAL COL. BEGINNING)                                 01920
***                                                                            01921
***      OP CODES:   1 = OUTPUT FROM BUFFER UNTIL WORD = 0                     01922
***                  2 = OUTPUT NWRD WORDS FROM BUFFER                         01923
***                  3 = (1) WITH LF FIRST                                     01924
```

```
***                 4 = (2) WITH LF FIRST                                    01925
***                 5 = TOP OF FORM                                          01926
***                 6 = OUTPUT CHAR. AT FWA AWRD TIMES                       01927
***                                                                          01928
***      STATUS:    0 = BUSY                                                 01929
***                 1 = OK                                                   01930
***                -1 = LINE PRINTER BUSY OR OFF LINE                        01931
***                -2 = ILLEGAL OP CODE                                      01932
***                                                                          01933
***                                                                          01934
***                                                                          01935
***  INFORMATION BLOCK                                                       01936
***                                                                          01937
IBD4  .DATA  .13              PN                                             01938
      .DATA  .10              PV                                             01939
      .DATA  .SLPD            IENT                                           01940
      .DATA  .SLPD            CENT                                           01941
      .DATA  .0               NWAL                                           01942
      .DATA  .0               PRAL                                           01943
      .DATA  .0,0             TOAL                                           01944
      .DATA  .0               NXWL                                           01945
      .DATA  .0               PRWL                                           01946
      .DATA  .0,0             TRAL                                           01947
      .DATA  .0,0,0           STAK                                           01948
      .DATA  .07400           OFLS                                           01949
      .EJEC  .                                                             01950
SLPD  .STX   .SPOZ            STORE PARAM FWA                                01951
      .STA   .SPOY            STORE RECALL NO.                               01952
      .SUF   .                SET TO WAIT ON OUTPUT                          01953
      .LDA   .SOPC.1          GET OP CODE                                    01954
      .DAR   .                                                             01955
      .JAN   .SPOA            IF BAD OP CODE                                 01956
      .SUB   .S6                                                           01957
      .JAP   .SPOA            IF BAD OP CODE                                 01958
      .ADD   .S2                                                           01959
      .JAZ   .SP05            IF OP CODE = 5                                 01960
      .JAP   .SP06            IF OP CODE = 6                                 01961
      .ADD   .S2                                                           01962
      .JAN   .SPOH            IF OP CODE = 1 OR 2                            01963
      .LDB   .S212            IF OP CODE = 3 OR 4                            01964
      .CALL  .SPDC            OUTPUT LF                                      01965
      .SUB   .S2                                                           01966
SPOH  .IZR   .                                                             01967
      .JAN   .SP01            IF OP CODE = 1 OR 3                            01968
      .LDA   .SNWD.1          IF OP CODE = 2 OR 4                            01969
      .JAP   .+*3                                                          01970
      .TZA   .                SET TO 0 IF REG.                               01971
      .LDB   .5,1             GET CHR. START                                 01972
      .CALL  .SPDF            SPACE TO START                                 01973
      .LDX   .SFWA.1          X = BUFFER FWA                                 01974
SPOD  .JAZ   .SPDE            IF DONE, CR                                    01975
      .LDB   .0,1             GET WORD                                       01976
```

```
        .CALL   .SPOW           OUTPUT WORD                             01977
        .IXR    .               .                                       01978
        .DAP    .               .                                       01979
        .JMP    .SPOD           CONTINUE                                01980
SPO1    .LDB    .4,1            GET CHL. START                          01981
        .CALL   .SPOF           SPACE TO START                          01982
SPO2    .LDX    .$FWA,1         A                                       01983
        .LDB    .0,1            GET WORD                                01984
        .JBZ    .SPOE           IF DONE, CR                             01985
        .CALL   .SPOW           OUTPUT WORD                             01986
        .IXR    .               .                                       01987
        .JMP    .SPO2+1         CONTINUE                                01988
SPO5    .LDB    .SPOT           GET TOF-LF                              01989
        .CALL   .SPOW           OUTPUT WORD, TOF                        01990
        .JMP    .SPOE+3         DONE, NO CR                             01991
SPO6    .LDB    .5,1            GET CHL. START                          01992
        .CALL   .SPOF           SPACE TO START                          01993
        .LDB    .$FWA,1         GET CHARACTER                           01994
        .LDA    .$WWD,1         GET REPEAT COUNT                        01995
SPO7    .JAZ    .SPOE           IF DONE, CR                             01996
        .DAR    .               .                                       01997
        .CALL   .SPOC           OUTPUT CHARACTER                        01998
        .JMP    .SPO7           CONTINUE                                01999
SPOE    .LDB    .$215           .                                       02000
        .CALL   .SPOC           OUTPUT CR                               02001
        .INCR   .01             .                                       02002
SPOG    .LDX    .SPO2           RESTORE PARAM. FWA                      02003
        .STA    .$STS,1         SETS STATUS = 1                         02004
        .LDA    .SPOY           RECALL NO.                              02005
        .LDXI   .LPRO           DRIVER NO.                              02006
        .JMP    .$101           TERMINATION ENTRY INTO SIOC             02007
SPOA    .LDA    .SN2            .                                       02008
        .JMP    .SPOG           STATUS = -2, BAD JMP CODE               02009
SPOW    .ENTR   .               OUTPUT WORD IN B                        02010
        .LRLB   .8              .                                       02011
        .CALL   .SPOC           LEFT CHARACTER                          02012
        .LRLB   .8              .                                       02013
        .CALL   .SPOC           RIGHT CHARACTER                         02014
        .JMP*   .SPOW           EXIT                                    02015
SPOC    .ENTR   .               OUTPUT CHAR. IN A                       02016
        .STA    .SPOX           SAVE A                                  02017
        .TBA    .               .                                       02018
        .LRLA   .8              .                                       02019
        .LSRA   .8              .                                       02020
        .JAZ    .SPOV+1         IGNORE 0'S                              02021
        .JOFM   .SPOU           IF MAI? IMPLIED                         02022
        .TBA    .               .                                       02023
        .LRLA   .8              .                                       02024
        .LSRA   .8              ISOLATE CHAN.                           02025
        .SUB    .$216           .                                       02026
        .JAP    .SPOV           IF NOT CONTROL CHAN.                    02027
        .ADD    .$3             .                                       02028
```

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```
        .JAZ   .$P08              IF TOF
        .IAR   .
        .ADD   .$P00
        .JAZ   .$P09              IF TIME FOR TOF
$P0M    .LDA   .$252              170 MS
        .STA   .$P0U+2            SET WAIT
        .SOF   .                  SET TO WAIT NEXT
$P0V    .OBR   .072               OUTPUT B TO PRINTER
        .LDA   .$P0X              RESTORE A
        .JMP*  .$P0C              EXIT
$P08    .STA   .$P00              SET TOF FLAG = 0
        .JMP   .$P0M
$P09    .DECR  .01
        .STA   .$P00              SET TOF FLAG = -1
        .LDA   .0999
        .JMP   .$P0M+1            WAIT 999 MS
$P00    .DATA  .-1                TOF FLAG (-1 OFF, 0 ON)
        .EJEC  .
$P0U    .ENTR  .                  WAIT ROUTINE
        .LDAI  .*                 WAIT TIME
        .CALL  .$ALWL
        .ROF   .                  NO WAIT NEXT TIME
        .SEN   .072,($P0U)*       READY?
        .COMPL .1                 NO, A=-1
        .JMP   .$P0G              STATUS = -1,BUSY
$P0F    .ENTR  .                  SPACE B-1 COLUMNS
        .STA   .$P0I              SAVE A
        .DECR  .021               B-1 TO A
        .JAZ   .$P0S+5            IF NO SPACING NEEDED
        .LDB   .$240              B=SPACE
$P0S    .CALL  .$P0C              SPACE 1 COL.
        .DAR   .
        .JAP   .$P0S              IF MORE
        .LDA   .$P0I              RESTORE A
        .JMP*  .$P0F              EXIT
***
$P0I    .DATA  .0
$P0X    .DATA  .0
$P0Y    .DATA  .0
$P0Z    .DATA  .0
$P0T    .DATA  .0105612           TOF-LF
        .EJEC  .
***
***
***     TELETYPE BCD INPUT DRIVER
***
***        OP CODES:       1 = INPUT CHARACTERS AND STORE 2 CHAR
***                           PER WORD STARTING AT FWA,UNTIL CR
***                        2 = SAME AS 1, EXCEPT ONE CHAR STORED PER WORD
***
***        STATUS:         0 = DRIVER BUSY
***                        1 = OPERATION COMPLETED SUCCESSFULLY
```

```
***                    -1 = DEVICE ILLEGALLY BUSY                                02081
***                    -2 = ILLEGAL OP CODE                                      02082
***                                                                              02083
***      PARAMETER DATA BLOCK FORMAT                                             02084
***                                                                              02085
***              OP CODE                                                         02086
***              STATUS                                                          02087
***              FWA                                                             02088
***              NWRD                                                            02089
***              A REG CONTAINS RECALL NO.                                       02090
***              X REG CONTAINS DATA BLOCK FWA                                   02091
***                                                                              02092
***      SPECIAL CHARACTER RECOGNIZED BY INPUT DRIVER PROGRAM                    02093
***                                                                              02094
***              RUB OUT - DELETES ALL INPUT AND RETURNS CONTROL                 02095
***                        TO OPERATOR TO START INPUT AGAIN                      02096
***            SEMI COLON - GIVES A CR AND LF AND ALLOWS OPERATOR                02097
***                        TO CONTINUE WITH INPUT                                02098
***               C^       - TERMINATES INPUT AND CAUSES DRIVER TO EXIT          02099
***                                                                              02100
***                                                                              02101
***                                                                              02102
***      INFORMATION BLOCK                                                       02103
***                                                                              02104
IBDD  .DATA  .9                  PN                                              02105
      .DATA  .10                 PP                                              02106
      .DATA  .STII               IENT                                            02107
      .DATA  .STII               CENT                                            02108
      .DATA  .0                  REAL                                            02109
      .DATA  .0                  PREAL                                           02110
      .DATA  .0.0                TUAL                                            02111
      .DATA  .0                  RWAL                                            02112
      .DATA  .0                  PRWL                                            02113
      .DATA  .0.0                TRAL                                            02114
      .DATA  .0.0.0              STAR                                            02115
      .DATA  .07400              OFIS                                            02116
      .EJEC  .                                                                   02117
***                                                                              02118
***   PROGRAM INITIAL ENTRY POINT                                                02119
***                                                                              02120
STII  .STA   .STIA               SAVE RECALL NO.                                 02121
      .STX   .STI2               SAVE PARAM. FWA                                 02122
      .LDA   .SNWD.1             A = NO. OF BUFFER WDS STORAGE                   02123
      .ADD   .SFWA.1             ADDR OF BUFFER LAST WORD + 1                    02124
      .STA   .STIY                                                               02125
      .LDA   =OPS=1              GET OP CODE                                     02126
      .ROF   .                                                                   02127
      .DAR   .                                                                   02128
      .JAN   .STIA               IF BAD OP CODE                                  02129
      .JAZ   .STIP               IF OP CODE = 1                                  02130
      .SUB   .02                                                                 02131
      .JAP   .STIA               IF BAD OP CODE                                  02132
```

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```
***
$TIC   .ENTR  .                  FROM 8
       .LDA   .0100
       .CALL  .$ALWL             WAIT FOR 100 MS
       .SEN   .0101.$TIR         READY ?
       .DECR  .01                NO.SET A=-1
       .JMP   .$TIF              ERROR EXIT.BUSY DEVICE.STATUS=-1
$TIR   .DBR   .01                YES.PRINT 8
       .JMP*  .$TIC              EXIT
***
***    IF RUB OUT
***
$TIH   .LDX   .$TIZ              PARAM. FWA
       .JMP   .$TIB              START OVER AGAIN
***
***    IF SEMI COLON
***
$TIJ   .LDB   .$CRLF
       .CALL  .$TIW
       .JMP   .$TII+1            READ AGAIN
***
***    IF CR. EXIT
***
$TIE   .LDB   .$CRLF
       .CALL  .$TIW              TYPE CR-LF
       .INCR  .01                A=1.STATUS AOK
$TIF   .LDX   .$TIZ              X=PARAM FWA
       .STA   .$STS.1            SET STATUS
       .LDA   .$TIX              RECALL NO.
       .LDXI  .TTY1              X=DRIVER NO.
       .JMP   .$IOT              TERMINATION ENTRY INTO $ADC
$TIA   .LDA   .$M2               IF BAD UP CODE
       .JMP   .$TIF
***
***    DATA
***
$TIN   .DATA  .'1
$TIU   .DATA  .0
$TIX   .DATA  .0
$TIY   .DATA  .0
$TIZ   .DATA  .0
       .EJEC  .
***
***
***  SUMMARY PRINT-OUT ROUTINE
***
***
IBSP   .DATA  .16                PN
       .DATA  .2                 PP
       .DATA  .SPRO              IENT
       .DATA  .SPRO              CENT
       .DATA  .0
```

```
        .DATA  .0
        .DATA  .0.0
        .DATA  .0
        .DATA  .0
        .DATA  .0.0
        .DATA  .0.0.0              STAK
        .DATA  .07400
        .EJEC  .
SP16    .DATA  .0                  STAT. # ON ENTRY
SP17    .DATA  .0                  TYPE FLAG ON ENTRY (-1=SENS,0=NORM,1=ARM).
***
***
***  ON ENTRY :
***
***     A = STAT. DATA BLK. FWA  (-1 FOR NONE)
***     B = PREAMBLE FWA TERMINATED BY 0 (-1 FOR NONE)
***     X = TEST  DATA BLK. FWA  (-1 FOR NONE)
***
***
SPRO    .STB   .PREA
        .STA   .SFWA
        .STX   .TFWA
        .EXC   .DPIM               DISABLE INTERRUPTS
        .JAN   .SP1                IF NO STAT. DATA
        .TAB   .
        .CALL  .TRAN.CORR.SBUF
        .LDA   .SBUF+CDOF          A=# WRDS. CORR. DATA
        .JAZ   .SP1                IF NONE
        .SUB   .$21
        .XAP   .$DR1               IF > 20. SET=20
        .ADD   .$21                A=# WRDS TO XFER
        .STA   .++3
        .CALL  .TRAN.+.SBUF+CORR
SP1     .LDA   .TFWA
        .JAN   .SP2                IF NO TEST DATA
        .TAB   .
        .CALL  .TRAN.FALE+20.TBUF
        .EXC   .EPIM               RE-ENABLE INTERRUPTS
SP2     .LDBI  .$DATE
        .CALL  .TRAN.4.PV1
        .CALL  .$TIME              TIME OF DAY (A=MIN,B=HRS)
        .MUL   .D100
        .TBA   .
        .RDF   .
        .CALL  .$BCD.10.4.PV2      TIME TO BCD
        .LDA   .SP16
        .CALL  .$BCD.10.2.PV3      STAT. # TO BCD
        .CALL  .PRINT.5.0.0        TOF
        .CALL  .PRINT.1.P01.47     SEGMENT 1
        .LDA   .PREA
        .JAN   .SP3                IF NO PREAMBLE
        .STA   .++4
```

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```
      .CALL  .PRINT.3.+.20       PREAMBLE
SP3   .LDA   .SFNA
      .JAN   .SP7                IF NO STAT.
      .LDA   .SBUF+NOFT
      .SOF   .
      .CALL  .BCD.PV4            * FUZES TESTED
      .LDA   .SBUF+NUFR
      .CALL  .BCD.PV5            * FUZES REJECTED
      .LDA   .SBUF+NOMS
      .CALL  .BCD.PV6            * MACHINE STOPS
      .CALL  .PRINT.1.PO2.1      SEGMENT 2
      .LDAI  .SBUF+CORR          LIST FNA
      .LDB   .SBUF+CODF          * ENTRIES IN LIST
      .TZX   .
      .CALL  .LIST               OUTPUT CORR DATA
SP7   .LDA   .TFNA
      .JAN   .SP8                IF NO TEST DATA
      .LDA   .TBUF+FLOT
      .ROF   .
      .CALL  .BCD.PV8            * FAILS THIS LOT
      .LDA   .TBUF+CONF          * CONSEC. FAILS
      .CALL  .BCD.PV9
      .LDA   .TBUF+FAIL
      .SUF   .
      .CALL  .BCD.PV7            TOTAL * FAILS
      .CALL  .PRINT.1.PO4.1      SEGMENT 4
      .LDA   .SP17
      .JAP   .SP6                IF NORMAL OR ARM LOGIC
      .LDA   .TBUF+FLCT
      .CALL  .BCD.PV22           TOTAL LOW FAILS
      .LDA   .TBUF+FNCT
      .CALL  .BCD.PV25           TOTAL HIGH FAILS
      .ROF   .
      .LDA   .TBUF+FLTL
      .CALL  .BCD.PV20           LOT LOW FAILS
      .LDA   .TBUF+FNTL
      .CALL  .BCD.PV23           LOT HIGH FAILS
      .LDA   .TBUF+FLPL
      .CALL  .BCD.PV21           LOW FAILS PREV. LOT
      .LDA   .TBUF+FNPL
      .CALL  .BCD.PV24           HIGH FAILS PREVIOUS LOT
      .CALL  .PRINT.3.PO12.1     BINARY SENSITIVITY FAIL INFO.
      .JMP   .SP8                DONE
SP4   .COMPL .011
      .INCR  .014
      .IXR   .                   X=1-A
      .LDB   .TBUF+FLOT
      .LDAI  .TBUF+FALE
      .ROF   .
      .CALL  .LIST               OUTPUT RAW FAIL DATA
SP5   .CALL  .PRINT.1.PO45.1
      .CALL  .PRINT.1.PO5.25     SEGMENT 5
```

```
        .JAN   .SP12                IF NONE
        .INCR  .021                 A=B+1
        .COMPL .2
        .IXR   .
        .CALL  .FOOP                OUTPUT LAST LINE
        .TBX   .
        .ROF   .
        .CALL  .FOOP                OUTPUT TOTALS
        .LDA   .SP17
        .JAZ   .SP98                IF ACC. IN VOLTS
        .LDA   .TBUF+MINA
        .CALL  .BCD.PV18            MIN. ACCEPT. (MS)
        .LDA   .TBUF+MAXA
        .CALL  .BCD.PV19            MAX. ACCEPT. (MS)
        .JMP   .SP97
SP98    .CALL  .$VCD.TBUF+MINA.PV18     MIN ACC. (VOLTS)
        .CALL  .$VCD.TBUF+MAXA.PV19     MAX. ACCEPT.
SP97    .CALL  .PRINT.1.PB10.1      ACC LIMITS
SP8     .CALL  .PRINT.5.0.0         TDF
        .TZA   .
        .STA   .$POD                SET READY
        .JMP   .$EXIT
PREA    .DATA  .0
SFUA    .DATA  .0
TFUA    .DATA  .0
SBUF    .BSS   .20+CORR             STATION DATA
TBUF    .BSS   .FALE+20
CNTV    .DATA  .0
        .EJEC  .
***
***
***  PRINT ROUTINE
***
***
SP20    .STA   .SA16
        .STX   .SX16
        .LDA   .PRINT
        .TAX   .
        .ADD   .$3
        .STA   .PRINT               UPDATE FOR RETURN
        .LDA   .0.1                 OPCODE
        .STA   .0016+2
        .LDA   .1.1                 FUA
        .STA   .0016+4
        .LDA   .2.1                 COL. START
        .STA   .0016+5
        .LDAI  .0016
        .NOP   .
        .CALL  .$IOC.*-5            OUTPUT BUFFER
        .LDA   .SA16
        .LDX   .SX16
        .JMP   .*                   EXIT
```

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```
        .ORG   .*-1
PRINT   .ENTR  .
        .JMP   .SP20
SA16    .DATA  .0
SX16    .DATA  .0
***
***  OUTPUT DRIVER PARAM. BLOCK
***
OB16    .DATA  .5                  LU
        .DATA  .0                  MODE
        .DATA  .*                  OPCODE
        .DATA  .*                  STATUS
        .DATA  .*                  FWA
        .DATA  .*                  COL START
        .EJEC  .
***
***
***  FREQUENCY DISTRIBUTION DISPLAY PROGRAM
***
***
***     A = LEFT LIMIT (-1 FOR BLANK)
***     B = RGHT LIMIT        "
***     X = CUM. FREQ. DIST. CELL
***
***
FDDP    .ENTR  .
        .ROF   .
        .STA   .AS16
        .STB   .BS16
        .STX   .XS16
        .STX   .TS16
        .CALL  .CL16               CLEAR PO15
        .LDB   .SP17
        .LDA   .XS16
        .JAN   .SP30               IF TOTALS
        .LDA   .AS16
        .JAN   .SP27               IF LEFT BLANK
        .JBZ   .SP33               IF VOLTS
        .LDA   .AS16
        .CALL  .$BCD,10,6,PO15     MS TO BCD
        .JMP   .SP27
SP33    .CALL  .$VCD,AS16,PO15
SP27    .LDA   .BS16
        .JAN   .SP28               IF RIGHT BLANK
        .JBZ   .SP34               IF VOLTS
        .LDA   .BS16
        .CALL  .$BCD,10,6,PO15+4
        .JMP   .SP28
SP34    .CALL  .$VCD,BS16,PO15+4
SP28    .LDA   .$254
        .STA   .PO15+3             DELINEATOR
        .LDAI  .PO15+40
```

```
        .STA    .SP36           BUFF ENTRY                              02497
        .LDX    .$2                                                     02498
SP22    .LDB    .TS16                                                   02499
        .SUF    .                                                       02500
        .LDA    .SP36                                                   02501
        .SUB    .$5                                                     02502
        .STA    .SP35                                                   02503
        .SUB    .$5                                                     02504
        .STA    .SP36                                                   02505
        .LDA    .0,2                                                    02506
        .CALL   .BCD.*          F TO BCD                                02507
SP36    .EQU    .*-1                                                    02508
        .TXA    .                                                       02509
        .SUB    .$2                                                     02510
        .JAZ    .SP25           IF CURR HIST.                           02511
        .LDA    .0,2            A=FREQ.                                 02512
        .ANA    .MSK1           REMOVE BIAS                             02513
SP24    .TAB    .                                                       02514
        .LDAE   .TD16.1                                                 02515
        .ASRA   .1              A=T/2                                   02516
        .RDF    .                                                       02517
        .MUL    .D100                                                   02518
        .DIVE   .TD16.1         B = %                                   02519
        .XOF    .SP29           SET B=0 ON OF                           02520
        .TBA    .                                                       02521
        .RDF    .                                                       02522
        .CALL   .%BCD.10.3,*    % TO BCD                                02523
SP35    .EQU    .*-1                                                    02524
        .LDA    .TS16                                                   02525
        .SUB    .$NJN                                                   02526
        .STA    .TS16           ADJUST FREQ. SOURCE                     02527
        .DECR   .065                                                    02528
        .JAP    .SP22           IF MORE                                 02529
SP26    .CALL   .PRINT,3,PD15,25 1 LINE                                 02530
        .LDA    .AS16           RESTORE REGISTERS                       02531
        .LDB    .BS16                                                   02532
        .LDX    .XS16                                                   02533
        .JMP*   .FDOP           RETURN                                  02534
SP25    .LDA    .0,2                                                    02535
        .ASRA   .2                                                      02536
        .ADD    .$4FS           F=F/4+8192                              02537
        .JMP    .SP24                                                   02538
SP29    .TZB    .                                                       02539
SP30    .LDA    .TD16+3                                                 02540
        .STA    .TD16+2         SET CURR TOTAL                          02541
        .LDX    .$2                                                     02542
        .LDAI   .PD15+33                                                02543
        .STA    .SP32                                                   02544
SP31    .LDA    .SP32                                                   02545
        .SUB    .$10                                                    02546
        .STA    .SP32           UPDATE BUFF ENTRY                       02547
        .LDAE   .TD16.1         %=TOTAL                                 02548
```

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```
        .CALL  .BCD.*
SP32    .EQU   .*-1
        .DECR  .045
        .JAP   .SP31                IF MORE
        .LDA   .$240
        .STA   .PO15+12
        .STA   .PO15+22
        .CALL  .PRINT.1.PO9.32      TOTALS
        .JMP   .SP26+5
***
TO16    .BSS   .4                   TOTALS- CURR.PREV.CUMM/4.CUMM
        .EJEC  .
***
***
***  CLEAR PO15 BUFFER TO BLANKS
***
***
CL16    .ENTR  .
        .LDX   .$39
        .LDB   .$BB
        .STBE  .PO15.1
        .DECR  .045
        .JAN+  .CL16
        .JMP   .CL16+2
        .EJEC  .
***
***
***  TRANSFER ROUTINE
***
***
SP40    .LDX   .TRAN
        .INR   .TRAN
        .INR   .TRAN
        .LDA   .0.1                 # WRDS
        .COMPL .011
        .IAR   .
        .STA   .TS16                - WRDS
        .LDX   .1.1                 FWA OF DEST. BUFF
SP50    .LDA   .0.2                 B=FWA OF SOURCE BUFF
        .STA   .0.1                 XFER 1 WORD
        .IBR   .
        .IXR   .
        .INR   .TS16
        .LDA   .TS16
        .JAN   .SP50                IF MORE
        .JMP   .*                   EXIT
        .ORG   .*-1
TRAN    .ENTR  .
        .JMP   .SP40
        .EJEC  .
***
***  LIST SUBROUTINE
```

```
***                                                                    02601
***     A=SOURCE FWA                                                   02602
***     B=# ENTRIES                                                    02603
***     X=TYPE FLAG ( 0= F OR MS, 1 = VOLTS )                          02604
***                                                                    02605
***                                                                    02606
SP65  .CALL   .PRINT,1,P03,20      'NONE'                              02607
      .JMP    .*                                                       02608
      .ORG    .*-1                                                     02609
LIST  .ENTR   .                                                        02610
      .JBZ    .SP65                IF LIST EMPTY                       02611
      .STA    .SP62                                                    02612
      .STX    .SP66                                                    02613
      .TWA    .                                                        02614
      .SUB    .S21                                                     02615
      .JAN    .*+3                                                     02616
      .LDB    .S20                 LIMIT TO 20 ENTRIES                 02617
      .TZA    .                                                        02618
      .DIV    .S10                                                     02619
      .STA    .SPR1                REMAINDER                           02620
SP60  .STB    .SPR2                # LINES -1                          02621
      .LDA    .SPR1                                                    02622
      .JPZ    .*+3                 IF LAST LINE                        02623
      .LDA    .S10                                                     02624
      .STA    .SP64                # ENTRIES THIS LINE                 02625
      .JAZ*   .LIST                IF LINE EMPTY, EXIT                 02626
      .CALL   .CL16                                                    02627
      .LDAI   .P015-4                                                  02628
      .STA    .SP63                                                    02629
      .TZX    .                                                        02630
SP61  .LDA    .SP63                                                    02631
      .ADD    .S4                                                      02632
      .STA    .SP63                SET BUFF ENTRY                      02633
      .STA    .SP69                                                    02634
      .LDAE   .*-1                                                     02635
SP62  .EQU    .*-1                                                     02636
      .LDB    .SP66                                                    02637
      .JBZ    .SP67                IF FREQ.                            02638
      .STA    .SP68                SOURCE VOLTS                        02639
      .CALL   .SYCO,SP68,*                                             02640
SP63  .EQU    .*-1                                                     02641
      .JMP    .SP69+1                                                  02642
SP67  .CALL   .BCD,*                                                   02643
SP69  .EQU    .*-1                                                     02644
      .INCR   .045                                                     02645
      .SUBI   .*                                                       02646
SP64  .EQU    .*-1                                                     02647
      .JAN    .SP61                IF MORE                             02648
      .CALL   .PRINT,3,P015,20                                         02649
      .LDA    .SP62                                                    02650
      .ADD    .S10                                                     02651
      .STA    .SP62                SET FWA FOR NEXT LINE               02652
```

```
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        .LDB    .SPR2                                                   02653
        .DECR   .023                                                    02654
        .JAP    .SP60           IF MORE LINES                           02655
        .JMP*   .LIST           EXIT                                    02656
SP60    .DATA   .0                                                      02657
SP68    .DATA   .0                                                      02658
SPR1    .DATA   .0                                                      02659
SPR2    .DATA   .0                                                      02660
        .EJEC   *                                                       02661
TS16    .DATA   .0                                                      02662
AS16    .DATA   .0                                                      02663
9S16    .DATA   .0                                                      02664
XS16    .DATA   .0                                                      02665
        .EJEC   *                                                       02666
***                                                                     02667
***                                                                     02668
***  UTILITY ROUTINE                                                    02669
***                                                                     02670
***                                                                     02671
BCD     .ENTR   *                                                       02672
        .STB    .SB16                                                   02673
        .LDBE*  .BCD                                                    02674
        .STB    .**5                                                    02675
        .CALL   .$BCD.10.5.*                                            02676
        .INR    .BCD                                                    02677
        .LDB    .SB16                                                   02678
        .JMP*   .BCD                                                    02679
SB16    .DATA   .0                                                      02680
        .EJEC   *                                                       02681
***                                                                     02682
***                                                                     02683
***  FORMATTED BUFFERS                                                  02684
***                                                                     02685
***                                                                     02686
CRLF    .SET    .0106612                                                02687
LFLF    .SET    .0105212                                                02688
***                                                                     02689
P01     .EQU    .*                                                      02690
        .DATA   .'XM-594 FUZE TESTING SYSTEM'                           02691
        .DATA   .CRLF                                                   02692
        .DATA   .'DATE                                                  02693
PV1     .BSS    .4              (DATE)                                  02694
        .DATA   .CRLF                                                   02695
        .DATA   .'TIME -                                                02696
PV2     .BSS    .2              (TIME)                                  02697
        .DATA   .CRLF                                                   02698
        .DATA   .'PROVE -                                               02699
PV3     .BSS    .1              (STAT #)                                02700
        .DATA   .CRLF,0                                                 02701
        .EJEC   *                                                       02702
P02     .DATA   .LFLF                                                   02703
        .DATA   .'STATION DATA'                                         02704
```

```
        .DATA   .CRLF,0212                                              02705
        .DATA   .'FUZES =                                               02706
PV4     .BSS    ,3              (# TESTED)                              02707
        .DATA   ,CRLF                                                   02708
        .DATA   .'FAILS =                                               02709
PV5     .BSS    ,3              (# REJECTS)                             02710
        .DATA   ,CRLF                                                   02711
        .DATA   .'STOPS =                                               02712
PV6     .BSS    ,3              (# STOPS)                               02713
        .DATA   ,CRLF,0212                                              02714
        .DATA   .'CORRELATION'                                          02715
        .DATA   ,CRLF                                                   02716
        .DATA   .'DATA'                                                 02717
        .DATA   ,0                                                      02718
        .EJEC   .                                                       02719
PQ3     .DATA   .'NOME',0                                               02720
...                                                                     02721
...                                                                     02722
PQ4     .DATA   .LFLF,LFLF                                              02723
        .DATA   .'PARAMETER DATA'                                       02724
        .DATA   ,CRLF,0212                                              02725
        .DATA   .'  FAILURES'                                          02726
        .DATA   ,CRLF,0212                                              02727
        .DATA   .'TOTAL = '                                             02728
PV7     .BSS    ,3              (# PARAM. FAILS)                        02729
        .DATA   ,CRLF                                                   02730
        .DATA   .'  LOT = '                                            02731
PV8     .BSS    ,3              (# FAILS THIS LOT)                      02732
        .DATA   ,CRLF                                                   02733
        .DATA   .'CONS. = '                                             02734
PV9     .BSS    ,3              (# CONSEC. FAILS)                       02735
        .DATA   ,CRLF,0212                                              02736
        .DATA   .'RAW DATA'                                             02737
        .DATA   ,0                                                      02738
        .EJEC   .                                                       02739
PQ45    .DATA   ,LFLF,0212                                              02740
        .DATA   .'FREQ. DIST.'                                          02741
        .DATA   ,0                                                      02742
...                                                                     02743
...                                                                     02744
PQ5     .DATA   .'   INTERVAL                                           02745
        .DATA   .'    '.0240                                            02746
        .DATA   .'PRESENT  LOT'                                         02747
        .DATA   .'      '                                               02748
        .DATA   .'PREVIOUS LOT'                                         02749
        .DATA   .'      '                                               02750
        .DATA   .' CUMULATIVE '                                         02751
        .DATA   ,0                                                      02752
        .EJEC   .                                                       02753
PQ6     .DATA   .LFLF                                                   02754
        .DATA   .'    VOLTS                                             02755
        .DATA   ,0                                                      02756
```

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```
***
***
PO11  .DATA  .LFLF
      .DATA  .'    N SEC '
      .DATA  .0
***
***
PO7   .DATA  .'FREQ.     X '
      .DATA  .0
      .EJEC  .
PO10  .DATA  .LFLF
      .DATA  .'ACCEPTANCE'
      .DATA  .CRLF
      .DATA  .'  LIMITS      '
PV18  .BSS   .3                  (MIN. ACCEPT. LIMIT)
      .DATA  .' .'
PV19  .BSS   .3                  (MAX. ACCEPT. LIMIT)
      .DATA  .0.
***
***
PO14  .DATA  .0212.0
***
***
PO9   .DATA  .LFLF
      .DATA  .' TOTAL'
PO15  .BSS   .40                 BUFFER AREA
      .DATA  .0
      .EJEC  .
PO12  .DATA  .LFLF
      .DATA  .'L CUR = '
PV20  .BSS   .3                  (LOW FAILS THIS LOT)
      .DATA  .CRLF
      .DATA  .'L PRV = '
PV21  .BSS   .3                  (LOW FAILS PREV. LOT)
      .DATA  .CRLF
      .DATA  .'L TOT = '
PV22  .BSS   .3                  (TOTAL LOW FAILS)
      .DATA  .CRLF.0212
      .DATA  .'H CUR = '
PV23  .BSS   .3                  (HIGH FAILS THIS LOT)
      .DATA  .CRLF
      .DATA  .'H PRV = '
PV24  .BSS   .3                  (HIGH FAILS PREV. LOT)
      .DATA  .CRLF
      .DATA  .'H TOT = '
PV25  .BSS   .3                  (TOTAL HIGH FAILS)
      .DATA  .0
      .EJEC  .
END1  .EQU   .*
      .MORE  .
      .EJEC  .
      .END   .
```

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```
      .EJEC  .
*****************************************************************
***                                                           ***
***              PREAMBLE DATA TABLE FOR TESTS                ***
***                                                           ***
*****************************************************************
      .EJEC  .
NTP1  .SET   .3
NTP2  .SET   .3
NTP3  .SET   .4
NTP4  .SET   .5
CUR1  .DATA  .'CURRENT',0
EMV1  .DATA  .'EMIT VLT',0
ICV1  .DATA  .'PING VLT',0
SEN1  .DATA  .'SENSITIVITY',0
ARM1  .DATA  .'ARM TIME',0
NRE1  .DATA  .'NOISE REJ',0
RFP1  .DATA  .'RF PWR',0
MOD1  .DATA  .'MOD AMP',0
CCF1  .DATA  .'CONSEC CUR FAILS',0
CVF1  .DATA  .'CONSEC VLT FAILS',0
CSF1  .DATA  .'CONSEC SEN FAILS',0
CAF1  .DATA  .'CONSEC ARM FAILS',0
CNF1  .DATA  .'CONSEC NOISE FAILS',0
CRF1  .DATA  .'CONSEC RF PWR FAILS',0
CMF1  .DATA  .'CONSEC MOD FAILS',0
LFA1  .DATA  .'LOI FAILED',0
MFF1  .DATA  .2,-1.3,*,**1,'PROBE   UP',0
MFF2  .EQU   .**3
ERR1  .DATA  .2,-1.3,*,**1,'DIL   BUSY',0
ERR2  .EQU   .**4
      .EJEC  .
*****************************************************************
*****************************************************************
***                TEST PROGRAM - BASIC TEST STATION 1        ***
***                      ( PROBE 1 )                          ***
*****************************************************************
*****************************************************************
***
***   PROGRAMMER: D. BUSCHER
***               HARRY DIAMOND LABS
***               MAY 1969
      .DUP   .20
      .SPAC  .1
*****************************************************************
***                PARAMETERS TO BE MEASURED                  ***
***                                                           ***
***                1.) FUZE CURRENT                           ***
***                2.) FUZE EMITTER VOLTAGE                   ***
***                3.) FUZE POWER                             ***
***                                                           ***
*****************************************************************
```

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```
      .EJEC  .
***   ADC CHANNEL ASSIGNMENTS   ********************************
***
***   CHAN(0) = FUZE CURRENT
***   CHAN(1) = FUZE EMITTER VOLTAGE
***   CHAN(2) = FUZE RF POWER
***
***
***
***   BUFFERED STORAGE REGISTER ASSIGNMENTS   ********************
***
***   REG(3) = INDICATOR LIGHTS
***   REG(5) = REED RELAYS
***
***
***
***   REED RELAY ASSIGNMENTS   ********************************
***
***   (BIT SET TO 1 CLOSES RELAY;BIT SET TO 0 OPENS RELAY)
***   RR(0) = MACHINE  STOP/START (0=STOP,1=START)
***   RR(2) = REJECT PUNCH
***   RR(7) = FUZE POWER  ON/OFF
***
***
***
***   INDICATOR LIGHT ASSIGNMENTS   ****************************
***
***   (BIT SET TO 1 TURNS ON LITE;BIT SET TO 0 TURNS OFF LITE)
***   LITE(0) = CURRENT
***   LITE(1) = EMITTER VOLTAGE
***   LITE(2) = RF POWER
***   LITE(10)= FUZE FAIL INDICATOR
      .EJEC  .
*****************************************************************
***                 PROGRAM INFORMATION BLOCK                 ***
*****************************************************************
      .SPAC  .5
[BT1  .DATA  .1                  PN
      .DATA  .030                PP
      .DATA  .CAL1               IENT
      .DATA  .CAL1               CENT
      .DATA  .0                  NKAL
      .DATA  .0                  PRAL
      .DATA  .0.0                TOAL
      .DATA  .0                  NKWL
      .DATA  .0                  PRWL
      .DATA  .0.0                TRAL
      .DATA  .0.0.0              STAK
      .ROF   .                   OFIS
***
***
***   CALIBRATE PROBE ONE
```

```
***                                                                     00105
***                                                                     00106
CAL1  .ROF    .                                                         00107
      .LDB    .$020                                                     00108
      .LDXI   .CRDT                                                     00109
      .CALL   .RRB1             SELECT CAL MODE                         00110
      .STX    .01               STORE OFF OR PLUS CAL REF               00111
      .LDA    .$50                                                      00112
      .CALL   .$ALWL            WAIT 50 MS                              00113
      .TZB    .                 0 = CHAN ADDR                           00114
ADC1  .DECR   .04                                                       00115
      .CALL   .$ADC,1,BSY1,**1  GET CAL DATA                            00116
      .LDXE   .FAD1,2           GET FWA OF PARAM BB                     00117
      .STXE   .*,1              STORE CAL DATA                          00118
01    .EQU    .**1                                                      00119
      .INCR   .023              INCR B INTO A & B                       00120
      .SUBI   .NTP1                                                     00121
      .JAN    .ADC1             CONTINUE TILL DONE                      00122
      .JOF    .TST1             IF DONE ALL CAL                         00123
      .SOF    .                                                         00124
      .LDB    .$060                                                     00125
      .LDXI   .COFF                                                     00126
      .JMP    .CAL1+4           DO ZERO CAL                             00127
***                                                                     00128
***                                                                     00129
***   PREPARES TEST PROGRAM FOR EXECUTION                               00130
***                                                                     00131
***                                                                     00132
TST1  .ZERO   .05                                                       00133
      .STX    .CALF+1           SET CAL FINISH FLAG                     00134
      .JMPW   .BUF1             RESETS LITES                            00135
      .LDA    .0200                                                     00136
      .CALL   .$ALWL            WAIT 200 MS                             00137
      .LDB    .$200                                                     00138
      .CALL   .RRB1             POWER ON                                00139
      .LDA    .0800                                                     00140
      .CALL   .$ALWL            WAIT 800 MS                             00141
      .INCR   .02                                                       00142
      .STB    .RCF1             RESET RECYCLE FLAG                      00143
      .CALL   .$SEN:1,(BSY1)                                            00144
      .ANA    .$2                                                       00145
      .JAZ    .M1               IF NOT RECYCLE                          00146
      .STX    .RCF1             SET RECYCLE FLAG                        00147
      .JMP    .FIT1             IF RECYCLE                              00148
M1    .LDAE   .TD61,1                                                   00149
      .JAP    .AL31             IF CONSEC FAILS                         00150
M1    .INCR   .045              INCR X TO A& X                          00151
      .SUBI   .NXP1                                                     00152
      .JAZ    .**4              DONE                                    00153
      .JMP    .M1               NOT DONE                                00154
***                                                                     00155
***                                                                     00156
```

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```
***
***   CHECK FOR COMPLETION OF SAMPLE LOT                                                    00157
***                                                                                         00158
***                                                                                         00159
***                                                                                         00160
      .LDA   .DSP1+NTTL          * FUZES TESTED THIS LOT                                    00161
      .SUB   .DSP1+SIZE          LOT SIZE                                                   00162
      .JAM   .FIT1               INDICATES LOT NOT COMPLETE                                 00163
      .SOF   .                   FLAG FOR S ADC                                             00164
      .TZA   .                                                                              00165
      .STA   .DSP1+NTTL          ZERO * TESTED THIS LOT                                     00166
      .STA   .DSP1+NRTL          ZERO * REJECTED THIS LOT                                   00167
***                                                                                         00168
***                                                                                         00169
***   OBTAINS AND PROCESSES TEST DATA                                                       00170
***                                                                                         00171
***                                                                                         00172
***   FUZE CURRENT TEST                                                                     00173
***                                                                                         00174
***                                                                                         00175
FIT1  .TZB   .                   ADC CHAN ADDR = ZERO                                       00176
      .LDX   .FAD1               *FNC1,FWA OF CUR. DATA                                     00177
      .LDA   .RCF1               GET RECYCLE FLAG                                           00178
      .CALL  .SADC,1,(BSY1),(FVT1)    MAKES CURRENT MEASUREMENT                             00179
      .TAX   .                                                                              00180
      .LDA   .LSD1               LITE STORAGE DATA.INITIALLY ZERO                           00181
      .INCR  .01                 MAKES BIT ZERO OF LSD1 = 1                                 00182
      .JMPM  .BUF1               TURNS ON CUR PASS LITE AND STORES AREG AS LSD1             00183
      .TXA   .                                                                              00184
***                                                                                         00185
***                                                                                         00186
***                                                                                         00187
***   FUZE EMITTER VOLTAGE TEST                                                             00188
***                                                                                         00189
***                                                                                         00190
FVT1  .STA   .TD01               STORES CUR RAW DATA                                        00191
      .INCR  .02                 SETS B=1,CHAN 1                                            00192
      .LDX   .FAD1+1             *FNV1, FWA OF VLT DATA                                     00193
      .LDA   .RCF1               GET RECYCLE FLAG                                           00194
      .CALL  .SADC,1,(BSY1),(FPT1)    MAKES VOLTAGE MEASUREMENT                             00195
      .TAX   .                                                                              00196
      .LDA   .02                 BIT-1 OF AREG SET TO 1                                     00197
      .ERA   .LSD1               BIT-1 OF LSD1 SET TO 1                                     00198
      .JMPM  .BUF1               TURNS ON VLT PASS LITE AND STORES AREG AS LSD1             00199
      .TXA   .                                                                              00200
***                                                                                         00201
***                                                                                         00202
***                                                                                         00203
***   FUZE RF POWER TEST                                                                    00204
***                                                                                         00205
***                                                                                         00206
FPT1  .STA   .TD11               STORES VLT RAW DATA                                        00207
      .LDB   .02                 SETS B=2,CHAN 2                                            00208
```

```
      .LDX   .FAD1+2              =FWP1, FWA OF PWR DATA                          00209
      .LDA   .RCF1                GET RECYCLE FLAG                                00210
      .CALL  .SADC,1,(BSY1),(CFF1-1)  MAKES PWR MEASUREMENT                       00211
      .TAX   .                                                                    00212
      .LDA   .B4                  BIT 2 OF AREG SET TO 1                          00213
      .ERA   .LSD1                BIT 2 OF LSD1 SET TO 1                          00214
      .JMPM  .BUF1                TURNS ON PWR PASS LITE AND STORES AREG IN LSD1  00215
      .TXA   .                                                                    00216
      .STA   .TD21                                                                00217
***                                                                               00218
***                                                                               00219
***                                                                               00220
***   CHECKS FOR FAILURE OF FUZE                                                  00221
***                                                                               00222
CFF1  .INCR  .02                                                                  00223
      .CALL  .BSEM,1,(BSY1)                                                       00224
      .LRLA  .15                                                                  00225
      .STA   .FUP1                A = POS IF UP, NEG IF DOWN                      00226
      .LDA   .RCF1                GET RECYCLE FLAG                                00227
      .JAZ   .RC11                IF RECYCLE                                      00228
      .INR   .DSP1+NTTL           INCR # TESTED THIS LOT                          00229
      .INR   .DSP1+NDFT           INCR TOTAL # FUZES TESTED                       00230
      .INR   .FNC1+SPOC           COUNT FOR CURRENT SPD INTERVAL                  00231
      .INR   .FWV1+SPOC           COUNT FOR VLT SPD INTERVAL                      00232
      .INR   .FWP1+SPOC           COUNT FOR PWR SPD INTERVAL                      00233
RC11  .LDA   .B7                                                                  00234
      .ERA   .LSD1                CHECKS IF ANY PARAMETER FAILED                  00235
      .JAZ   .AL41                IF FUZE PASSES                                  00236
      .LDA   .LSD1                GET LITE DATA                                   00237
      .ERA   .$150                                                                00238
      .JMPM  .BUF1                LITE FAIL LITE                                  00239
      .LDA   .SAA                 GET '** '.                                      00240
      .STA   .RTS1+5                                                              00241
      .LDB   .RCF1                GET RECYCLE FLAG                                00242
      .LDA   .FUP1                GET PROBE POSITION FLAG                         00243
      .JIF   .022,MIS1            IF PROBE UP AND RECYCLE                         00244
      .JAZ   .CHK1                IF RECYCLE                                      00245
      .JAP   .A1                  IF PROBE UP                                     00246
      .LDB   .0206                                                                00247
      .CALL  .RRD1                CLOSE REJECT PUNCH                              00248
      .LDA   .D200                                                                00249
      .CALL  .BALWL               WAIT 200 MS                                     00250
      .LDB   .$200                                                                00251
      .CALL  .RRD1                OPEN REJECT PUNCH                               00252
      .LDA   .LSD1                GET LITE DATA                                   00253
      .ANA   .$5                                                                  00254
      .JAZ   .CPF1                IF TRUE INCR CORREC DATA                        00255
A1    .INR   .DSP1+NDFR           INCR TOTAL REJECTS                              00256
      .INR   .DSP1+NRTL           INCR LOT REJECTS                                00257
      .LDA   .FUP1                GET PROBE POSITION FLAG                         00258
      .JAP   .MIS1                IF PROBE UP                                     00259
***                                                                               00260
```

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```
***                                                                     00261
***                                                                     00262
***   CHECKS FOR ALARM SITUATIONS                                       00263
***                                                                     00264
***                                                                     00265
CAS1  .TZB    .                       SET ROUTINE COUNTER               00266
      .STB    .TD51                                                     00267
      .LDXE   .FAD1,2                 GET PARAM FWA                     00268
      .LDA    .CPFA,1                 GET # CONSEC REJ ALLOWED          00269
      .SUB    .CONF,1                 SUB # CONSEC FAILS                00270
      .JAN    .AL21                   IF TOO MANY CONSEC. REJECTS       00271
R1    .INCR   .023                    INCR B INTO A & B                 00272
      .SUBI   .NTP1                                                     00273
      .JAN    .CAS1+1                 IF NOT DONE                       00274
      .LDA    .DSP1+NRAL              GET # REJ ALLOWED PER LOT         00275
      .SUB    .DSP1+NRTL              SUB # REJ THIS LOT                00276
      .STA    .TD31                   FLAG - FOR LOT FAIL,+ FOR OK      00277
***                                                                     00278
***                                                                     00279
***   CHECK IF REAL TIME OUTPUT WANTED                                  00280
***                                                                     00281
***                                                                     00282
CHK1  .LDA    .DSP1+RTDF              GET REAL TIME FLAG                00283
      .ADD    .SPDB                   ADD SPU BUSY FLAG                 00284
      .JAZ    .+*4                    IF READY FOR REAL TIME            00285
      .JMP    .CHA1                   NOT READY FOR REAL-TIME           00286
      .CALL   .SVCD,(TD01),(RTD1+2)     GET ASC                         00287
      .CALL   .SVCD,(TD11),(RTD1+9)                                     00288
      .CALL   .SVCD,(TD21),(RTD1+16)                                    00289
      .LDAI   .I021                                                     00290
      .CALL   .SIOC,(CHA1)                                              00291
***                                                                     00292
***                                                                     00293
***                                                                     00294
***   CHECK IF TIME FOR SUMMARY PRINT OUT INTERVAL                      00295
***                                                                     00296
***                                                                     00297
CHA1  .LDA    .RCF1                   GET RECYCLE FLAG                  00298
      .JAZ    .EXI1                   IF RECYCLE                        00299
      .LDB    .TD41                   GET ROUTINE COUNTER               00300
      .TBA    .                                                         00301
      .SUBI   .NTP1                                                     00302
      .JAZ    .L1                     IF DONE                           00303
      .LDXE   .FAD1,2                 GET FWA OF PARAM DB               00304
      .LDAE   .SPDC,1                 COUNT SINCE LAST SPD              00305
      .SUB    .SUMY,1                 # BETWEEN SPD                     00306
      .JAP    .SPD1                   IF TIME FOR SPD                   00307
      .INR    .TD41                                                     00308
      .JMP    .CHA1+3                 CONTINUE                          00309
L1    .TZA    .                                                         00310
      .STA    .TD41                   RESET COUNTER                     00311
***                                                                     00312
```

```
***
***   EXIT ROUTINE                                                                  00313
***                                                                                 00314
***                                                                                 00315
***                                                                                 00316
EXI1  .TZB    .                                                                     00317
      .CALL   .RRO1               POWER OFF                                         00318
      .LDA    .RCF1               GET RECYCLE FLAG                                  00319
      .JAZ    .9EXIT              IF RECYCLE                                        00320
      .LDA    .DSP1+NTTL          GET # FUZES TESTED THIS LOT                       00321
      .SUB    .DSP1+SIZE          LOT SIZE                                          00322
      .JAN    .9EXIT                                                                00323
      .LDA    .TD31                                                                 00326
      .JAN    .AL11               IF LOT FAILED                                     00325
CAT1  .JMP    .9EXIT                                                                00326
***                                                                                 00327
***                                                                                 00328
***                                                                                 00329
***   OUTPUT ROUTINE TO INDICATOR LIGHTS                                            00330
***                                                                                 00331
***                                                                                 00332
BUF1  .ENTR   .                                                                     00333
      .STA    .LSD1               STORES PRESENT DISPOSITION OF LITES               00334
      .LDB    .03                 # LITE BUF REG                                    00335
      .CALL   .9BUF,1             TURNS ON PROPER LITE                              00336
      .JMP*   .BUF1                                                                 00337
***                                                                                 00338
***                                                                                 00339
***   UTILITY ROUTINES                                                              00340
***                                                                                 00341
***                                                                                 00342
CPF1  .INR    .DSP1+CORR          INCR CORRELATION DATA                             00343
      .JMP    .A1                 RETURN                                            00344
AL11  .TZA    .                                                                     00345
      .STA    .TD31                                                                 00346
      .LDBI   .NTP1                                                                 00347
      .DECR   .04                 NO PARAM DATA FLAG                                00348
      .JMP    .AL21                                                                 00349
AL31  .TAB    .                                                                     00350
      .TZA    .                                                                     00351
      .STA    .CONF-1,2           ZEROS CONSEC FAILS                                00352
      .DECR   .01                                                                   00353
      .STAE   .TD61,1                                                               00354
      .JMP    .M1                                                                   00355
AL41  .LDA    .BBB                GET ' BLANK BLANK                                 00356
      .STA    .RTS1+5                                                               00357
      .LDA    .FUP1               GET PROBE POSITION FLAG                           00358
      .JAP    .M1S1               IF PROBE UP                                       00359
      .JMP    .CHK1                                                                 00360
***                                                                                 00361
***                                                                                 00362
***                                                                                 00363
***   SUMMARY PRINT OUT ROUTINE                                                     00364
```

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```
***
***
SPO1  .LDBE  .FPD1.2          GET PREAMBLE FWA
      .LDA   .WAT1+4          GET STA DB FWA
      .CALL  .$SPO.1.(C1)
      .DECR  .01
      .STAE  .SPOC.1          RESETS PARAMETER SPO COUNT
      .INR   .TD41
C1    .LDA   .TD41            GET COUNTER
      .SUBI  .NTP1
      .JAZ   .L1
      .JMP   .EXI1
***
***
***
***   ERROR ROUTINES
***
***
***   IF DIC CHANNEL BUSY
***
***
BSY1  .JMPM  .SFM1            STOP MACHINE
B1    .LDA   .$10
      .CALL  .$ALWL           WAIT 10 MS
      .LDAI  .ERR1            ADDRESS OF I-O DATA BLOCK
      .CALL  .$IOC.(B1)       PRINT ERROR MESSAGE
      .LDB   .$1B8            GET '1 '
      .STB   .ERR2
      .JMP   .EXI1            EXIT
***
***
***   IF PROBE UP ILLEGALLY
***
***
MIS1  .JMPM  .SFM1            STOP MACH
      .LDA   .$10
      .CALL  .$ALWL           WAIT 10 MS
      .LDAI  .MFF1
      .CALL  .$IOC.(MIS1+2)
      .LDA   .$1B8            GET '1
      .STA   .MFF2
      .JMP   .EXI1
***
***
***
***   IF LOT FAIL OR CONSECUTIVE PARAMETER FAIL
***
***
AL21  .JMPM  .SFM1            STOP MACHINE
      .LDBE  .CFD1.2          GET PREAMBLE FWA
WAT1  .LDA   .D100
      .CALL  .$ALWL           WAIT 100 MS
```

```
      .LDAI  .DSP1                GET STA DW FWA
      .CALL  .$SPO.1.(WAT1)
      .IXR   .
      .JXZ   .$EXIT
      .LDB   .TD51
      .STXE  .TD61.2              STORE FWA OF PARAM CONSEC FAIL DB
      .JMP   .R1
***
***
***
***   ROUTINE WHICH STOPS THE MACHINE
***
***
SFM1  .ENTR  .
      .STB   .BSV1                SAVE B
      .LDB   .$5                  # OF REED RELAY BUF REG
      .LDA   .$2                  DATA FOR MACH STOP.
      .CALL  .$REL.1              MACH STOP.VIS ALARM ON.FM OFF
      .INR   .DSP1+NOMS           INCR # MACH STOPS
      .LDB   .BSV1                RESTORE B
      .JMP*  .SFM1
BSV1  .BSS   .1
***
***
***   REED RELAY OUTPUT ROUTINE
***   PRESERVES STOP STATUS
***
***
RRO1  .ENTR  .
      .LDA   .$RRO                PRESERVE RR STATUS
      .ANA   .$3                  PRESERVES BITS 0 AND 1
      .MERGE .031                 CREATE DATA WORD
      .LDB   .$5                  RR ADDRESS
      .CALL  .$REL.1              OUTPUT
      .JMP*  .RRO1                RETURN
      .EJEC  .
***
***
***   PROGRAM DATA
***
***
LSD1  .DATA  .0                   LITE STORAGE DATA
RCF1  .DATA  .1                   RECYCLE FLAG
FUP1  .DATA  .-1                  PROBE POSITION FLAG (-) DOWN (+) UP
TD01  .DATA  .0
TD11  .DATA  .0
TD21  .DATA  .0
TD31  .DATA  .0                   LOT FAIL FLAG
TD41  .DATA  .0                   SPO COUNTER
TD51  .DATA  .0                   ALARM COUNTER
TD61  .DATA  .-1
      .DUP   .NTP1-1
```

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      .DATA  .-1                                                                00469
FAD1  .DATA  .FWC1.FWV1.FWP1                                                    00470
FPD1  .DATA  .CUR1.ENV1.RFP1                                                    00471
CFD1  .DATA  .CCF1.CVF1.CRF1.LFA1                                               00472
      .EJEC  .                                                                  00473
***************************************************************               00474
***************************************************************               00475
***                                                                           00476
***                                                                           00477
***                                                                           00478
***   BTS # 1, PAGE 1 STATION DATA STORAGE AREA                               00479
***                                                                           00480
***                                                                           00481
DSP1  .DATA  .0                  SIZE OF SAMPLE LOT                           00482
      .DATA  .0                  REJECTS ALLOWED EACH LOT                     00483
      .DATA  .-1                 REAL TIME DATA FLAG                          00484
DSS1  .DATA  .0100000            NUMBER OF FUZES TESTED                       00485
      .DATA  .0100000            NUMBER OF FUZES REJECTED                     00486
      .DATA  .0100000            NUMBER OF MACHINE SETUPS                     00487
DAA1  .DATA  .0                  NUMBER OF FUZES TESTED THIS LOT              00488
      .DATA  .0                  NUMBER OF FUZES REJECTED THIS LOT            00489
      .DATA  .1                  NUMBER OF CORREL DATA WRDS FOLLOWING         00490
      .DATA  .0100000            NUMBER OF CUR & PWR FAILS                    00491
      .EJEC  .                                                                00492
***                                                                           00493
***                                                                           00494
***                                                                           00495
***   CURRENT PARAMETER STORAGE AREA                                          00496
***                                                                           00497
***                                                                           00498
      .DATA  .-1                 COUNT FOR SPO INTERVAL                       00499
FWC1  .DATA  .0                  FAILURES PER LOT                             00500
      .DATA  .0100000            TOTAL PARAMETER FAILS                        00501
      .DATA  .0                  # OF CONSEC PARAM FAILS                      00502
      .DATA  .0                  CPFA                                         00503
      .DATA  .0                  SUNY                                         00504
      .DATA  .0                  SOFF                                         00505
      .DATA  .0                  SRUT                                         00506
      .DATA  .0                  LROR                                         00507
      .DATA  .0                  HROR                                         00508
      .DATA  .0                  ORES                                         00509
      .DATA  .0                  MINA                                         00510
      .DATA  .0                  MAXA                                         00511
      .DATA  .0                  COFF                                         00512
      .DATA  .0                  CROT                                         00513
      .DATA  .0                  LOWER FREQ. DIST. LIMIT                      00514
      .DATA  .0                  UPPER FREQ. DIST. LIMIT                      00515
      .DATA  .0                  WIDTH OF FREQ. DIST. INTERVAL                00516
      .DATA  .14                 NUMBER OF FREQ. DIST. INTERVALS              00517
      .DATA  .0100000            CURRENT LOT FREQ. DIST.                      00518
      .DUP   .13                                                              00519
      .DATA  .0100000                                                         00520
```

```
        .DATA   .0100000            PREVIOUS LOT FREQ. DIST.                    00521
        .DUP    .13                                                             00522
        .DATA   .0100000                                                        00523
        .DATA   .0100000            CUMULATIVE FREQ. DIST.                      00524
        .DUP    .13                                                             00525
        .DATA   .0100000                                                        00526
        .DATA   .-1                 CURRENT LOT FAILURE RAW DATA                00527
        .DUP    .19                                                             00528
        .DATA   .-1                                                             00529
        .EJEC   .                                                               00530
***                                                                             00531
***                                                                             00532
***                                                                             00533
***     VOLTAGE PARAMETER STORAGE AREA                                          00534
***                                                                             00535
***                                                                             00536
        .DATA   .-1                 COUNT FOR SPO INTERVAL                      00537
FHY1    .DATA   .0                  FAILURES PER LOT                            00538
        .DATA   .0100000            TOTAL PARAMETER FAILS                       00539
        .DATA   .0                  # OF CUMSEC PARAM FAILS                     00540
        .DATA   .0                  CPFA                                        00541
        .DATA   .0                  SUMY                                        00542
        .DATA   .0                  SOFF                                        00543
        .DATA   .0                  SROT                                        00544
        .DATA   .0                  LROR                                        00545
        .DATA   .0                  HROR                                        00546
        .DATA   .0                  ONES                                        00547
        .DATA   .0                  MINA                                        00548
        .DATA   .0                  MAXA                                        00549
        .DATA   .0                  COFF                                        00550
        .DATA   .0                  CROT                                        00551
        .DATA   .0                  LOWER FREQ. DIST. LIMIT                     00552
        .DATA   .0                  UPPER FREQ. DIST. LIMIT                     00553
        .DATA   .0                  WIDTH OF FREQ. DIST. INTERVAL               00554
        .DATA   .14                 NUMBER OF FREQ. DIST. INTERVALS             00555
        .DATA   .0100000            CURRENT LOT FREQ. DIST.                     00556
        .DUP    .13                                                             00557
        .DATA   .0100000                                                        00558
        .DATA   .0100000            PREVIOUS LOT FREQ. DIST.                    00559
        .DUP    .13                                                             00560
        .DATA   .0100000                                                        00561
        .DATA   .0100000            CUMULATIVE FREQ. DIST.                      00562
        .DUP    .13                                                             00563
        .DATA   .0100000                                                        00564
        .DATA   .-1                 CURRENT LOT FAILURE RAW DATA                00565
        .DUP    .19                                                             00566
        .DATA   .-1                                                             00567
        .EJEC   .                                                               00568
***                                                                             00569
***                                                                             00570
***     POWER PARAMETER STORAGE AREA                                            00571
***                                                                             00572
```

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```
***
      .DATA  .-1                  COUNT FOR SPU INTERVAL
FWP1  .DATA  .0                   FAILURES PER LOT
      .DATA  .0100000             TOTAL PARAMETER FAILS
      .DATA  .0                   # OF CONSEC PARAM FAILS
      .DATA  .0                   CPFA
      .DATA  .0                   SUMY
      .DATA  .0                   SOFF
      .DATA  .0                   SHUT
      .DATA  .0                   LROR
      .DATA  .0                   HROR
      .DATA  .0                   ORES
      .DATA  .0                   MINA
      .DATA  .0                   MAXA
      .DATA  .0                   COFF
      .DATA  .0                   CROT
      .DATA  .0                   LOWER FREQ. DIST. LIMIT
      .DATA  .0                   UPPER FREQ. DIST. LIMIT
      .DATA  .0                   WIDTH OF FREQ. DIST. INTERVAL
      .DATA  .14                  NUMBER OF FREQ. DIST. INTERVALS
      .DATA  .0100000             CURRENT LOT FREQ. DIST.
      .DUP   .13
      .DATA  .0100000
      .DATA  .0100000             PREVIOUS LOT FREQ. DIST.
      .DUP   .13
      .DATA  .0100000
      .DATA  .0100000             CUMULATIVE FREQ. DIST.
      .DUP   .13
      .DATA  .0100000
      .DATA  .-1                  CURRENT LOT FAILURE RAW DATA
      .DUP   .19
      .DATA  .-1
      .EJEC  .
***
***
***
***   INPUT OUTPUT ROUTINE DATA BLOCK
***
***
IO21  .DATA  .5,-1.4,*,(RTS1),26.10
RTS1  .DATA  .'PROBE 1
RTD1  .DATA  .'C = +10.00V   V = +10.00V   P = +10.00V'
      .EJEC  .
*****************************************************************
***                 TEST PROGRAM - BASIC TEST STATION 1         ***
***                       ( PROBE 2 )                           ***
*****************************************************************
***
***   PROGRAMMER: D. BUSCHER
***               HARRY DIAMOND LABS
***               JUNE 1969
      .DUP   .20
```

```
      .SPAC  .1
*****************************************************************
***                 PARAMETERS TO BE MEASURED                 ***
***                                                           ***
***                 1.) FUZE CURRENT                          ***
***                 2.) FUZE EMITTER VOLTAGE                  ***
***                 3.) FUZE SENSITIVITY                      ***
***                                                           ***
*****************************************************************
      .EJEC  .
***   ADC CHANNEL ASSIGNMENTS   ******************************
***
***   CHAN(6) = CURRENT
***   CHAN(7) = TC PIN 6 VOLTAGE
***
***
***
***
***   BUFFERED STORAGE REGISTER ASSIGNMENTS   ******************
***
***   REG(3) = INDICATOR LIGHTS
***   REG(4) = CONTROL PULSE GATE
***   REG(6) = REED RELAYS
***
***
***
***   REED RELAY ASSIGNMENTS   *********************************
***
***   (BIT SET TO 1 CLOSES RELAY;BIT SET TO 0 OPENS RELAY)
***   RR(0) = MACHINE  STOP/START (0=STOP,1=START)
***   RR(2) = REJECT PUNCH
***   RR(3) = SHORTEN ARMING TIME AND ENABLE FM
***   RR(7) = FUZE POWER  ON/OFF
***
***
***
***   INDICATOR LIGHT ASSIGNMENTS   ****************************
***
***   (BIT SET TO 1 TURNS ON LITE;BIT SET TO 0 TURNS OFF LITE)
***   LITE(0) = CURRENT
***   LITE(1) = EMITTER VOLTAGE
***   LITE(2) = SENSITIVITY
***   LITE(10)= FUZE FAIL INDICATOR
      .EJEC  .
*****************************************************************
***                 PROGRAM INFORMATION BLOCK                 ***
*****************************************************************
      .SPAC  .5
IBT2  .DATA  .2                  PN
      .DATA  .030                PP
      .DATA  .CAL2               IENT
      .DATA  .CAL2               CENT
```

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```
        .DATA  .0                  NXAL
        .DATA  .0                  PRAL
        .DATA  .0.0                TUAL
        .DATA  .0                  NXWL
        .DATA  .0                  PRWL
        .DATA  .0.0                TRAL
        .DATA  .0.0.0              STAK
        .ROF   .                   OFIS
        .EJEC  .
***
***
***     CALIBRATE PROBE 2
***
***
CAL2    .ROF   .
        .LDB   .$020
        .LDXI  .CROT
        .CALL  .RRD2               SELECT CAL MODE
        .LDA   .$50
        .CALL  .$ALWL              WAIT 50 MS
        .LDB   .$6
        .CPX   .                   X NEGATIVE
        .CALL  .$ADC.1.BSY2.++1    GET CUR CAL DATA
        .CPX   .                   RESTORE X
        .STAE  .FWC2.1             STORE DATA
        .IBR   .
        .CPX   .
        .CALL  .$ADC.1.BSY2.++1    GET VLT CAL DATA
        .CPX   .
        .STAE  .FWV2.1             STORE DATA
        .JOF   .TST2               IF DONE
        .SOF   .
        .LDB   .$060               FOR 0 CAL MODE
        .LDXI  .COFF
        .JMP   .CAL2+4             DO 0 CAL
***
***
***     PREPARES TEST PROGRAM FOR EXECUTION
***
***
TST2    .ZERO  .05
        .STX   .CALF+2             SET CAL FINISH FLAG
        .JMPM  .BUF2               RESETS LITES
        .LDA   .D200
        .CALL  .$ALWL              WAIT 200 MS
        .LDB   .$200
        .CALL  .RRD2               POWER ON
        .LDA   .D800
        .CALL  .$ALWL              WAIT 800 MS
        .INCR  .02
        .STB   .RCF2               RESET RECYCLE FLAG.
        .CALL  .$SEN.1.BSY2        SENSE RECYCLE
```

```
        .ANA   .$100
        .JAZ   .M2                  IF NOT RECYCLE
        .STX   .RCF2                SET RECYCLE FLAG TO 0
        .JMP   .FIT2
M2      .LDAE  .TD62.1
        .JAP   .AL32                IF CONSEC FAILS ON LAST TEST 2
M2      .INCR  .045
        .SUBI  .NTP2
        .JAZ   .++4                 IF ALL PARAM CHECKED
        .JMP   .M2                  NOT DONE
***
***
***
***     CHECK FOR COMPLETION OF SAMPLE LOT
***
***
        .LDA   .DSP2+NTTL           # TESTED THIS LOT
        .SUB   .DSP2+SIZE           LOT SIZE
        .JAN   .FIT2                INDICATES LOT INCOMPLETE
        .SOF   .                    FLAG FOR $ ADC
        .TZA   .
        .STA   .DSP2+NTTL           ZERO # TESTED THIS LOT
        .STA   .DSP2+NRTL           ZERO # REJ THIS LOT
***
***
***
***     OBTAINS AND PROCESSES TEST DATA
***
***
***     FUZE CURRENT TEST
***
***
FIT2    .LDB   .$6                  ADC CHAN ADDR.
        .LDX   .FAD2                =FWC2,FWA OF CUR DATA
        .LDA   .RCF2                GET RECYCLE FLAG
        .CALL  .$ADC,1,(BSY2),(FVT2)    MAKES CUR MEASUREMENT
        .TAX   .                    STORE RAW DATA
        .LDA   .LSD2                LITE DATA INITIAL 0
        .INCR  .01                  MAKES BIT ZERO OF LSD2 =1
        .JMPM  .BUF2                CUR PASS LITE ON,STORE LITE DATA
        .TXA   .
***
***
***     FUZE IC PIN 6 VOLTAGE
***
***
FVT2    .STA   .TD02                STORES CURRENT RAW DATA
        .LDB   .$7                  ADC CHAN ADDR
        .LDX   .FAD2+1              =FWV2,FWA OF VLT DATA
        .LDA   .RCF2                GET RECYCLE FLAG
        .CALL  .$ADC,1,(BSY2),(FST2)    MAKE VLT MEASUREMENT
        .TAX   .                    STORE RAW DATA
```

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```
        .LDA   .$2                 BIT 1 OF AREG SET TO 1
        .ERA   .LSD2               BIT 1 OF LSD2 SET TO 1
        .JMPM  .BUF2               VLT PASS LITE ON,STORE LITE DATA
        .TXA
***
***
***
***     FUZE SENSITIVITY TEST
***
***
FST2    .STA   .TD12               STORES VLT RAW DATA
        .LDB   .$210
        .CALL  .RR02               ENABLE FM, SHORTEN ARM TIME
        .LDA   .D200
        .CALL  .$ALWL              WAIT 200 MS
        .INCR  .02                 WAVE TEK FREQ ADDR.
        .LDA   .$123
        .CALL  .$REL.1             SELECT OSC FOR AMP.
        .LDB   .$4                 CONTROL PULSE ADDR.
        .LDA   .$10                DATA FOR CALL
        .CALL  .$BUF.1
        .LDA   .D400
        .CALL  .$ALWL              WAIT 400 MS
        .INCR  .02                 SENSE LINE ADDRESS
        .CALL  .$SEN.1.(BSY2)      CHECK FIRE PULSE
        .LRLA  .8
        .JAN   .IFP2               IF FIRE PULSE
        .LDB   .$B11               DUMMY VALUE FOR FAIL
        .JMP   .NFP2               NO FIRE PULSE
IFP2    .LDB   .$2                 ARM TIME ADDRESS
        .CALL  .$DIC.1.(BSY2)      GET DATA
        .TAB   .
NFP2    .LDX   .FAD2+2             GET FWA OF PARAM DB
        .LDA   .RCF2               GET RECYCLE FLAG
        .CALL  .$TDP               PROCESS DATA
        .STA   .TD22               STORES DATA
        .JOF   .++4                IF PASS SEN
        .JMP   .CFF2               IF FAIL SEN
        .LDA   .$4
        .ERA   .LSD2               BIT 2 OF LSD2 = 1
        .JMPM  .BUF2               LITE SEN PASS LITE.
***
***
***
***     CHECKS FOR FAILURE OF FUZE
***
***
CFF2    .INCR  .02
        .CALL  .$SEN.1.(BSY2)
        .LRLA  .10
        .STA   .FUP2               PROBE UP (+), DOWN (-)
        .LDA   .RCF2               GET RECYCLE FLAG
```

```
        .JAZ    .RC02           IF RECYCLE
        .INR    .DSP2+NTTL      INCR # TESTED THIS LOT
        .INR    .DSP2+NOFT      INCR TOTAL TESTED
        .INR    .FWC2+SPOC      COUNT FOR CURRENT SPO INTERVAL
        .INR    .FWV2+SPOC      COUNT FOR VLT SPO.INTERVAL
        .INR    .FWS2+SPOC      COUNT FOR SEN SPO.INTERVAL
RC02    .LDA    .$7
        .ERA    .LSD2
        .JIZ    .AL42           IF FUZE PASSES
        .LDA    .LSD2           GET LITE DATA
        .ERA    .$400
        .JMPM   .BUF2           LITE FAIL LITE
        .LDA    .$AA            GET ' ** '
        .STA    .RTS2+5
        .LDB    .RCF2           GET RECYCLE FLAG
        .LDA    .FUP2           GET PROBE POSITION.FLAG
        .JIF    .022,MIS2       IF PROBE UP AND RECYCLE
        .JBZ    .CHK2           IF RECYCLE
        .JAZ    .A2             IF PROBE UP
        .LDB    .$204
        .CALL   .RRO2           CLOSE REJECT PUNCH
        .LDA    .0200
        .CALL   .$ALWL          ON WL FOR 200 MS
        .LDB    .$200
        .CALL   .RRO2           OPEN REJECT PUNCH
        .LDA    .LSD2           GET LITE DATA
        .ANA    .$6
        .JAZ    .VSF2           IF VLT & SEN FAIL
A2      .INR    .DSP2+NOFR      INCR # FUZES REJ
        .INR    .DSP2+NRTL      INCR # FUZES REJ THIS LOT
        .LDA    .FUP2           GET PROBE POSITION.FLAG
        .JAP    .MIS2           IF PROBE UP
***
***
***
***     CHECKS FOR ALARM SITUATIONS
***
***
CAS2    .TZB    .               SET ROUTINE COUNTER
        .STB    .TDS2
        .LOXE   .FAD2,2         GET PREAMBLE FWA
        .LDA    .CPFA,1         GET CONSEC REJ ALLOWED
        .SUB    .CONF,1         SUB # CONSEC FAILS.
        .JAN    .AL22           IF TOO MANY CONSEC REJ
R2      .INCR   .023            INCR B INTO A & B
        .SUBI   .NTP2
        .JAN    .CAS2+1         IF NOT DONE
        .LDA    .DSP2+NRAL      GET # REJ ALLOWED PER LOT
        .SUB    .DSP2+NRTL      SUB # REJ THIS LOT
        .STA    .TD32           FLAG - FOR LOT FAIL, + FOR OK
***
***
```

```
                                                                                                                    00885
...   CHECK IF REAL TIME OUTPUT WANTED                                                                              00886
...                                                                                                                 00887
...                                                                                                                 00888
CHK2  .LDA    .DSP2+RTDF          GET REAL TIME FLAG                                                                00889
      .AND    .FF08               AND SPO BUSY FLAG                                                                 00890
      .SAZ    .+4                 IF READY FOR REAL TIME                                                            00891
      .JMP    .CHA2               IF ANY BUSY                                                                       00892
      .CALL   .DECD.(TD02),(RTD2+2)    GET ASC CODE                                                                 00893
      .CALL   .DECD.(TD12),(RTD2+9)                                                                                 00894
      .CALL   .DECD.(TD22),(RTD2+16)                                                                                00895
      .LDAI   .TD22                                                                                                 00896
      .CALL   .DIOC.(CHA2)                                                                                          00897
...                                                                                                                 00898
...                                                                                                                 00899
...   CHECK IF TIME FOR SUMMARY PRINT OUT INTERVAL                                                                  00900
...                                                                                                                 00901
...                                                                                                                 00902
CHK2  .LDA    .RCF2               GET RECYCLE FLAG                                                                  00903
      .SAZ    .ERR2               IF RECYCLE                                                                        00904
      .LDA    .TD42               GET ROUTINE COUNTER                                                               00905
      .TAA    .                                                                                                     00906
      .SUBI   .NFP2                                                                                                 00907
      .SAZ    .L2                 IF DONE                                                                           00908
      .LDAE   .PAR2.2             GET PARAM FWA                                                                     00909
      .LDAE   .SPOC.1             COUNT SINCE LAST SPO                                                              00910
      .SUB    .SWAT.1             = BETWEEN SPO                                                                     00911
      .SAP    .SP02               IF TIME FOR SPO                                                                   00912
      .INR    .TD42                                                                                                 00913
      .JMP    .CHA2+3             CONTINUE                                                                          00914
L2    .TZA    .                                                                                                     00915
      .STA    .TD42               ZERO COUNTER                                                                      00916
...                                                                                                                 00917
...                                                                                                                 00918
...   EXIT ROUTINE                                                                                                  00919
...                                                                                                                 00920
...                                                                                                                 00921
EXIT  .LDA    .04                 CTRL PULSE ADDR                                                                   00922
      .LDA    .021                DATA TO STOP AND RESET OSC                                                        00923
      .CALL   .OUAF.1             STOP & RESET OSC                                                                  00924
      .TAB    .                                                                                                     00925
      .CALL   .0004               POWER OFF                                                                         00926
      .LDA    .RCF2               GET RECYCLE FLAG                                                                  00927
      .SAZ    .SERIT              IF RECYCLE                                                                        00928
      .LDA    .DSP2+NTTL          GET # TESTED THIS LOT                                                             00929
      .SUB    .DSP2+SIZE          LOT SIZE                                                                          00930
      .JAP    .SERIT                                                                                                00931
      .LDA    .TD32                                                                                                 00932
      .JAN    .AL12               IF LOT FAILED                                                                     00933
EXIT  .JMP    .SERIT                                                                                                00934
...                                                                                                                 00935
...                                                                                                                 00936
```

```
***
***   OUTPUT ROUTINE TO INDICATOR LIGHTS
***
***
DUF2  .EQUR  .
      .STA   .LSD2              STORES LITE DATA
      .LDD   .02                A=LITE REG ADDR
      .CALL  .DUF.1             TURNS ON PROPER LITE
      .JMP+  .DUF2
***
***
***   UTILITY ROUTINES
***
***
USF2  .IMR   .DSP2+CORR         INCR CORRELATION DATA
      .JMP   .02                RETURN
AL12  .TZA   .
      .STA   .TD32
      .LDDT  .DTP2
      .DECR  .04                X =-1, NO PARAM FWA
      .JMP   .AL22
AL32  .TAD   .
      .TZA   .
      .STA   .CONF-1.2          ZEROS CONSEC FAILS
      .DECR  .01
      .STAD  .TD62.1            RESET FLAG
      .JMP   .02
AL42  .LDA   .BBD               GET ' BLANK BLANK
      .STA   .DTS2+5
      .LDA   .FUP2              GET PROBE POSITION FLAG
      .JMP   .DES2              IF PROBE UP
      .JMP   .CHK2
***
***
***
***   SUMMARY PRINT OUT ROUTINE
***
***
SPO2  .LDDQ  .PPD2.2            GET PREAMBLE FWA
      .LDA   .DAT2+6            GET STA DB FWA
      .CALL  .DSPO.2.(C2)
      .DECR  .01
      .STAD  .SPOC.1            RESETS PARAM SPO COUNT
      .IMR   .TD62
C2    .LDA   .TD62              GET ROUTINE COUNTER
      .SUBI  .DTP2
      .JAZ   .L2
      .JMP   .EXIT
***
***
***
***   ERROR ROUTINES
```

```
                                                
```

```
      .CALL  .WREL.1            STOPS MACHINE
      .INR   .DSP2+NOMS         INCR = MACH STOPS
      .LDO   .DSV2              RESTORE B
      .JMP+  .SFP2
DSV2  .DATA  .0
...
...
...   REID RELAY OUTPUT
...   PRESERVES STOP STATUS
...
...
RRD2  .ENTR  .
      .LDA   .RRD+1             PREVIOUS RR STATUS
      .AMA   .A3                SAVE BITS 0 AND 1
      .MERGE .DA1               CREATE DATA WORD
      .LDO   .06                RR ADDRESS
      .CALL  .WREL.1            OUTPUT
      .JMP+  .RRD2              RETURN
      .EJEC  .
...
...
...   PROGRAM DATA
...
...
LSD2  .DATA  .0                 LITE STORAGE DATA
RCF2  .DATA  .1                 RECYCLE FLAG
FUP2  .DATA  .-1                PROBE POSITION FLAG (-) DOWN (+) UP
TD02  .DATA  .0                 CUR RAW DATA
TD12  .DATA  .0                 VLT RAW DATA
TD22  .DATA  .0                 SEN RAW DATA
TD36  .DATA  .0                 LUT FAIL FLAG
TD42  .DATA  .0                 SPD COUNTER
TD52  .DATA  .0                 ALARM COUNTER
TD62  .DATA  .-1
      .DUP   .DTP2-1
      .DATA  .-1
FAD2  .DATA  .FUC2.FUV2.FUS2
PPD2  .DATA  .CUR1.LCV1.SEN1
CFD2  .DATA  .CCF1.CVF1.CSF1.LFA1
DTS2  .DATA  .PROBE 2
DTD2  .DATA  .C = +10.00V   V = +10.00V   S = +10.00V
      .EJEC  .
*****************************************************************
*****************************************************************
...
...
...
...   BTS = 1. PROBE 2 STATION DATA STORAGE AREA
...
...
DSP2  .DATA  .0                 SIZE OF SAMPLE LUT
      .DATA  .0                 REJECTS ALLOWED EACH LUT
```

```
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        .DATA  .-1                  REAL TIME DATA FLAG
0552    .DATA  .0100000             NUMBER OF FUZES TESTED
        .DATA  .0100000             NUMBER OF FUZES REJECTED
        .DATA  .0100000             NUMBER OF MACHINE STOPS
0042    .DATA  .0                   NUMBER OF FUZES TESTED THIS LOT
        .DATA  .0                   NUMBER OF FUZES REJECTED THIS LOT
        .DATA  .1                   NUMBER OF DETAILED DATA WRCS FOLLOWING
        .DATA  .0100000             NUMBER OF VLT & SEN FAILS
        .EJEC  .
***
***
***
***   CURRENT PARAMETER STORAGE AREA
***
***
        .DATA  .-1                  COUNT FOR SPD INTERVAL
FUCZ    .DATA  .0                   FAILURES PER LOT
        .DATA  .0100000             TOTAL PARAMETER FAILS
        .DATA  .0                   # OF CONSEC PARAMETER FAILS
        .DATA  .0                   CPFA
        .DATA  .0                   SUMT
        .DATA  .0                   SOFF
        .DATA  .0                   SROT
        .DATA  .0                   LROR
        .DATA  .0                   HROR
        .DATA  .0                   DRES
        .DATA  .0                   MINA
        .DATA  .0                   MAXA
        .DATA  .0                   LOFF
        .DATA  .0                   CROT
        .DATA  .0                   LOWER FREQ. DIST. LIMIT
        .DATA  .0                   UPPER FREQ. DIST. LIMIT
        .DATA  .0                   WIDTH OF FREQ. DIST. INTERVAL
        .DATA  .14                  NUMBER OF FREQ. DIST. INTERVALS
        .DATA  .0100000             CURRENT LOT FREQ. DIST.
        .DUP   .13
        .DATA  .0100000
        .DATA  .0100000             PREVIOUS LOT FREQ. DIST.
        .DUP   .13
        .DATA  .0100000
        .DATA  .0100000             CUMULATIVE FREQ. DIST.
        .DUP   .13
        .DATA  .0100000
        .DATA  .-1                  CURRENT LOT FAILURE RAW DATA
        .DUP   .19
        .DATA  .-1
        .EJEC
***
***
***
***   VOLTAGE PARAMETER STORAGE AREA
***
```

```
                                                                                01145
      .0078  .-1              COUNT FOR SPU INTERVAL                            01146
      .0078  .0               FAILURES PER LOT                                  01147
      .0078  .0000000         TOTAL PARAMETER FAILS                             01148
      .0078  .0               # OF CONSEC PARAMETER FAILS                       01149
      .0078  .0               CPFA                                              01150
      .0078  .0               SHRT                                              01151
      .0078  .0               SOFF                                              01152
      .0078  .0               SHOT                                              01153
      .0078  .0               LOOR                                              01154
      .0078  .0               HOOR                                              01155
      .0078  .0               OOES                                              01156
      .0078  .0               NOOA                                              01157
      .0078  .0               NAEA                                              01158
      .0078  .0               COFF                                              01159
      .0078  .0               COOT                                              01160
      .0078  .0               LOWER FREQ. DIST. LIMIT                           01161
      .0078  .0               UPPER FREQ. DIST. LIMIT                           01162
      .0078  .0               WIDTH OF FREQ. DIST. INTERVAL                     01163
      .0078  .14              NUMBER OF FREQ. DIST. INTERVALS                   01164
      .0078  .0000000         CURRENT LOT FREQ. DIST.                           01165
      .007F  .11                                                                01166
      .0078  .0000000                                                           01167
      .0078  .0000000         PREVIOUS LOT FREQ. DIST.                          01168
      .007F  .11                                                                01169
      .0078  .0000000                                                           01170
      .0078  .0000000         CUMULATIVE FREQ. DIST.                            01171
      .007F  .11                                                                01172
      .0078  .0000000                                                           01173
      .0078  .-1              CURRENT LOT FAILURE RAW DATA                       01174
      .007F  .20                                                                01175
      .0078  .-1                                                                01176
      .0A0C  .                                                                  01177
***                                                                             01178
***                                                                             01179
***   [illegible] PARAMETER STORAGE AREA                                        01180
***                                                                             01181
***                                                                             01182
      .0078  . 1              COUNT FOR SPU INTERVAL                            01183
      .0078  .0               FAILURES PER LOT                                  01184
      .0078  .0000000         TOTAL PARAMETER FAILS                             01185
      .0078  .0               # OF CONSEC PARAMETER FAILS                       01186
      .0078  .0               CPFA                                              01187
      .0078  .0               SHRT                                              01188
      .0078  .0A3             SOFF                                              01189
      .0078  .0A3             SHOT                                              01190
      .0078  .0               LOOR                                              01191
      .0078  .0               HOOR                                              01192
      .0078  .0               OOES                                              01193
      .0078  .0               NOOA                                              01194
      .0078  .0               NAEA                                              01195
      .0078  .0               COFF                                              01196
```

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```
        .DATA  .2                 CNET
        .DATA  .0                 LOWER FREQ. DIST. LIMIT
        .DATA  .0                 UPPER FREQ. DIST. LIMIT
        .DATA  .0                 WIDTH OF FREQ. DIST. INTERVAL
        .DATA  .14                NUMBER OF FREQ. DIST. INTERVALS
        .DATA  .0100000           CURRENT LOT FREQ. DIST.
        .DUP   .13
        .DATA  .0100000
        .DATA  .0100000           PREVIOUS LOT FREQ. DIST.
        .DUP   .13
        .DATA  .0100000
        .DATA  .0100000           CUMULATIVE FREQ. DIST.
        .DUP   .13
        .DATA  .0100000
        .DATA  .-1                CURRENT LOT FAILURE AND DATA
        .DUP   .19
        .DATA  .-1
        .EJEC  .
***
***
***
***     INPUT OUTPUT ROUTINE DATA BLOCK
***
***
IO22    .DATA  .5,-1,4,+,(RTS2),26,10
        .EJEC  .
*****************************************************************
*****************************************************************
***                 TEST PROGRAM - BASIC TEST STATION 2       ***
***                          ( PROBE # 3 )                    ***
*****************************************************************
*****************************************************************
***
***     PROGRAMMER: R. BUSCHER
***                 HARRY DIAMOND LABS
***                 JUNE 1969
        .DUP   .20
        .SPAC  .1
*****************************************************************
***                 PARAMETERS TO BE MEASURED                 ***
***                                                           ***
***                 1.) FUZE CURRENT                          ***
***                 2.) FUZE ARMING TIME                      ***
***                 3.) FUZE MUV                              ***
***                 4.) FUZE NOISE REJECTION                  ***
***                                                           ***
*****************************************************************
        .EJEC  .
*****************************************************************
***                 PROGRAM INFORMATION BLOCK                 ***
*****************************************************************
        .SPAC  .5
```

```
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TD13  .0000  .)                  PB                                    01269
      .0010  .000                PP                                    01250
      .0020  .(CAL)              KEBT                                  01251
      .0030  .(CAL)              CEBT                                  01252
      .0040  .B                  WBAL                                  01253
      .0050  .0                  PBAL                                  01254
      .0060  .0.0                TBAL                                  01255
      .0070  .0                  RBBL                                  01256
      .0080  .0                  PBWL                                  01257
      .0090  .0.0                TBAL                                  01258
      .00A0  .0.0.0              SEAK                                  01259
      .00B0  .                   BPIS                                  01260
      .0.0C  .                                                         01261
...                                                                    01262
...                                                                    01263
...   CALIBRATE PROBE PANEL                                            01264
...                                                                    01265
...                                                                    01266
CAL)  .00D0  .                                                         01267
      .100   .0020                                                     01268
      .1001  .(CD0'                                                    01269
      .(111  .0000)              SELECT CAL MODE                       01270
      .100   .021                                                      01271
      .(111  .0010               WAIT 25 MS                            01272
      .!Ab   .                   CHAN = FOR CHR                        01273
      .(P0   .                                                         01274
      .(111  .040C./.0599.+01    GET CHR CAL DATA                      01275
      .(P0   .                                                         01276
      .5104  .0001.1             STORE CHR DATA                        01277
      .100   .05                 CHAN = FOR HBO                        01278
      .(P0   .                                                         01279
      .(111  .040C./.0599.+01    GET HBO CAL DATA                      01280
      .(P0   .                                                         01281
      .5104  .0001.1             STORE HBO DATA                        01282
      .00F   .'111               .                                     01283
      .10F   .                                                         01284
      .100   .0004                                                    01285
      .1001  .(000                                                    01286
      .00F   .(01 0+0            DO ZERO CAL                           01287
...                                                                    01288
...                                                                    01289
...   PROGRAM 'OS' PROGRAM FOR EXECUTION                               01290
...                                                                    01291
...                                                                    01292
'513  .1Z0   .                                                         01293
      .510   .(01.0+1            SET CAL FINISH FLAG                   01294
      .2000  .0001               RESETS LITES                          01295
      .130   .06                                                      01296
      .100   .000.               .                                     01297
      .(111  .0000.2             ZERO THRESHOLD SIGNAL                 01298
      .1+0   .010+               DATA FOR CALL                         01299
      .(111  .0000.2             SET LOW THRESHOLD , DISABLE DSC       01300
```

```
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        .5[illegible]  .02                 DATA FOR CALL
        .CALL  .[illegible].2              MAX DUP AND START ARM COUNTER
        .LDA   .[illegible]
        .CALL  .[illegible]                POWER ON
        .LDA   .[illegible]
        .CALL  .[illegible]                WAIT 100 MS
        .[illegible]  .02
        .5[illegible]  .[illegible]                RESET RECYCLE FLAG
        .[illegible]  .
        .CALL  .[illegible].2.(DSY3)       SENSE RECYCLE
        .[illegible]  .02
        .[illegible]  .[illegible]                IF NOT RECYCLE
        .5[illegible]  .[illegible]                SET RECYCLE FLAG = 0
        .[illegible]  .[illegible]
[illegible]  .[illegible]  .[illegible]
        .[illegible]  .[illegible]                IF CONSEC FAILS ON LAST TEST 3
[illegible]  .[illegible]  .[illegible]                INCR A INTO A&X
        .5[illegible]  .[illegible]
        .[illegible]  .[illegible]                IF DONE
        .[illegible]  .[illegible]                NOT DONE
...
...
...     CHECK FOR COMPLETION OF SAMPLE LOT
...
...
        .LDA   .DSP.+NOTTL          # TESTED THIS LOT
        .5[illegible]  .DSP.+SIZE          LOT SIZE
        .[illegible]  .[illegible]                IF LOT COMPLETE
        .5[illegible]  .                   FLAG FOR SADC
        .[illegible]  .
        .5[illegible]  .DSP.+NOTTL          # TESTED THIS LOT
        .5[illegible]  .DSP.+NOTTL          # REJECTED THIS LOT
        .LDA   .[illegible]                NOISE ON FWA
[illegible]  .5[illegible]  .[illegible].2              ZERO REJECT THIS LOT
        .LDA   .[illegible].2              GET LOW FAILS THIS LOT
        .5[illegible]  .[illegible].2              STORE IN PREVIOUS LOT
        .5[illegible]  .[illegible].2              ZERO LOW FAILS THIS LOT
...
...
...     OBTAINS AND PROCESSES TEST DATA
...
...
...
...
...     FUZE CURRENT TEST
...
...
[illegible]  .[illegible]  .                   ADC CHAN ADDR
        .LDA   .[illegible]                CUR DB FWA
        .LDA   .[illegible]                RECYCLE FLAG
        .CALL  .[illegible].2.(DSY3).(FSY3)    MEASURE CURRENT
        .[illegible]  .
```

```
        .LDA   .LSD3              GET LITE DATA
        .INCR  .01                MAKES BIT 0 OF LSD3 = 1
        .JMPM  .DUF3              LITE CUR PASS LITE.
        .TXA   .
***
***
***     FUZE MODULATION TEST
***
***
FST3    .STA   .TD03              STORE CUR RAW DATA
        .LDB   .$5                ADC CHAN ADR
        .LDX   .FAD3+1            MOD DW FWA
        .LDA   .RCF3              RECYCLE FLAG
        .CALL  .$ADC.2.(BSY3),(FAT3)
        .TAX   .
        .LDA   .LSD3              GET LITE DATA
        .ERA   .$2
        .JMPM  .DUF3              MOD PASS LITE ON
        .TXA   .
***
***
***     FUZE ARMING TIME
***
***
FAT3    .STA   .TD23              STORE MOD RAW DATA
        .LDA   .D500
        .CALL  .$ALWL             WAIT 500 MS
        .INCR  .06                B=X=1
NFP3    .CALL  .$SEN.2.BSY3       CHECK FP
        .LRLA  .8
        .JIF   .044.IFP3          IF FP AFTER 600 MS
        .JXZ   .FSA3              IF NO FP.
        .JAN   .IFP3-3            IF FP BEFORE 600 MS
        .DXR   .
        .LDA   .D900
        .CALL  .$ALWL             WAIT 900 MS
        .JMP   .NFP3              CHECK FOR FP AGAIN
FSA3    .LDB   .$B11              GET 2048 DUMMY ARM.TIME
        .JMP   .NOF3+1
        .LDA   .D900
        .CALL  .$ALWL             WAIT 900 MS
IFP3    .LDB   .$2                ARM TIME ADDR
        .CALL  .$DIC.2.BSY3       GET ARM TIME
        .DXR   .
        .JXZ   .NOF3              IF FP BEFORE 600 MS
        .SUB   .D600
        .JAP   .++3               IF NO COUNTER OVERFLOW
        .ADD   .$B10              GET 1024. OVERFLOW.CORRECTION FACTOR
        .AND   .D600
NOF3    .TAB   .
        .LDX   .FAD3+2            FWA OF ARM DW
        .LDA   .RCF3              GET RECYCLE FLAG
```

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```
        .CALL   .STOP           PROCESS ARM TIME                        01405
        .STB    .TD13           STORE ARM TIME RAW.DATA                 01406
        .JOF    .+*4            IF FUZE PASSED                          01407
        .JMP    .MST3           IF FAIL                                 01408
        .LDA    .LSD3           GET LITE DATA                           01409
        .ERA    .04                                                     01410
        .JMPM   .BUF3           LITES ARM PASS LITE                     01411
MST3    .CALL   .CSD3           STOP DOP, RESET MSG , ENAB FM           01412
***                                                                     01413
***                                                                     01414
***     SUPPLY NOISE TEST.                                              01415
***                                                                     01416
***                                                                     01417
FNT3    .LDB    .8310                                                   01418
        .CALL   .RRD3           ENABLE SUPPLY NOISE                     01419
        .LDA    .820                                                    01420
        .CALL   .SALML          WAIT 20 MS                              01421
        .LDB    .04                                                     01422
        .LDA    .02                                                     01423
        .CALL   .SBUF.2         START SLEW COUNTER                      01424
        .LDA    .8217                                                   01425
        .CALL   .SALML          WAIT 143 MS                             01426
        .INCR   .02             SENSE LINE ADDR                         01427
        .CALL   .BSEN.2,BSY3    CHECK FP                                01428
        .LRLA   .8                                                      01429
        .JAN    .R3             IF FAIL                                 01430
        .LDA    .LSD3           GET LITE DATA                           01431
        .ERA    .8020           SET BIT 6 OF LSD .3=1                   01432
        .JMPM   .BUF3           LITE NOISE PASS LITE                    01433
        .TZX    .               .                                       01434
        .STX    .FWB3+CONF      ZERO CONSEC FAILS                       01435
        .LDX    .90K            GET ' OK '                              01436
        .JMP    .CFF3-1                                                 01437
R3      .LDX    .8FL            GET ' FL                                01438
        .LDA    .RCF3           GET RECYCLE FLAG                        01439
        .JAZ    .CFF3-1         IF RECYCLE                              01440
        .LDB    .FAD3+3         FWA OF NOISE DB                         01441
        .INR    .FLOT,2         FAILS PER LOT                           01442
        .INR    .FAIL,2         TOTAL FAILS                             01443
        .INR    .CONF,2         CONSEC FAILS                            01444
        .INR    .FLTL,2         FAIL LOW THIS LOT                       01445
        .INR    .FLCT,2         FAIL LOW CUMULATIVE                     01446
        .STX    .RTD3+23        STORE OK OR FL                          01447
***                                                                     01448
***                                                                     01449
***     CHECK FOR FAILURE OF FUZE                                       01450
***                                                                     01451
***                                                                     01452
CFF3    .INCR   .02                                                     01453
        .CALL   .BSEN.2,(BSY3)                                          01454
        .LRLA   .15                                                     01455
        .STA    .FWP3           PROBE UP (+), DOWN (-)                  01456
```

```
        .LDA   .RCF3              GET RECYCLE FLAG
        .JAZ   .RC03              IF RECYCLE
        .INR   .DSP3+NTTL         INCR # TESTED THIS LOT
        .INR   .DSP3+NOFT         INCR TOTAL TEATED
        .INR   .FWC3+SPOC         INCR SPO COUNTS FOR PARAMETERS
        .INR   .FWA3+SPOC
        .INR   .FWM3+SPOC
        .INR   .FWN3+SPOC
RC03    .LDA   .LSD3              GET LITE DATA
        .TZX   .
        .ERA   .$02
        .JAZ   .AL43              IF FUZE PASSED ALL TESTS
        .SUB   .$2
        .INCR  .04
        .JAZ   .AL43              IF PASSED ALL BUT MOD TEST
        .LDA   .LSD3              GET LITE DATA
        .ERA   .$400
        .JMPM  .BUF3              LITE FAIL LITE
        .LDA   .$AA               GET ' ** '
        .STA   .RTS3+5
        .LDB   .RCF3              GET RECYCLE FLAG
        .LDA   .FUP3              GET PROBE POSITION FLAG
        .JIF   .022,MIS3          IF PROBE UP AND RECYCLE
        .JBZ   .CNK3              IF RECYCLE
        .JAZ   .A3                IF PROBE UP
        .LDB   .$204
        .CALL  .RR03              CLOSE REJECT PUNCH.
        .LDA   .D100
        .CALL  .$ALWL             WAIT 100 MS
        .LDB   .$200
        .CALL  .RR03              OPEN REJECT PUNCH
A3      .INR   .DSP3+NOFR         INCR TOTAL # REJ
        .INR   .DSP3+NRTL         INCR REJ THIS LOT
***
***
***     CHECK FOR ALARM SITUATIONS
***
***
CAS3    .TZB   .                  SET ROUTINE COUNTER
        .STB   .TD73
        .LDXE  .FAD3,2            GET PARAM FWA
        .LDA   .CPFA,1            GET CONSEC REJ ALLOWED
        .SUB   .CONF,1            SUB # CONSEC FAILS.
        .JAN   .AL23              IF TOO MANY CONSEC FAILS
T3      .INCR  .023               INCR B INTO A & B
        .SUBI  .NTP3
        .JAN   .CAS3+1            IF NOT DONE
        .LDA   .DSP3+NRAL         GET # REJ ALLOWED PER LOT
        .SUB   .DSP3+NRTL         SUB # REJ THIS LOT
        .STA   .TD83              FLAG (-) FOR LOT FAIL, (+) OK
***
***
```

```
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***   CHECK IF REAL TIME OUTPUT WANTED                                    01509
***                                                                       01510
***                                                                       01511
CHK3  .LDA   .DSP3+RTDF          GET REAL TIME DATA FLAG                  01512
      .JAZ   .+*4                IF REAL TIME WANTED                      01513
      .JMP   .CHA3                                                        01514
      .CALL  .BVCD,(TD03),(RTB3+2)    GET ASC                             01515
      .LDA   .TD13                                                        01516
      .CALL  .BBCD,10,4,(RTD3+16)                                         01517
      .CALL  .BVCD,(TD23),(RTD3+9)                                        01518
      .LDAI  .1023                                                        01519
      .CALL  .BIOC,(CHA3)                                                 01520
***                                                                       01521
***                                                                       01522
***   CHECK IF TIME FOR SUMMARY PRINT OUT                                 01523
***                                                                       01524
***                                                                       01525
CHA3  .LDA   .RCF3               GET RECYCLE FLAG                         01526
      .JAZ   .EXI3               IF RECYCLE                               01527
      .LDB   .TD93               GET ROUTINE COUNTER                      01528
      .TBA   ,                                                            01529
      .SUBI  .NTP3               SUB # PARAM TESTS                        01530
      .JAZ   .L3                                                          01531
      .LDXE  .FAD3,2             GET FWA OF PARAM DB                      01532
      .LDAE  .SPDC,1             COUNT SINCE LAST SPD                     01533
      .SUB   .SUMY,1             = BETWEEN SPD                            01534
      .JAP   .SPD3               IF TIME FOR SPD                          01535
      .IBR   .TD93                                                        01536
      .JMP   .CHA3+3             NOT DONE                                 01537
L3    .TZA   ,                                                            01538
      .STA   .TD93               RESET ROUTINE COUNTER                    01539
***                                                                       01540
***                                                                       01541
***   EXIT ROUTINE                                                        01542
***                                                                       01543
***                                                                       01544
EXI3  .TZB   ,                                                            01545
      .CALL  .RRB3               TURN OFF POWER                           01546
      .LDA   .RCF3               GET RECYCLE FLAG                         01547
      .JAZ   .BEXIT              IF RECYCLE                               01548
      .LDA   .DSP3+BTTL          = TESTED THIS LOT                        01549
      .SUB   .DSP3+SIZE          LOT SIZE                                 01550
      .JAN   .BEXIT              IF NOT NEW LOT                           01551
      .LDA   .TD83               GET LOT FAIL FLAG                        01552
      .JAN   .AL13               IF LOT FAILED                            01553
CAT3  .JMP   .BEXIT                                                       01554
***                                                                       01555
***                                                                       01556
***   OUTPUT ROUTINE TO INDICATOR LIGHTS                                  01557
***                                                                       01558
***                                                                       01559
BUF3  .ENTR                                                               01560
```

```
        .STA   .LSD3              STORES PRESENT DISPOSITION OF LITES          01561
        .LDB   .$2                LITE REG ADDR                                01562
        .CALL  .SBUF.2            TURNS ON PROPER LITES                        01563
        .JMP*  .BUF3                                                           01564
***                                                                            01565
***                                                                            01566
***     UTILITY ROUTINES                                                       01567
***                                                                            01568
***                                                                            01569
AL13    .TZA   .                                                               01570
        .STA   .TDB3                                                           01571
        .LDBI  .NTP3                                                           01572
        .DECR  .04                                                             01573
        .JMP   .AL23+6                                                         01574
AL33    .TAB   .                                                               01575
        .TZA   .                                                               01576
        .STA   .CONF-1,2          ZERO CONSCE FAILS                            01577
        .DECR  .01                                                             01578
        .STAE  .TD63,1            RESETS FLAG                                  01579
        .JMP   .+3                                                             01580
AL43    .LDA   .$BB               GET ' BLANK BLANK                            01581
        .STA   .RTS3+5                                                         01582
        .LDA   .FUP3              GET PROBE POSITION FLAG                      01583
        .JAP   .+ES3              IF PROBE UP                                  01584
        .JIF   .050,CHK3          IF ALL PASSED                                01585
        .LDA   .RCF3              GET RECYCLE FLAG                             01586
        .JAZ   .CHK3              IF RECYCLE                                   01587
        .JMP   .CAS3              IF ALL BUT MUD PASSED                        01588
AL53    .ENTR  .                                                               01589
        .TBA   .                  GET PARAM # IN A                             01590
        .SUB   .$2                                                             01591
        .JAZ   .+*+6              IF ARM TIME                                  01592
        .JAP   .$IR1              IF NOISE                                     01593
        .ADM   .$L02              IF CUR OR MUD                                01594
        .TAB   .                                                               01595
        .LDAE  .SPD3,2            GET SPU CALL ADDR                            01596
        .JMP*  .AL53                                                           01597
CS03    .ENTR  .                                                               01598
        .LDB   .$4                                                             01599
        .LDA   .$045                                                           01600
        .CALL  .SBUF,2            STOP & RESET COUNTERS RESET OSC              01601
        .LDB   .$210                                                           01602
        .CALL  .RR03                                                           01603
        .JMP*  .CS03                                                           01604
***                                                                            01605
***                                                                            01606
***     SUMMARY PRINT OUT ROUTINES                                             01607
***                                                                            01608
***                                                                            01609
SP03    .CALL  .AL53              GET SPU CALL ADDR IN A                       01610
        .STA   .Z3                PREPARE CALL                                 01611
        .LDB   .TD93                                                           01612
```

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```
        .LDBE   .FPD3.2             GET PREAMBLE FWA
        .LDA    .WAT3+4             GET STATION DB FWA
        .CALL   .$SPO.3.C3          OUTPUT TO LP
Z3      .EQU    .+-3
        .DECR   .01
        .STAE   .SPOC.1             RESET SPU COUNT
        .INR    .TD93
C3      .LDA    .TD93               GET COUNTER
        .SUBI   .NTP3               SUB # PARAM TESTS
        .JAZ    .L3
        .JMP    .EXI3
***
***
***     ERROR ROUTINES
***
***
***
***
***
***     IF ADC OR DIGITAL INPUT BUSY
***
***
BSY3    .JMPM   .SFM3               STOPS MACH
B3      .LDA    .$10
        .CALL   .$ALWL              WAIT 10 MS
        .LDAI   .ERR1               FWA OF I/O DB
        .CALL   .$IOC.B3            INITIATES ERROR MSG
        .LDB    .$3BB               GET '3 '
        .STB    .ERR2
        .JMP    .EXI3               EXIT
***
***
***     IF PROBE UP ILLEGALLY
***
***
MIS3    .JMPM   .SFM3               STOP MACHINE
        .LDA    .$10
        .CALL   .$ALWL              WAIT 10 MS
        .LDAI   .MFF1               GET I/O DB FWA
        .CALL   .$IOC.(MIS3+2)
        .LDA    .$3BB               GET '3 '
        .STA    .MFF2
        .JMP    .EXI3
***
***
***
***     IF LOT OR CONSECUTIVE PARAM FAIL
***
***
AL23    .CALL   .AL53               GET SPU CALL ADDR IN A
        .STA    .V3                 PREPARE CALL
        .LDB    .TD73               GET ROUTINE COUNTER
```

```
      .JMPM  .SFM3              STOP MACH
      .LDBE  .CF03.2            GET PREAMBLE,FWA
WAT3  .LDA   .D100
      .CALL  .$ALWL             WAIT 100 MS
      .LDAI  .DSP3              GET STA DB FWA
      .CALL  .$SPO.3.WAT3
V3    .EQU   .*-3
      .IXR   .
      .JXZ   .$EXIT
      .LDB   .TD73
      .STXE  .TD63.2            STORE FWA OF FAIL PARAM
      .JMP   .T3
...
...
...   ROUTINE WHICH STOPS MACHINE
...
...
SFM3  .ENTR  .
      .STB   .BSV3              SAVE B
      .LDB   .$6                * RR BUF REG
      .LDA   .$2                MACHINE STOP DATA
      .CALL  .$REL.2            STOPS MACH
      .INR   .DSP3+NOMS         INCR * MACH STOPS
      .LDB   .BSV3              RESTORE B
      .JMP*  .SFM3
BSV3  .DATA  .0
...
...
...   REED RELAY OUTPUT (PRESERVES STOP STATUS)
...
...
RRO3  .ENTR  .                  DATA IN B
      .LDA   .$RRO+3            PREVIOUS RR STATUS
      .ANA   .$3                SAVE BITS ZERO AND ONE
      .MERGE .031               CREATE DATA WORD
      .LDB   .$6
      .CALL  .$REL.2            OUTPUT DATA WORD
      .JMP*  .RRO3              RETURN
      .EJEC  .
...
...
...   PROGRAM DATA
...
...
LSD3  .DATA  .0                 LITE STORAGE DATA
RCF3  .DATA  .1                 RECYCLE FLAG
FUP3  .DATA  .-1                PROBE POSITION FLAG (-) DOWN (+) UP
TD03  .DATA  .0
TD13  .DATA  .0
TD23  .DATA  .0
TD63  .DATA  .-1                CONSEC FAIL FLAG
      .DUP   .NTP3-1
```

```
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      .DATA  .-1
TD73  .DATA  .0                  ALARM COUNTER FLAG                          01717
TDB3  .DATA  .0                  LOT FAIL FLAG                               01718
TD93  .DATA  .0                  SPD CJUNT FLAG                              01719
FAD3  .DATA  .FWC3.FWM3.FWA3.FWB3                                            01720
FPD3  .DATA  .CUR1.MOD1.ARR1.RKE1                                            01721
CFD3  .DATA  .CCF1.CMF1.CAF1.CAF1.LFA1                                       01722
SPD3  .DATA  .$SP2.$SP1.$SPD                                                 01723
RTS3  .DATA  .'PROBE 3                                                       01724
RTD3  .DATA  .'C = +10.00V   M = +10.C3V   A = 1024'                         01725
      .DATA  .' MS   N = OK'                                                 01726
      .EJEC  .                                                               01727
***********************************************************************      01728
***********************************************************************      01729
***                                                                          01730
***                                                                          01731
***                                                                          01732
***                                                                          01733
***   BTS = 2. PROBE 3 STATION STORAGE AREA                                  01734
***                                                                          01735
***                                                                          01736
DSP3  .DATA  .0                  SIZE OF SAMPLE LOT                          01737
      .DATA  .0                  REJECTS ALLOWED EACH LOT                    01738
      .DATA  .-1                 REAL TIME DATA FLAG                         01739
DSS3  .DATA  .0100000            NUMBER OF FUZES TESTED                      01740
      .DATA  .0100000            NUMBER OF FUZES REJECTED                    01741
      .DATA  .0100000            NUMBER OF MACHINE STOPS                     01742
DAA3  .DATA  .0                  NUMBER OF FUZES TESTED THIS LOT             01743
      .DATA  .0                  NUMBER OF FUZES REJECTED THIS LOT           01744
      .DATA  .0                  NUMBER OF CORREL DATA ERRS                  01745
      .EJEC                                                                  01746
***                                                                          01747
***                                                                          01748
***                                                                          01749
***   CURRENT PARAMETER STORAGE AREA                                         01750
***                                                                          01751
***                                                                          01752
      .DATA  .-1                 COUNT FOR SPD INTERVAL                      01753
FWC3  .DATA  .0                  FAILURES PER LOT                            01754
      .DATA  .0100000            TOTAL PARAMETER FAILS                       01755
      .DATA  .0                  # OF CONSEC PARAMETER FAILS                 01756
      .DATA  .0                  CPFA                                        01757
      .DATA  .0                  SHHY                                        01758
      .DATA  .0                  SOFF                                        01759
      .DATA  .0                  SROT                                        01760
      .DATA  .0                  LABR                                        01761
      .DATA  .0                  HBOR                                        01762
      .DATA  .0                  BRES                                        01763
      .DATA  .0                  RIMA                                        01764
      .DATA  .0                  MAIA                                        01765
      .DATA  .0                  COFF                                        01766
      .DATA  .0                  CRUT                                        01767
      .DATA  .0                  LOWER FREQ. DEST. LIMIT                     01768
```

```
      .DATA  .0                 UPPER FREQ. DIST. LIMIT
      .DATA  .0                 WIDTH OF FREQ. DIST. INTERVAL
      .DATA  .14                NUMBER OF FREQ. DIST. INTERVALS
      .DATA  .0100000           CURRENT LOT FREQ. DIST.
      .DUP   .13
      .DATA  .0100000
      .DATA  .0100000           PREVIOUS LOT FREQ. DIST.
      .DUP   .13
      .DATA  .0100000
      .DATA  .0100000           CUMULATIVE FREQ. DIST.
      .DUP   .13
      .DATA  .0100000
      .DATA  .-1                CURRENT LOT FAILURE RAW DATA
      .DUP   .19
      .DATA  .-1
      .EJEC  .
***
***
***
***   ARMING TIME PARAMETER STORAGE AREA
***
***
      .DATA  .-1                COUNT FOR SPD INTERVAL
FWA3  .DATA  .0                 FAILURES PER LOT
      .DATA  .0100000           TOTAL PARAMETER FAILS
      .DATA  .0                 # OF CONSEC PARAMETER FAILS
      .DATA  .0                 CPFA
      .DATA  .0                 SUMY
      .DATA  .0                 SUFF
      .DATA  .1                 SHOT
      .DATA  .0                 LNOR
      .DATA  .0                 NNOR
      .DATA  .0                 ONES
      .DATA  .0                 MINA
      .DATA  .0                 MAXA
      .DATA  .0                 CUFF
      .DATA  .1                 CROT
      .DATA  .0                 LOWER FREQ. DIST. LIMIT
      .DATA  .0                 UPPER FREQ. DIST. LIMIT
      .DATA  .0                 WIDTH OF FREQ. DIST. INTERVAL
      .DATA  .14                NUMBER OF FREQ. DIST. INTERVALS
      .DATA  .0100000           CURRENT LOT FREQ. DIST.
      .DUP   .13
      .DATA  .0100000
      .DATA  .0100000           PREVIOUS LOT FREQ. DIST.
      .DUP   .13
      .DATA  .0100000
      .DATA  .0100000           CUMULATIVE FREQ. DIST.
      .DUP   .13
      .DATA  .0100000
      .DATA  .-1                CURRENT LOT FAILURE RAW DATA
      .DUP   .19
```

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```
        .DATA  .-1                                                      01821
        .EJEC  .                                                        01822
***                                                                     01823
***                                                                     01824
***     NOD PARAMETER STORAGE AREA                                      01825
***                                                                     01826
***                                                                     01827
        .DATA  .-1              COUNT FOR SPO INTERVAL                  01828
FWRD    .DATA  .0               FAILURES PER LOT                        01829
        .DATA  .0100000         TOTAL PARAMETER FAILS                   01830
        .DATA  .0               # OF CONSEC PARAMETER FAILS              01831
        .DATA  .0               CPFA                                    01832
        .DATA  .0               SORT                                    01833
        .DATA  .0               SORF                                    01834
        .DATA  .0               SRBT                                    01835
        .DATA  .0               LRBR                                    01836
        .DATA  .0               ARBR                                    01837
        .DATA  .0               RRES                                    01838
        .DATA  .0               RLBA                                    01839
        .DATA  .0               RRLA                                    01840
        .DATA  .0               CRFF                                    01841
        .DATA  .0               CRBT                                    01842
        .DATA  .0               LOWER FREQ. DIST. LIMIT                 01843
        .DATA  .0               UPPER FREQ. DIST. LIMIT                 01844
        .DATA  .0               WIDTH OF FREQ. DIST. INTERVAL           01845
        .DATA  .14              NUMBER OF FREQ. DIST. INTERVALS         01846
        .DATA  .0100000         CURRENT LOT FREQ. DIST.                 01847
        .DUP   .13                                                      01848
        .DATA  .0100000                                                 01849
        .DATA  .0100000         PREVIOUS LOT FREQ. DIST.                01850
        .DUP   .13                                                      01851
        .DATA  .0100000                                                 01852
        .DATA  .0100000         CUMULATIVE FREQ. DIST.                  01853
        .DUP   .13                                                      01854
        .DATA  .0100000                                                 01855
        .DATA  .-1              CURRENT LOT FAILURE RAW DATA            01856
        .DUP   .19                                                      01857
        .DATA  .-1                                                      01858
        .EJEC  .                                                        01859
***                                                                     01860
***                                                                     01861
***     NOISE REJECTION GO/NO-GO STORAGE AREA                           01862
***                                                                     01863
***                                                                     01864
        .DATA  .-1              COUNT FOR SPO INTERVAL                  01865
FWRD    .DATA  .0               FAILURES PER LOT                        01866
        .DATA  .0100000         TOTAL PARAMETER FAILS                   01867
        .DATA  .0               # CONSEC PARAM FAILS                    01868
        .DATA  .0               CONSECUTIVE REJ ALLOWED                 01869
        .DATA  .0               SPO.INTERVAL                            01870
        .DATA  .0               FAIL NUM THIS LOT                       01871
        .DATA  .0               FAIL NUM PREVIOUS LOT                   01872
```

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      .DATA  .0100000            FAIL LOW CUMULATIVE                    01873
      .DATA  .0                  FAIL HIGH THIS LOT                     01874
      .DATA  .0                  FAIL HIGH PREVIOUS.LOT                 01875
      .DATA  .0100000            FAIL HIGH CUMULATIVE                   01876
      .EJEC  .                                                          01877
***                                                                     01878
***                                                                     01879
      INPUT/OUTPUT ROUTINE DATA BLOCK                                   01880
***                                                                     01881
***                                                                     01882
1023  .DATA  .5,-1.4,*,(RTS3),30.10                                     01883
      .EJEC  .                                                          01884
*****************************************************************     01885
*****************************************************************     01886
***                TEST PROGRAM - BASIC TEST STATION 3            ***   01887
***                  FINAL TEST CHAMBERS                          ***   01888
*****************************************************************     01889
*****************************************************************     01890
***                                                               ***   01891
***   PROGRAMMER: D. BUSCHER                                      ***   01892
***               HARRY DIAMOND LABS                              ***   01893
***               JUNE 1969                                       ***   01894
      .DUP   .20                                                        01895
      .SPAC  .1                                                         01896
*****************************************************************     01897
***                PARAMETERS TO BE MEASURED                      ***   01898
***                                                               ***   01899
***                1.) FUZE CURRENT                               ***   01900
***                2.) FUZE R. F. POWER                           ***   01901
***                3.) FUZE SENSITIVITY                           ***   01902
***                4.) FUZE ARMING TIME                           ***   01903
***                5.) NOISE REJECTION                            ***   01904
*****************************************************************     01905
      .EJEC  .                                                          01906
*****************************************************************     01907
***                 PROGRAM INFORMATION BLOCK                     ***   01908
*****************************************************************     01909
      .SPAC  .5                                                         01910
1874  .DATA  .4                  PN                                     01911
      .DATA  .030                PP                                     01912
      .DATA  .CAL4               IENT                                   01913
      .DATA  .CAL4               CENT                                   01914
      .DATA  .0                  NVAL                                   01915
      .DATA  .0                  PVAL                                   01916
      .DATA  .0,0                TVAL                                   01917
      .DATA  .0                  NVWL                                   01918
      .DATA  .0                  PVWL                                   01919
      .DATA  .0,0                TVAL                                   01920
      .DATA  .0,0,0              STAK                                   01921
      .ROF   .                   OFIS                                   01922
      .EJEC  .                                                          01923
***                                                                     01924
```

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```
***
***     CALIBRATE FINAL TEST CHAMBERS
***     AND CHECK CHAMBER CALL
***
***
CAL4  .INCR  .02
      .STB   .RCF4              RESET RECYCLE FLAG
      .CALL  .$SEN.3.BSY4       CHECK CHAMBER CALL,AND RECYCLE
      .LRLA  .7
      .JAN   .CC42              IF CHAN. 2
      .LRLA  .8
      .JAP   .MIS4              IF NO CHAMBER CALL
      .LDXI  .'41'              IF CHAMBER 1
      .TZB   .
      .JMP   .**4
CC42  .LDXI  .'42'
      .STB   .CHF4              CHAMBER FLAG (0=CHAN 1)
      .STX   .RTT4              TEMP STORE OF CH. #
      .LRLA  .15
      .JAP   .**4               IF NOT RECYCLE
      .TZA   .
      .STA   .RCF4              SET RECYCLE FLAG (0=RECYCLE)
      .LDB   .$5
      .TZA   .
      .CALL  .$REL.3            OPEN MULTIPLEX RR
      .ROF   .
      .LDB   .$020
      .LDXI  .CROT
A4    .CALL  .RRD4              SELECT CAL MODE
      .LDA   .$50
      .CALL  .$ALWL             WAIT 50 MS
      .TZB   .                  B = CUR CHAN #
      .CPX   .
      .CALL  .$ADC.3.BSY4.**1   GET CUR CAL DATA
      .CPX   .
      .STAE  .FWC4.1            STORE CUR CAL DATA
      .LDB   .$2                B = PWR CHAN #
      .CPX   .
      .CALL  .$ADC.3.BSY4.**1   GET PWR CAL DATA
      .CPX   .
      .STAE  .FWP4.1            STORE PWR CAL DATA
      .JOF   .TST4              IF DONE CAL
      .SOF   .
      .LDB   .$060
      .LDXI  .COFF
      .JMP   .A4                DO ZERO CAL
***
***
***   PREPARE FOR TEST
***
***
TST4  .ZERO  .05                A = X = 0
```

```
      .STX   .CALF+4            SET CAL FINISH FLAG                  01977
      .JMPM  .BUF4              RESET LITES                          01978
      .LDA   .D200                                                   01979
      .CALL  .$ALHL             WAIT 200 MS                          01980
      .INCR  .02                                                     01981
      .STB   .NLF4              RESET NEW LOT FLAG.                  01982
      .STB   .STF4              RESET FULL TEST FLAG                 01983
      .STX   .TD44              RESET FUZE FAIL FLAG                 01984
      .LDA   .RCF4                                                   01985
      .JAZ   .CHC4              IF RECYCLE                           01986
M4    .LDAE  .TD44,1                                                 01987
      .JAP   .AL34              IF CONSEC FAIL                       01988
M4    .INCR  .045                                                    01989
      .SUBI  .NTP4                                                   01990
      .JAZ   .+*+4                                                   01991
      .JMP   .M4                                                     01992
***                                                                  01993
***                                                                  01994
***   CHECK FOR COMPLETION OF SAMPLE LOT                             01995
***                                                                  01996
***                                                                  01997
      .LDA   .DSP4+NTTL         * TESTED THIS LOT                    01998
      .SUB   .DSP4+SIZE         LOT SIZE                             01999
      .JAN   .CHC4              IF NOT NEW LOT                       02000
      .SOF   .                                                       02001
      .TZA   .                                                       02002
      .STA   .DSP4+NTTL         * TESTED THIS LOT                    02003
      .STA   .DSP4+NRTL         * REJECTED THIS LOT                  02004
      .STA   .NLF4              NEW LOT FLAG                         02005
      .LDB   .FAD4+4            NOISE ON FMA                         02006
      .STA   .FLO-.2            ZERO FAILS THIS LOT                  02007
      .LDA   .FLTL.2            FAIL LOW THIS LOT                    02008
      .STX   .FLPL.2            FAIL LOW PREVIOUS LOT                02009
      .STA   .FLTL.2            ZERO FAIL LOW THIS LOT               02010
***                                                                  02011
***                                                                  02012
***   CHECK FULL TEST                                                02013
***                                                                  02014
***                                                                  02015
CHC4  .INR   .DSF4+1            * FUZES SINCE LAST TEST              02016
      .LDA   .DSF4+1                                                 02017
      .SUB   .DSF4              * BETWEEN FULL TESTS                 02018
      .JAN   .FIT4              IF NOT TIME FOR FULLTEST             02019
***                                                                  02020
***                                                                  02021
***   ARMING TIME TEST                                               02022
***                                                                  02023
***                                                                  02024
***   ***                                                            02025
      .STA   .DSF4+1            ZERO # SINCE LAST TEST               02026
      .STA   .STF4              ZERO FULL TEST FLAG                  02027
      .LDA   .LSD4              GET LITE DATA                        02028
```

```
                .ERA    .$2                                                     02029
                .JMPN   .BUF4           LITE FULL TEST LITE                     02030
                .TZB    .               WAVETEK AMP ADDR                        02031
                .LDA    .MSK4           GET 01777                               02032
                .CALL   .$BUF,3         SET MAX AMP                             02033
                .INCR   .02             WAVETEK AMP PROG ADDR                   02034
                .LDA    .$523           DATA TO PROGRAM AMPLITUDE               02035
                .CALL   .$BUF,3         READY AMP                               02036
                .LDB    .$4             CTRL PULSE ADDR                         02037
                .LDA    .$10            DATA TO ENABLE & START COUNTER & MAX OUP 02038
                .CALL   .$BUF,3         ENABLE COUNTER , MAX OUP                02039
                .LDB    .$200                                                   02040
                .CALL   .RRQ4           POWER ON                                02041
                .LDA    .D700                                                   02042
                .CALL   .$ALML          WAIT 700 MS                             02043
                .INCR   .06             SER LINE ADDR AND A = 1                 02044
NFP4            .CALL   .$SEN.3.BSY4    CHK FOR FP                              02045
                .LRLA   .8                                                      02046
                .JIF    .044.IFP4       IF FP AFTER 700 MS                      02047
                .JXZ    .FSA4           IF NO FP                                02048
                .JAN    .IFP4-3         IF FP BEFORE 700 MS                     02049
                .DIR    .                                                       02050
                .LDA    .D900                                                   02051
                .CALL   .$ALML          WAIT 900 MS                             02052
                .JMP    .NFP4                                                   02053
FSA4            .LDB    .$811           GET 2048                                02054
                .JMP    .NUF4+1                                                 02055
                .LDA    .D500                                                   02056
                .CALL   .$ALML                                                  02057
IFP4            .LDB    .$2             ARM TIME ADDR                           02058
                .CALL   .$DIC.3.BSY4                                            02059
                .DIR    .                                                       02060
                .JXZ    .NUF4           IF FP BEFORE 700 MS                     02061
                .SUB    .D600                                                   02062
                .JAP    .**3            IF NO COUNTER OVERFLOW                  02063
                .ADD    .$810           GET 1024                                02064
                .ADD    .D600                                                   02065
NUF4            .TAB    .                                                       02066
                .LDX    .FAD4+3         GET ARM DB FNA                          02067
                .LDA    .RCF4           GET RECYCLE FLAG                        02068
                .CALL   .STDP           PROCESS DATA                            02069
                .STBE   .TD34           STORE RAW DATA                          02070
                .JOF    .**4                                                    02071
                .JMP    .**6                                                    02072
                .LDA    .LSD4           GET LITE DATA                           02073
                .ERA    .$4             SET LSB4                                02074
                .JMPN   .BUF4           LITE ARM PASS                           02075
***             .                                                               02076
***                                                                             02077
***     NOISE REJECTION TEST                                                    02078
***                                                                             02079
***                                                                             02080
```

```
        .CALL   .CSD4           STOP DUP,ENABLE F.M.                    02081
        .LDB    .$310                                                   02082
        .CALL   .RRD4           APPLY NOISE                             02083
        .LDA    .$20                                                    02084
        .CALL   .$ALWL          WAIT 20 MS                              02085
        .ZERO   .03             A = B = 0                               02086
        .CALL   .$BUF,3         SET WAVETEK AMP = 0                     02087
        .LDB    .$4             CTRL PULSE ADDR                         02088
        .LDA    .$10                                                    02089
        .CALL   .$BUF,3         ENABLE AND RESET DUP SCAN COUNTER       02090
        .LDA    .0200                                                   02091
        .CALL   .$ALWL          WAIT 200 MS                             02092
        .INCR   .02             SEN LINE ADDR                           02093
        .CALL   .$SEN,3,BST4    CHECK FP                                02094
        .LRLA   .8                                                      02095
        .JAN    .R4             IF FP, FUZE FAILS                       02096
        .LDA    .LSD4           GET LITE DATA                           02097
        .ERA    .$020           SET LSD4                                02098
        .JMPM   .BUF4           LITE NOISE PASS LITE                    02099
        .LDA    .$0K            GET ' OK '                              02100
        .LDB    .RCF4           GET RECYCLE FLAG                        02101
        .JBZ    .FIT4-1         IF RECYCLE                              02102
        .TZB    .               ZERO CONSEC FAILS                       02103
        .STB    .FWN4+CONF                                              02104
        .JMP    .S4                                                     02105
R4      .LDA    .$FL            GET ' FL '                              02106
        .LDB    .RCF4           GET RECYCLE FLAG                        02107
        .JBZ    .FIT4-1         IF RECYCLE                              02108
        .LDB    .FAD4+4         GET FWA OF NOISE DB                     02109
        .INR    .FLOT,2         FAILS PER LOT                           02110
        .INR    .FAIL,2         TOTAL FAILS                             02111
        .INR    .CONF,2         CONSEC FAILS                            02112
        .INR    .FLTL,2         FAIL LOW THIS LOT                       02113
        .INR    .FLCT,2         FAIL LOW CUM                            02114
S4      .INR    .FWA4+SPOC      INCR SPO COUNT                          02115
        .INR    .FWN4+SPOC                                              02116
        .STA    .RTD4+30                                                02117
***                                                                     02118
***                                                                     02119
***     FUZE SENSITIVITY TEST                                           02120
***                                                                     02121
***                                                                     02122
FIT4    .CALL   .CSD4           RESET DUP.. ENABLE F.M.                 02123
        .LDA    .0100                                                   02124
        .CALL   .$ALWL          WAIT 100 MS                             02125
        .INCR   .02             WAVETEK FREQ ADDR                       02126
        .LDA    .$123           DATA FOR CALL                           02127
        .CALL   .$REL,3         SELECT OSC FOR AMPLITUDE                02128
        .LDB    .$4             CTRL PULSE ADDR                         02129
        .LDA    .$10                                                    02130
        .CALL   .$BUF,3         ENABLE DUP, START OSC                   02131
        .LDA    .0400                                                   02132
```

```
        .CALL   .$ALWL              WAIT 400 MS
        .INCR   .02
        .CALL   .$SEN,3,BSY4        CHECK FP
        .LRLA   .8
        .JAN    .T4                 IF FP
        .LDB    .$011               DUMMY VALUE FOR FAIL
        .JMP    .W4
T4      .LDB    .$2
        .CALL   .$DIC,3,BSY4        GET DATA
        .TAB    .
W4      .LDX    .FAD4+2
        .LDA    .NLF4
        .XAZ    .$SOF               IF NEW LOT
        .LDA    .RCF4               GET RECYCLE FLAG
        .CALL   .$TDP               PROCESS DATA
        .STD    .TD24               STORE DATA
        .JOF    .**4                IF FUZE PASSES
        .JMP    .FST4               IF FAIL SEN
        .LDA    .LSD4               GET LITE DATA
        .ERA    .$8
        .JMPN   .BUF4               LITE SEN PASS LITE
***
***
***     CURRENT TEST
***
***
FST4    .CALL   .CSD4               RESET MODE
        .LDA    .NLF4               GET NEW LOT FLAG
        .XAZ    .$SOF               IF NEW LOT
        .TZB    .                   ADC CHAN *
        .LDX    .FAD4               PARAM DB FWA
        .LDA    .RCF4               GET RECYCLE FLAG
        .CALL   .$ADC,3,(BSY4),(FPT4)    MEASURE CURRENT
        .TAX    .
        .LDA    .LSD4
        .TAR    .
        .JMPN   .BUF4               LITE CUR PASS LITE
        .TXA    .
***
***
***     FUZE RF POWER TEST
***
***
FPT4    .STA    .TD04               STORE CUR DATA
        .LDB    .$2                 ADC CHAN ADDR
        .LDX    .FAD4+1             PARAM DB FWA
        .LDA    .RCF4               GET RECYCLE FLAG
        .CALL   .$ADC,3,(BSY4),(CFF4-1)  MEASURE RF PWR
        .TAX    .
        .LDA    .$040
        .ERA    .LSD4
        .JMPN   .BUF4               LITE PWR PASS LITE
```

```
                .TXA    .
                .STA    .TD14           STORE PWR DATA                          02185
                ***                                                             02186
                ***                                                             02187
                ***     CHECK FOR FUZE FAIL                                     02188
                ***                                                             02189
                ***                                                             02190
                ***                                                             02191
                CFF4    .INCR   .02                                             02192
                        .CALL   .$SEN.3.BSY4    CHECK IF PROBE DOWN             02193
                        .ANA    .$401                                           02194
                        .STA    .FUP4           IF NEITHER PROBE DOWN (STORE 0) 02195
                        .LDA    .RCF4           GET RECYCLE FLAG                02196
                        .JAZ    .RC04           IF RECYCLE                      02197
                        .INR    .DSP4+NTTL      INCR # TESTED THIS LOT          02198
                        .INR    .DSP4+NOFT      INCR TOTAL FUZES TESTED         02199
                        .INR    .FWC4+SPOC      SPO INTERVAL COUNT              02200
                        .INR    .FWP4+SPOC      INCR SPO INTERVAL               02201
                        .INR    .FWS4+SPOC                                      02202
                RC04    .LDB    .STF4           Get FULL TEST FLAG              02203
                        .DAR    .                                               02204
                        .JBZ    .X4             IF NOT FULL TEST                02205
                        .LDA    .LSD4           GET LITE DATA                   02206
                        .ANA    .$026                                           02207
                        .ERA    .$026                                           02208
                        .LDB    .$200                                           02209
                        .XAZ    .ST28           IF PASS SAMPLE TEST             02210
                X4      .LDA    .LSD4                                           02211
                        .ANA    .$051                                           02212
                        .ERA    .$051                                           02213
                        .JIF    .030.AL44       IF FUZE PASSES                  02214
                        .TZX    .                                               02215
                        .JAZ    .++3            IF NOT FAIL REGULAR TEST        02216
                        .LDX    .$400                                           02217
                        .MERGE  .061                                            02218
                        .ERA    .LSD4                                           02219
                        .JMPM   .BUF4           LITE FAIL LITE(S)               02220
                        .LDA    .DS12                                           02221
                        .STA    .TD44                                           02222
                        .LDA    .$AA            GET ' ++ '                      02223
                        .STA    .RTS4+5                                         02224
                        .LDA    .RCF4           GET RECYCLE FLAG                02225
                        .LDB    .FUP4           GET PROBE POSITION_FLAG         02226
                        .JIF    .03U.MIS4       IF PROBE UP AND RECYCLE         02227
                        .JBZ    .Y4             IF PROBE UP                     02228
                        .JAZ    .CHK4           IF RECYCLE                      02229
                        .LDA    .LSD4           GET LITE DATA                   02230
                        .ANA    .$050                                           02231
                        .JAZ    .PSF4           IF PWR AND SEN FAIL             02232
                U4      .LDA    .STF4           GET SAMPLE TEST FLAG            02233
                        .DAR    .                                               02234
                        .JAZ    .Y4             IF NOT FULL TEST                02235
                        .LDA    .LSD4           GET LITE DATA                   02236
```

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```
        .ANA    .0030                   IF NOISE AND SEN FAIL                   02237
        .JAZ    .NSF4                   IF NOISE AND SEN FAIL                   02238
Y4      .INR    .DSP4+NOFR              INCR TOTAL REJECTS                      02239
        .INR    .DSP4+NRTL              INCR # REJ THIS LOT                     02240
        .LDA    .FUP4                   GET PROBE POSITION.FLAG                 02241
        .JAZ    .NIS4                   IF PROBE UP                             02242
***                                                                             02243
***                                                                             02244
***     CHECK FOR ALARM SITUATIONS                                              02245
***                                                                             02246
***                                                                             02247
CmS4    .TZB    .                       SET RUNTIME COUNTER                     02248
        .STB    .TD74                                                           02249
        .LDXE   .FAD4,2                 GET PARAM PNA                           02250
        .LDA    .CPFA,1                 GET CONSEC REJ ALLOWED                  02251
        .SUB    .CONF,1                 SUB # CONSEC FAILS                      02252
        .JAN    .AL24                   IF TOO MANY CONSEC FAILS                02253
Q4      .INCR   .023                    INCR A AND B                            02254
        .SUBI   .NTP4                                                           02255
        .JAN    .CAS4+1                 IF NOT DONE                             02256
        .LDA    .DSP4+NRAL              GET # REJECTS ALLOWED THIS LOT          02257
        .SUB    .DSP4+NRTL              SUB # REJ THIS LOT                      02258
        .STA    .TD84                   FLAG=-1 FOR LOT FAIL, (=0 OK            02259
***                                                                             02260
***                                                                             02261
***     CHECK IF REAL TIME OUTPUT WANTED                                        02262
***                                                                             02263
***                                                                             02264
CHK4    .LDA    .DSP4+RTDF              GET REAL TIME FLAG                      02265
        .ADD    .SPDB                   ADD SPD BUSY FLAG                       02266
        .JAZ    .+*4                    IF READY                                02267
        .JMP    .CHA6                   NOT READY                               02268
        .LDA    .STF4                                                           02269
        .JAZ    .+*5                    IF FULL TEST                            02270
        .LDA    .826                    # MRDS OUTPUT                           02271
        .JMP    .+*3                                                            02272
        .LDA    .8045                   # MRDS OUTPUT                           02273
        .STA    .IO24+5                 # MRDS IB DRIVER ON                     02274
        .CALL   .SVCD,(TD04),(RTD4+2)                                           02275
        .CALL   .SVCD,(TD14),(RTD4+9)                                           02276
        .CALL   .SVCD,(TD24),(RTD4+16)                                          02277
        .LDA    .TD34                   GET ARM TIME                            02278
        .CALL   .SBCD,10.4,(RTD4+23)                                            02279
        .LDAI   .IO24                                                           02280
        .CALL   .SIOC,(CHA4)                                                    02281
        .LDAI   .*                                                              02282
RTT6    .EQU    .*-1                    TEMP STORAGE OF CH. #                   02283
        .STA    .RTS4+3                 STORE CH. # FOR RTD                     02284
***                                                                             02285
***                                                                             02286
***     CHECK IF TIME FOR SUMMARY PRINT OUT                                     02287
***                                                                             02288
```

```
***
CHA4  .LDA   .RCF4              GET RECYCLE FLAG                        02289
      .JAZ   .EXI4              IF RECYCLE                              02290
      .LDB   .TD94              GET RUNTIME COUNTER                     02291
      .TBA   .                                                          02292
      .SUBI  .NTP4              SUB # OF PARAM TESTED                   02293
      .JAZ   .L4+1                                                      02294
      .LDXE  .FAD4,2            GET PARAM ON FWA                        02295
      .LDAE  .SPOC,1            COUNT SINCE LAST SPO                    02296
      .SUB   .SUMY,1            # BETWEEN SPO                           02297
      .JAP   .SPO4              IF TIME FOR SPO                         02298
      .INR   .TD96                                                      02299
      .JMP   .CHA4+3            CONTINUE                                02300
L4    .TZA   .                                                          02301
      .STA   .TD94              ZERO FLAG                               02302
***                                                                     02303
***                                                                     02304
***   EXIT ROUTINE                                                      02305
***                                                                     02306
***                                                                     02307
EXI4  .LDA   .S400                                                      02308
      .ORA   .TD44              OR IN FAIL DATA                         02309
      .TAB   .                                                          02310
      .CALL  .RR04              POWER OFF                               02311
      .LDA   .S10                                                       02312
      .CALL  .SALWL             WAIT 10 MS                              02313
      .TZB   .                                                          02314
      .CALL  .RR04              RESET CHAM RELAYS                       02315
      .LDA   .RCF4              GET RECYCLE FLAG                        02316
      .JAZ   .SEXIT             IF RELYCLE                              02317
      .LDA   .DSP4+NTTL         # TESTED THIS LOT                       02318
      .SUB   .DSP4+SIZE         LOT SIZE                                02319
      .JAN   .SEXIT                                                     02320
      .LDA   .TD84              GET LOT FAIL FLAG                       02321
      .JAN   .ALI4                                                      02322
CAT4  .JMP   .SEXIT                                                     02323
***                                                                     02324
***                                                                     02325
***                                                                     02326
***   OUTPUT TO INDICATOR LIGHTS                                        02327
***                                                                     02328
***                                                                     02329
BUF4  .ENTR  .                                                          02330
      .STA   .LSD4              STORES LITE DATA                        02331
      .LDB   .B2                # LITE BUF REG                         02332
      .CALL  .BBUF,3            TURNS ON DESIGNATED LITE                02333
      .JMP*  .BUF4                                                      02334
***                                                                     02335
***                                                                     02336
***   UTILITY ROUTINES                                                  02337
***                                                                     02338
***                                                                     02339
                                                                        02340
```

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```
PSF4    .INR    .DSP4+CORR          INCR PWR AND SEN FAIL                    02341
        .JMP    .U6                                                          02342
NSF4    .INR    .DSP4+CORR+1        INCR SEN AND NOISE FAIL                  02343
        .JMP    .Y4                                                          02344
AL14    .TZA    .                                                            02345
        .STA    .TD84                                                        02346
        .LDBI   .NTP4                                                        02347
        .DECR   .04                                                          02348
        .JMP    .AL24+4             IF ADR FAIL                              02349
AL34    .TAB    .                                                            02350
        .TZA    .                                                            02351
        .STA    .CONF-1,2           ZERO PARAMETER CONSEC FAILS              02352
        .DECR   .01                                                          02353
        .STAE   .TD64,1             RESETS FLAG                              02354
        .JMP    .U6                                                          02355
AL44    .STA    .FWM4+CONF          ZERO CONSEC FAILS                        02356
        .LDA    .BBB                GET ' BLANK BLANK '                      02357
        .STA    .RTS4+5                                                      02358
        .LDA    .FWP4               GET PROBE POSITION FLAG                  02359
        .JAZ    .NIS4               IF PROBE UP                              02360
        .JMP    .CHK4                                                        02361
AL54    .ENTR   .                                                            02362
        .TBA    .                   COUNTER IN A                             02363
        .SUB    .03                                                          02364
        .XAM    .AL02               IF REG CALL                              02365
        .TAB    .                                                            02366
        .LDAE   .SPD4,2             GET SPD CALL ADDR IN A                   02367
        .JMP*   .AL54                                                        02368
CSD4    .ENTR   .                                                            02369
        .LDB    .96                 CTRL PULSE ADDR                          02370
        .LDA    .8025                                                        02371
        .CALL   .SBUF,3             RESET DSC, & DISABLE HLP                 02372
        .LDB    .8210                                                        02373
        .CALL   .RRD4               ENABLE FM                                02374
        .JMP*   .CSD4                                                        02375
***                                                                          02376
***                                                                          02377
***     SUMMARY PRINT OUT ROUTINE                                            02378
***                                                                          02379
***                                                                          02380
SPD4    .CALL   .AL54                                                        02381
        .STA    .Z4                 PREPARE SPD CALL                         02382
        .LDB    .TD94                                                        02383
        .LDBE   .FPD4,2             GET PREAMBLE+FNA                         02384
        .LDA    .NAT4+4             GET STATION DB FNA                       02385
        .CALL   .DSPD,4,C4                                                   02386
Z4      .EQU    .*-3                                                         02387
        .DECR   .01                                                          02388
        .STAE   .SPDC,1             RESET PARAM SPD COUNT                    02389
        .INR    .TD94                                                        02390
C4      .LDA    .TD94               GET COUNTER                              02391
        .SUBI   .NTP4                                                        02392
```

```
      .JAZ   .L4                                                        02393
      .JMP   .EXI4                                                      02394
***                                                                     02395
***                                                                     02396
***   ERROR ROUTINES                                                    02397
***                                                                     02398
***                                                                     02399
***                                                                     02400
***                                                                     02401
***   IF ADC OR DIC BUSY                                                02402
***                                                                     02403
***                                                                     02404
BST4  .JMPM  .SFM4              STOP MACHINE                            02405
B4    .LDA   .B10                                                       02406
      .CALL  .$ALWL                                                     02407
      .LDAI  .ERR1                                                      02408
      .CALL  .$IOC,(B4)         PRINTS ERROR MSG                        02409
      .LDB   .$488              GET '4 '                                02410
      .STB   .ERR2                                                      02411
      .JMP   .EXI4                                                      02412
***                                                                     02413
***                                                                     02414
***                                                                     02415
***   IF PROBE UP ILLEGALLY                                             02416
***                                                                     02417
***                                                                     02418
MIS4  .JMPM  .SFM4              STOP MACHINE                            02419
      .LDA   .B10                                                       02420
      .CALL  .$ALWL             WAIT 10 MS                              02421
      .LDAI  .MFF1              GET I/O DN FWA                          02422
      .CALL  .$IOC,(MIS4+2)                                             02423
      .LDA   .$488              GET '4                                  02424
      .STA   .MFF2                                                      02425
      .JMP   .EXI4                                                      02426
***                                                                     02427
***                                                                     02428
***   IF LOT OR CONSEC PARAMETER FAIL                                   02429
***                                                                     02430
***                                                                     02431
AL24  .CALL  .AL54                                                      02432
      .STA   .V4                STORE SPD CALL ADDR                   02433
      .LDB   .TD74              GET COUNTER                           02434
      .JMPM  .SFM4              STOP MACH                             02435
      .LDBE  .CFD4,2            GET PREAMBLE FWA                      02436
WAT4  .LDA   .D100                                                      02437
      .CALL  .$ALWL             WAIT 100 MS                           02438
      .LDAI  .DSP4              GET STA DN FWA                        02439
      .CALL  .$SPD,4,WAT4                                             02440
V4    .EQU   .+-3                                                     02441
      .INR   .                                                        02442
      .JNZ   .$EXIT                                                   02443
      .LDB   .TD74                                                    02444
```

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```
        .STXE  .TD64.2          STORE FWA OF FAIL PARAM
        .JMP   .04
***
***
***     ROUTINE WHICH STOPS MACH
***
***
SFM4    .ENTR  .
        .STB   .BSV4            SAVE B
        .LDB   .$6              * RR BUF REG
        .LDA   .$2              DATA FOR MACH STOP.
        .CALL  .$REL.3          STOP MACHINE
        .INR   .DSP4+NDMS       INCR * MACH STOPS
        .LDB   .BSV4            RESTORE B
        .JMP*  .SFM4
BSV4    .DATA  .0
***
***
***     REED RELAY OUTPUT
***     PRESERVES STOP STATUS
***
***
RRO4    .ENTR  .                DATA IN BREG
        .LDA   .$RRO+5          PRESERVE RR STATUS.
        .ANA   .$3              SAVE BITS 0 AND 1
        .MERGE .031             CREATE DATA WORD
        .LDB   .$6              RR ADDRESS
        .CALL  .$REL.3          OUTPUT
        .JMP*  .RRO4            RETURN
        .EJEC  .
***
***
***     PROGRAM DATA
***
***
LSD4    .DATA  .0               LITE STORAGE DATA
NLF4    .DATA  .1               NEW LOT FLAG
STF4    .DATA  .1               SAMPLE TEST FLAG
RCF4    .DATA  .1               RECYCLE FLAG
CHF4    .DATA  .0               CHANGER FLAG (0=CHAN 1)
FUP4    .DATA  .-1              PROBE POSITION FLAG (-) DOWN (+) UP
TD04    .DATA  .0               CUR DATA
TD14    .DATA  .0               PWR DATA
TD24    .DATA  .0               SEN DATA
TD34    .DATA  .0               ARM DATA
TD44    .DATA  .0               FUZE FAIL FLAG
TD64    .DATA  .-1
        .DUP   .NTP4-1          CONSEC FAIL FLAGS
        .DATA  .-1
TD74    .DATA  .0               ALARM COUNTER FLAG
TD84    .DATA  .0               LOT FAIL FLAG
TD94    .DATA  .0               SPO COUNT FLAG
```

```
FAD4  .DATA  .FMC4,FWP4,FWS4,FWA4,FWR4                                  02497
FPD4  .DATA  .CUR1,RFP1,SEN1,ANR1,NME1                                  02498
CFD4  .DATA  .CCF1,CRF1,CSF1,CAF1,CNF1,LFAI                             02499
SPD4  .DATA  .0SP2,0SP1,0SP0                                            02500
RTS4  .DATA  .'PROBE 4                                                  02501
RTD4  .DATA  .'C = +10.00V   P = +10.00V   S = +10.00V                  02502
      .DATA  .'  A = 1024 MS.  B = OK'                                  02503
      .EJEC  .                                                          02504
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;02505
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;02506
***                                                                     02507
***                                                                     02508
***                                                                     02509
***   BTS # 4, FINAL TEST STATION                                       02510
***                                                                     02511
***                                                                     02512
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;02513
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;02514
DSF4  .DATA  .0                 # FUZES BETWEEN FULL TESTS              02515
      .DATA  .0                 # SINCE LAST FULL TEST                  02516
DSP4  .DATA  .0                 SIZE OF SAMPLE LOT                      02517
      .DATA  .0                 REJECTS ALLOWED EACH LOT                02518
      .DATA  .-1                REAL TIME FLAG                          02519
DSS4  .DATA  .0100000           NUMBER OF FUZES TESTED                  02520
      .DATA  .0100000           NUMBER OF FUZES REJECTED                02521
      .DATA  .0100000           NUMBER OF MACHINE STOPS                 02522
DAA4  .DATA  .0                 NUMBER OF FUZES TESTED THIS LOT         02523
      .DATA  .0                 NUMBER OF FUZES REJECTED THIS LOT       02524
      .DATA  .2                 NUMBER OF CORREL DATA WRDS              02525
      .DATA  .0100000           PWR & SEN FAIL                          02526
      .DATA  .0100000           SEN & NOISE FAIL                        02527
      .EJEC  .                                                          02528
***                                                                     02529
***                                                                     02530
***                                                                     02531
***   CURRENT PARAMETER STORAGE AREA                                    02532
***                                                                     02533
***                                                                     02534
      .DATA  .-1                COUNT FOR SPO INTERVAL                  02535
FMC4  .DATA  .0                 FAILURES PER LOT                        02536
      .DATA  .0100000           TOTAL PARAMETER FAILS                   02537
      .DATA  .0                 # CONSEC PARAM FAILS                    02538
      .DATA  .0                 CPFA                                    02539
      .DATA  .0                 SWNY                                    02540
      .DATA  .0                 SOFF                                    02541
      .DATA  .0                 SROT                                    02542
      .DATA  .0                 LROR                                    02543
      .DATA  .0                 MROR                                    02544
      .DATA  .0                 CRES                                    02545
      .DATA  .0                 NLNA                                    02546
      .DATA  .0                 MAXA                                    02547
      .DATA  .0                 COFF                                    02548
```

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```
        .DATA  .0                 CROT
        .DATA  .0                 LOWER FREQ. DIST. LIMIT
        .DATA  .0                 UPPER FREQ. DIST. LIMIT
        .DATA  .0                 WIDTH OF FREQ. DIST. INTERVAL
        .DATA  .14                NUMBER OF FREQ. DIST. INTERVALS
        .DATA  .0100000           CURRENT LOT FREQ. DIST.
        .DUP   .13
        .DATA  .0100000
        .DATA  .0100000           PREVIOUS LOT FREQ. DIST.
        .DUP   .13
        .DATA  .0100000
        .DATA  .0100000           CUMULATIVE FREQ. DIST.
        .DUP   .13
        .DATA  .0100000
        .DATA  .-1                CURRENT LOT FAILURE RAW DATA
        .DUP   .19
        .DATA  .-1
        .EJEC  .
***
***
***
***     RF POWER PARAMETER STORAGE AREA
***
***
        .DATA  .-1                COUNT FOR SPD INTERVAL
FWP4    .DATA  .0                 FAILURES PER LOT
        .DATA  .0100000           TOTAL PARAMETER FAILS
        .DATA  .0                 # OF CONSEC PARAMETER FAILS
        .DATA  .0                 CPFA
        .DATA  .0                 SWNY
        .DATA  .0                 SOFF
        .DATA  .0                 SROT
        .DATA  .0                 LROR
        .DATA  .0                 HROR
        .DATA  .0                 ORES
        .DATA  .0                 MINA
        .DATA  .0                 MAXA
        .DATA  .0                 COFF
        .DATA  .0                 CROT
        .DATA  .0                 LOWER FREQ. DIST. LIMIT
        .DATA  .0                 UPPER FREQ. DIST. LIMIT
        .DATA  .0                 WIDTH OF FREQ. DIST. INTERVAL
        .DATA  .14                NUMBER OF FREQ. DIST. INTERVALS
        .DATA  .0100000           CURRENT LOT FREQ. DIST.
        .DUP   .13
        .DATA  .0100000
        .DATA  .0100000           PREVIOUS LOT FREQ. DIST.
        .DUP   .13
        .DATA  .0100000
        .DATA  .0100000           CUMULATIVE FREQ. DIST.
        .DUP   .13
        .DATA  .0100000
```

```
        .DATA  .-1                 CURRENT LOT FAILURE RAW DATA
        .DUP   .19
        .DATA  .-1
        .EJEC  .
***
***
***     SENSITIVITY PARAMETER STORAGE AREA
***
***
        .DATA  .-1                 COUNT FOR SPD INTERVAL
FWS4    .DATA  .0                  FAILURES PER LOT
        .DATA  .0100000            TOTAL PARAMETER FAILS
        .DATA  .0                  # OF CONSEC PARAMETER FAILS
        .DATA  .0                  CPFA
        .DATA  .0                  SUMY
        .DATA  .512                SUFF
        .DATA  .513                SROT
        .DATA  .0                  LROR
        .DATA  .0                  HROR
        .DATA  .0                  ORES
        .DATA  .0                  MINA
        .DATA  .0                  MAXA
        .DATA  .0                  COFF
        .DATA  .2                  CROT
        .DATA  .0                  LOWER FREQ. DIST. LIMIT
        .DATA  .0                  UPPER FREQ. DIST. LIMIT
        .DATA  .0                  WIDTH OF FREQ. DIST. INTERVAL
        .DATA  .14                 NUMBER OF FREQ. DIST. INTERVALS
        .DATA  .0100000            CURRENT LOT FREQ. DIST.
        .DUP   .13
        .DATA  .0100000
        .DATA  .0100000            PREVIOUS LOT FREQ. DIST.
        .DUP   .13
        .DATA  .0100000
        .DATA  .0100000            CUMULATIVE FREQ. DIST.
        .DUP   .13
        .DATA  .0100000
        .DATA  .-1                 CURRENT LOT FAILURE RAW DATA
        .DUP   .19
        .DATA  .-1
        .EJEC  .
***
***
***     ARMING TIME STORAGE AREA
***
***
        .DATA  .-1                 COUNT FOR SPD INTERVAL
FWA4    .DATA  .0                  FAILURES PER LOT
        .DATA  .0100000            TOTAL PARAMETER FAILS
        .DATA  .0                  # OF CONSEC PARAMETER FAILS
        .DATA  .0                  CPFA
        .DATA  .0                  SUMY
```

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```
        .DATA  .0                 SOFF
        .DATA  .1                 SROT
        .DATA  .0                 LROR
        .DATA  .0                 HROR
        .DATA  .0                 ORES
        .DATA  .0                 MINA
        .DATA  .0                 MAXA
        .DATA  .0                 COFF
        .DATA  .1                 CROT
        .DATA  .0                 LOWER FREQ. DIST. LIMIT
        .DATA  .0                 UPPER FREQ. DIST. LIMIT
        .DATA  .0                 WIDTH OF FREQ. DIST. INTERVAL
        .DATA  .14                NUMBER OF FREQ. DIST. INTERVALS
        .DATA  .0100000           CURRENT LOT FREQ. DIST.
        .DUP   .13
        .DATA  .0100000
        .DATA  .0100000           PREVIOUS LOT FREQ. DIST.
        .DUP   .13
        .DATA  .0100000
        .DATA  .0100000           CUMULATIVE FREQ. DIST.
        .DUP   .13
        .DATA  .0100000
        .DATA  .-1                CURRENT LOT FAILURE RAW DATA
        .DUP   .19
        .DATA  .-1
        .EJEC  .
***
***
***     NOISE REJECTEION PARAMETER STORAGE AREA
***
***
        .DATA  .-1                COUNT FOR SPD INTERVAL
FWN4    .DATA  .0                 FAILURES PER LOT
        .DATA  .0100000           TOTAL PARAMETER FAILS
        .DATA  .0                 # CONSEC PARAM FAILS
        .DATA  .0                 # CONSEC REJ ALLOWED
        .DATA  .0                 SPD INTERVAL
        .DATA  .0                 FAIL LOW THIS LOT
        .DATA  .0                 FAIL LOW PREVIOUS LOT
        .DATA  .0100000           FAIL LOW CUMULATIVE
        .DATA  .0                 FAIL HIGH THIS LOT
        .DATA  .0                 FAIL HIGH PREVIOUS LOT
        .DATA  .0100000           FAIL HIGH CUMULATIVE
        .EJEC  .
***
***
***     INPUT/OUTPUT ROUTINE DATA BLOCK
***
***
IB24    .DATA  .5,-1,4,*,(RTS4),37,10
        .EJEC  .
        .MORE  .
```

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.END

02705

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13. ABSTRACT

Software techniques used in an automated real-time fuze testing system are discussed. Most of the techniques are independent of the electrical circuit being tested and the computer controlling the system. Although the software described was initially designed for testing the XM596 proximity fuze, only the actual fuze testing programs need be specifically designed for a given testing system. The programs comprising SOSOFT are functionally organized into eight major subsystems--real-time priority scheduling system, interrupt servicing system, input/output control system, executive utility system, basic testing system, data-display system, conversational control system, and reliability monitoring system.

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