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USERS MANUAL

SIGMA 5 AND 7
NEW SYSTEMS EXERCISER

PROGRAM NO.705889

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1-1 INTRODUCTION

The Systems Exerciser is a level 3 test, specifically designed to help the user to detect and isolate systems failures encountered in an operating environment. It is designed to fill the gap between level 2 tests, stand alone functional tests, and level 4 and 5 tests, which are on-line testing facilities. It is most useful when an operating system encounters an excessive number of system errors which cannot be identified to a unit and the system must be taken off-line.

The goals of the systems exerciser are:

(a) Exercise the system in a manner that tries to repeat and isolate intermittent and solid errors.

(b) Exercise the system resources in a manner that can achieve a high system throughput.

(c) Concentrate on fault detection and thorough fault reporting. The system exerciser starts by testing every resource element in the system. If any element fails, the user is directed to the appropriate level 2 test. If the resource elements do not fail, a base device is selected on which an image of the system exerciser is copied.

The exerciser consists of four separate automatic passes, each pass having three phases. Passes differ from one another in the buffer sizes. Pass zero uses a block size of 2048 (X'800') bytes.

Phase zero selects a Source Device and saturates the device with as many different data patterns as possible. A Source Device, which is always assigned to a RAD, Disk Pack, or Magnetic Tape is the systems exerciser's source for data patterns which are used by the system resource.

Phase one locks the Source Device to a read only mode and writes data patterns to all bi-directional devices (excluding magnetic tape). Bi-directional devices are those devices capable of executing read and write orders. The bi-directional devices are saturated with the data patterns to enable random reads to be invoked to any part of the device.

Phase two keeps the Source Device locked to a read only mode and drives all other devices in the read or write mode. During this phase, the CPU is dedicated to verifying the integrity of data transferred in and out of memory.

Pass one uses a block size of 11 (X'B') bytes and repeats phases zero, one and two as described. Pass two uses a maximum buffer size which is computed from the available memory space and the various devices specified in the configuration and repeats the same three phases. Pass three uses random buffer sizes which are generated from a pseudo-random numbers generator and also repeats the three phases.

There exists a manual pass, in which the user can specify his own buffer size. This manual pass will also go through the three phases.

The Systems Exerciser also maintains an error file on the Base device. The contents of this file is a history of all errors occurring in the system.

The Systems Exerciser can be controlled from either a local ASR/KSR or a remote terminal and it is capable of assigning either the local ASR/KSR to control the exerciser while the remote terminal acts as an observer or their roles can be switched. The input device is always selected for input so

the user need not wait for the exerciser to come to an input mode. He is free to input changes to the exerciser at all times.

The system exerciser has a message severity level and a halt severity level which specify the conditions under which error messages are to be output to the user and the system exerciser halted. These parameter can be modified by the user to vary the severity threshold.

SECTION II

2-1 USER'S LANGUAGE

All communications between the systems exerciser and the user, local and/or remote, is performed through a user's language which is interpreted and acted on by a communications control package. This section describes the user language, its format and how to use it.

2-2 General

The language consists of many utility commands and is designed to suit the needs of the user.

The system exerciser is always in one of two modes, the halt mode or the run mode. The halt mode, denoted by the halt prompt character H> , indicates that the systems exerciser is in an idle state. The run mode, denoted by the run prompt character R>, indicates that the systems exerciser is in a running state. All user language and syntax descriptions which follow apply to both modes of the systems exerciser. Inputs are accepted by the systems exerciser in either mode.

To simplify the description of the user language, the following convention will be followed:

Output from the system exerciser will be underscored.
(CR) - refers to a carriage return character (new line character).

2-3 Abstract and Explanation

The system exerciser is designed to aid the user at the teletype by providing a program abstract and explanations of various system exerciser features. The user invokes the abstract or explanation, whenever the system exerciser presents a prompt character (R> for a run prompt character and H> for a halt prompt character to inform the user of the current state of the system exerciser).

The abstract is an explanation of the systems exerciser's language which is output to the message device, which can be a teletype or line printer. The format to get the abstract is:

H>ABSTRACT(CR) or R>ABSTRACT(CR)

The explanation is an output describing directives and destinations A directive specifies a task to be performed by the exerciser and a destination specifies either memory or a table used by the exerciser. (Detail discussion of directives and destination is deferred to Section 2-6).

The format to get the explanation is:

H>EXPLAIN, directive (CR) or H>EXPLAIN, destination (CR)

Example: To get an explanation of the SNAP directive

R>EXPLAIN,SNAP(CR)

To get an explanation of the destination, ELEMENT table

R>EXPLAIN,ELEMENT(CR)

2-4 Input Format

The input format is divided into five fields. The fields are defined as the directive field, destination field, qualifier 1 field, qualifier 2 field and qualifier 3 field. (Detail discussion of each of the fields is deferred to Section 2-6). The following illustrates the relationship between a statement and its fields.

R>DIRECTIVE, DESTINATION,QUALIFIER1,QUALIFIER2,QUALIFIER3

All input formats maintain the above relationship, the only variation is that some inputs may only require a directive while others require a directive, destination and only one or two qualifier fields.

All fields in an input must be separated by a comma(,) and the input can be terminated by a carriage return, a line feed or a prompt character. The user is permitted to skip a field (leave a field unchanged), by typing a comma. The system exerciser will respond with a series of single quotation marks(') to mark the spaces over to the next field. The input function to the system exerciser always attempts to align its fields. Therefore, if a user inputs too many characters, the input line will be repeated to display what was stored, to the user.

There are a group of special characters reserved for the following actions. These characters are given utility functions to either correct an error or to indicate various modes of inputs.

(a) > - Reset Input Buffer

The user may use this character to clear his current input and restart his entries. It must be used before the carriage return character is used to terminate the input.

Example:

R >PRINT, MEMORY, 230A >
R >

(b) < - Reset Field

The user may use this character to clear his current input to a field and correct it. The correction can be made by following the < character with the correct entry.

Example:

H >PRINT, MEMORY, 230A <
H >PRINT, MEMORY,

(c) : - Decimal Digit Follows

This character may be used to indicate that a decimal digit follows. Without this character the digit is assumed hexadecimal.

Example:

H> PRINT, MEMORY, AIFE,:13(CR)

(d) (- Set Message Mode

) - Reset Message Mode

A message may be sent between the controlling terminal and observer terminal by enclosing the message between the two parenthesis symbol.

Example:

R> DISPLAY, MEMORY, E27 (HI THERE) 2, 7(CR)

Seven words will be displayed starting at location E272 to both controlling and observer terminals. Additionally, the message HI THERE will be output to the observer terminal.

(e) + - * / - Arithmetic Operators

The user may use these characters to perform arithmetic operations on parameters. Each symbol has the following definitions:

+ - Add

- - Subtract

* - Multiply

/ - Divide

Example: To convert a doubleword address to a word address

DOUBLEWORD ADDRESS * 2

Example: To convert a byte address to a word address

BYTE ADDRESS/4

Example: To get to an address plus 10 locations

ADDRESS + : 10

Example: To get to an address which is 20 locations away from a doubleword address

DOUBLEWORD ADDRESS * 2 + : 20

(f) ? - EXPLAIN OPERATION

This character may be entered at any time. It will output an explanation of the last operation performed by the system exerciser to the controller teletype.

(g) LIST DIRECTIVES

The user may request a list of all available directives in the system exerciser by entering a carriage return immediately after the prompt character.

Example: R> (CR)

(h) LIST DESTINATIONS

The user may request a list of all applicable destinations by entering a carriage return after the comma following the directive.

Example: To get a list of all destinations.

R> SEARCH, (CR)

2-5 Input Modes

There are two modes of input, the statement mode and the data mode.

2-6 Statement Mode

When the systems exerciser presents a prompt character (R> for a run prompt character and H> for a halt prompt character to inform the user of the current state of the systems exerciser), the system is in the statement mode and is prepared to accept an input statement. An input statement can invoke one of three

conditions, (a) put the systems exerciser into a statement mode again, (b) put the systems exerciser into a data mode or (c) the systems exerciser will execute the action specified by the statement.

A statement has from one to five fields, each field separated by a comma. The fields are defined as the directive field, destination field, qualifier 1 field, qualifier 2 field and qualifier 3 field. The following illustrates the relationship between a statement and its field. The underscored characters are output from the systems exerciser.

R> DIRECTIVE, DESTINATION, QUALIFIER 1, QUALIFIER 2, QUALIFIER 3

(a) DIRECTIVE

The directives available to the user are:

(1) ABSTRACT	(8) PRINT	(15) SNAP	(21) UNSNAP
(2) BRANCH	(9) REDUMP	(16) SPREAD	(22) ERRORS
(3) COMPARE	(10) RELOAD	(17) START	
(4) DISPLAY	(11) REPLACE	(18) STORE	
(5) EXPLAIN	(12) RUN	(19) SWITCH	
(6) HALT	(13) SEARCH	(20) TIO	
(7) HIO	(14) SIO	(21) TDV	

A directive field specifies a task to be performed. The field accepts both hexadecimal digits and alpha-numeric characters as input.

Brevity can be employed when making entries to the directive by entering the minimum number of characters which uniquely defines the directive.

If a string of characters is entered to which more than one match can be found, a carriage return is issued, followed by an output of all matching directives which is terminated with the original multi-matched string. This will enable the user to append the string and complete the statement.

Example:

R>ST,0,0 (CR)

START

STORE

ST

(b) DESTINATION

The destinations available to the user are:

(1) MEMORY	(9) A:2	(17) C:5	(25) C:13	(33) P:2	
(2) ACCESS	(10) A:3	(18) C:6	(26) TIME	(34) P:3	
(3) CONTROL	(11) A:4	(19) C:7	(27) E:1	(35) REGISTER	
(4) ELEMENT	(12) BYTES	(20) C:8	(28) E:2		
(5) OPERATOR	(13) C:1	(21) C:9	(29) E:3		
(6) SYSTEM	(14) C:2	(22) C:10	(30) E:4		
(7) PROGRAM	(15) C:3	(23) C:11	(31) PARAMETER		
(8) A:1	(16) C:4	(24) C:12	(32) P:1		

The destination field specifies; memory, an array or a table used by the system exerciser. Brevity can be employed when making entries to the destination field by entering the minimum number of characters which uniquely defines the destination.

If a string of characters is entered to which no destination can be found, an error message is typed and the s tatement retyped to but excluding the incorrect field. If a string of characters is entered to which more than one match can be

found, a carriage return is issued followed by an output of all matching destinations which is terminated with the original multi-matched character string destination. This will enable the user to append to the string and complete the statement.

Example:

```
R> PRINT, C (CR)
            CONTROL
            C:X
            C:1
            C:2
            C:3
             .
             .
             .
            C:13
   PRINT,C
```

The destination is the most flexible field in the statement. It enables the user to look at the contents of entire tables which control the exerciser, thus providing the exact status of the resources, or it can be used to interrogate and modify specific entries in the various tables to control the exerciser in a way the user chooses. The user can vary this field to deselect or select resource elements, control the pattern or the area to be exercised.

(c) QUALIFIERS

The qualifier fields specify the boundary conditions to be imposed on the destination. The fields accepts decimal or hexadecimal digits, depending on the associated destination field. Any other type of input character will result in an invalid character message and retyping of the statement up to but excluding the error field. The user may invoke the EXPLAIN directive (explained in the SYNTAX section) to determine if the field requires either a decimal digit or hexadecimal digit.

The qualifier fields have the following relations and interpretations.

1. Qualifier 1 $\leq$ Qualifier 2:
   The qualifiers are treated as lower and upper limits respectively. The resulting range is validated to make certain that it is commensurate with the specified destination.

2. Qualifier 1 $>$ Qualifier 2:
   Qualifier 2 is a count starting at the lower limit specified by Qualifier 1. The resulting range is validated to make certain that it is commensurate with the specified destination.

3. Qualifier 2 Omitted:
   When qualifier 1 is entered by itself, qualifier 2 omitted, qualifier 2 is assigned a value of 1.

4. Nothing Entered:
   When both qualifiers 1 and 2 are omitted, they are assigned values 0 and 1, respectively.

5. Qualifier 3 omitted:
   When qualifier 3 is omitted, it is assigned a value of 0.

All qualifiers are checked for range validity commensurate with the specified destination. In the event of a validity error, an error message naming the faulty qualifier field is output and the statement is repeated to the faulty field to allow it to be completed.

Example:

R> TDV, 02, 04 (CR) - TDV

to devices 02,03 and 04.

R> TIO, 80, 3 (CR) - TIO

to devices 80, 81 and 82.

(d) EXAMPLES AND EXPLANATIONS

The following examples are illustrations to clarify the above explanation of the user's language and is by no means all that can be done with the statements.

1. ABSTRACT (CR)

This directive will provide an explanation of the exercisers language to be output to the message device.

2. HALT (CR)

This directive will force the system exerciser into the halt mode. The directive is acknowledged by the following characters on the control and observer terminals, H >.

3. RUN (CR)

This directive will force the system exerciser into the run mode. The directive is acknowledged by the following characters on the control and observer terminals, R>. It is invoked in order to put the exerciser from the halt mode back to the run mode.

4. SWITCH (CR)

This directive is to be used only when there is a control terminal and an observer terminal in use. This directive will switch the roles of the control to the observer and the observer to control.

5. UNSNAP (CR)

This directive is used to exit from the snap mode (explained later) and to return to a normal operation of the systems exerciser

6. BRANCH, Q1 (CR)

This directive will transfer control to the location specified by Q1.

Example:

H> BRANCH, 5AE (CR)

Branch to location X'5AE'.

7. HIO, Q1, Q2, Q3 (CR)

This directive executes an HIO to all device address specified, from Q1 to Q2, and outputs the I/O status of all the specified device addresses to the teletype (Q3=0) or to the message device (Q3≠0).

Example:

H> HIO, 80, 3 (CR)

Execute HIO to device addresses 80, 81 82.

8. SIO, Q1, Q2 (CR)

This directive executes an SIO to the device address specified in Q1 whose command doubleword address is specified in Q2 and outputs the I/O status of the specified device address to the teletype (Q3=0) or to the message device (Q3≠0).

Example:

H> SIO, 02, 111 (CR)

Execute SIO to device address 02 using the command doubleword in location 222 and output the I/O status to the teletype.

9. TIO Q1, Q2, Q3 (CR)

This directive executes a TIO to all device addresses specified, from Q1 to Q2 and outputs the I/O status of all the specified device addresses to the teletype (Q3=0) or to the message device (Q3≠0).

Example:

R> TIO, F0 (CR)

Execute TIO to device address F0.

10. TDV, Q1, Q2, Q3 (CR)

This directive executes a TDV to all device addresses specified, from Q1 to Q2, and outputs the I/O status of all the specified device addresses to the teletype (Q3=0) or to the message device (Q3≠0).

Example:

R> TDV, F0 (CR)

Execute TDV to device address F0.

11. EXPLAIN, DIRECTIVE (CR)

This directive outputs an explanation of the specified directive (explained in Section 2-3).

12. SNAP, Q1, Q2, Q3 (CR)

This directive causes the contents of Q3 to be output whenever any locations between Q1 and Q2 are accessed.

If Q3 is negative, the system exerciser will go into the halt mode instead of printing the contents of the location.

Example:

R> SNAP, 10A0, 10F0, -10B0 (CR) types the address

R> 10A0 10A0 then halts

H>

13. SPREAD, Q1, Q2, Q3 (CR)

This directive will spread the value Q3 (pattern into locations Q1 through Q2.

Example:

R> SPREAD, 400, 4FF, AAAAAAAA (CR)

14. START, Q1, Q2 (CR)

This directive starts the system exerciser at the pass and phase specified in Q1 and Q2. Detail discussion of pass and phase will be deferred to another section.

Example:

R> START, 0,0, (CR)

Start the exerciser from the beginning with the existing configuration.

15. DISPLAY, DESTINATION, Q1, Q2 (CR)

This directive outputs the contents of the specified destination from Q1 to Q2 on the teletype.

The destination can be memory or one of the tables used in the system exerciser.

The Qualifiers can be memory addresses, positions in a table or a count.

Example:

R> DISPLAY, MEMORY, 2A0,3 (CR)

Display contents of locations 2A0, 2A1, 2A2.

R> DISPLAY, C:X,0,8 (CR)

Display the first 8 values of the C:X entry of the control matrix table.

16. PRINT, DESTINATION, Q1, Q2 (CR)

This directive outputs the contents of the specified destination from Q1 to Q2 on the line printer. If the line printer is inoperative, the teletype will be the default device.

This directive is identical to DISPLAY, except that the output will appear on the line printer instead of the teletype.

Example:

H> PRINT, CONTROL,0,1F(CR)

Print the Control Table to the line printer.

17. STORE, DESTINATION, Q1, Q2 (CR)

This directive stores into the specified destination from Q1 to Q2. It will respond by an output specifying the lower limit, Q1. The user can then input the values he desires until the higher limit, Q2, is reached. Each value must be separated by a comma. A carriage return will also terminate the input.

Example:

R> STORE, MEMORY, 100,3 (CR)

100 0, 1, 2 (CR)

Store to memory locations 100,101,102 values 0, 1 and 2 .

18. REPLACE, DESTINATION Q1, Q2 (CR)

This directive displays the current contents of the specified destination from Q1 to Q2. It then allows the user to replace the contents of these locations.

The directive will respond with an output of the lower limits, Q1 to the higher limits Q2, followed by a carriage return and a second line with the current

values to modify the current values. Each value must be separated by a comma.

Example:

H> REPLACE, C:X,0,2 (CR)

Replace first two contents of C:X file from 1 and 2 to 2 and 1.

C:X 00000001, 00000002

C:X 00000002, 00000001, (CR)

19. SEARCH, DESTINATION, Q1, Q2, Q3 (CR)

This directive allows the user to search for specified entries in the destination. It will search the specified destination from Q1 to Q2 for the value specified by Q3 and output the location address and contents of every successful search.

This directive allows the user to search partial words. If the value assigned to Q3 does not constitute a complete word, it will search only for the value of Q3 and ignore the high order positions. Therefore, it will output a successful search of two or more entries with different high order bit configurations.

Q3 must be assigned leading zeroes in order to search on a complete word.

Example:

R> SEARCH, C:X, 0, A, 0 (CR)

Search the C:X table for zero entries in the least significant digit position.

005 00000000

00A 00000000

R>

20. COMPARE, DESTINATION, Q1, Q2, Q3 (CR)

This directive allows the user to search for the state of specific bit positions in the destination. It will output the address and contents of every location where the value of Q3 and the destination from Q1 to Q2 have any pair of 1-bits in corresponding bit positions.

If Q3 is not assigned a complete word, the compare will be performed on partial words. Therefore, to compare for a complete word it is necessary to assign leading zeroes to Q3.

Example:

H> COMPARE, C:3, 0, 9, 80000000 (CR)

Search the C:3 table for the entries with the most significant bit set.

007 81134678

H>

21. RELOAD, Q1 (CR)

This directive allows the user to load the program and/or data from the base device and restart the system exerciser. The value assigned to Q1, determines if the program and data, program only or data only is to be loaded and the system exerciser restarted or just to restart.

Q1 = 0, reload the program and data and restart.

Q1 = 1, reload the program only and restart.

Q1 = 2, reload the data only and restart.

Q1 = 3, restart.

Example:

H> RELOAD,0(CR) reloads program and data and restarts.

22. REDUMP, Q1 (CR)

This directive allows the user to dump the program and/or data, currently residing in memory, to the base device and restart the system exerciser. The value assigned to Q1, determines if the program and data, program only or data only is to be dumped and the system exerciser restarted or just to restart.

Q1 = 0, dump the program and data and restart.
Q1 = 1, dump the program only and restart.
Q1 = 2, dump the data only and restart.
Q1 = 3, restart.

Example:

H> REDUMP,1 (CR) dump the program only and restart.

2-7 Data Mode

There are certain directives which put the systems exerciser into a data mode. The data mode enables the user to modify program parameters and/or contents of specific memory locations. Examples of directives which put the systems exerciser into the data mode are STORE and REPLACE. In this mode, the systems exerciser waits for the user to respond with input values, which must be separated by a comma. However, the input can also be terminated with a carriage return.

Example:

H> REPLACE, C:X, 0, 2 (CR)
C:X 00000001, 00000002
C:X 00000002, 00000001,(CR) Systems Exerciser is in data mode.

SECTION III

3-1 Operating Environment

The systems exerciser is designed to execute on any hardware configuration for which standard operating systems are designed. However, it requires at least the following minimum configuration.

(a) 16K of memory

(b) Console teletype, ASR/KSR

(c) 1 RAD or Disc Pack, and XDS Model

(d) 1 Magnetic Tape Unit, 9-Track or 7-Track with packing option.

(e) 1 Card Reader

3-2 Loading Instructions

The system exerciser is loaded from the Diagnostic Magnetic Tape Library. The following procedure is to be followed:

(a) Mount magnetic tape library and load the magnetic tape library control program. (or load a card deck).

(b) When the operator keyboard, ASR/KSR, is selected for input, type in the name.

(c) A successful load will be indicated for the following message.

ENTER DATA AND TIME
MO DY YR HR MN SC

(d) The user may respond by entering decimal digits for the date and time or can input a carriage return. If the date and time is entered, each field must be separated by a comma. The input will be automatically terminated with the last comma.

Example:

ENTER DATE AND TIME
MO DY YR HR MN SC
07,04,70,12,10,10

ENTER DATE AND TIME
MO DY YR HR MN SC
(CR)

(e) A second message will follow immediately.
!!! LOAD CONFIGURATION CARDS

The user must load the configuration card deck into the card reader and put the card reader into the automatic mode and type RUN (CR). The last card of the configuration deck must be a blank card. (configuration card format is described in section 3-3). Sigma 5 user must specify CPU model number (8201) and address 0.

(f) A successful loading of the configuration cards will be indicated by the exercisers outputting of the resultant resource map (CONTROL TABLE). The exerciser will then announce the selection of the BASE device and enter a halt state to allow the operator to change the selection.

(g) Any card reader errors detected during the loading of the configuration deck will result in a self-explanatory error message, followed by a message, RELOAD CARD. This means that the user can restart from the last card and that is not necessary to reload the entire deck.

(h) However, if the user has configuration card entries for non-existent devices on the system the following message will be output.

NO DEVICE RECOGNITION, LOAD CONFIGURATION CARDS

In this case, the user must delete the configuration cards which specify non-existent resources and reload the entire configuration deck.

3-3 Configuration Card Format

The configuration card format is as follows:

XXXX,YYY

where, XXXX denotes the device controller model number and YYY denotes the device address, including IOP number. The configuration card must be one entry per card.

3-4 Operating Instructions

The system exerciser is designed to minimize constant operator intervention but to allow maximum operator control over the system. It is also designed for remote usage by eliminating any processor control panel functions. Automatic recoveries are attempted for all but the most catastrophic failure types. All operations of the system exerciser are performed through the user language via the controlling keyboard. The user can effectively use the input statements to modify existing configurations, pursue failures or to look at the exerciser status at any time. The keyboard is always selected for user input.

3-5 Restart and Recovery

The systems exerciser has automatic recovery features which are designed to recover under as many different error types as possible. However, there are some errors which are not recoverable. If a memory parity is detected in the resident monitor area, the exerciser will automatically reload and restart the program. However, if the memory parity is detected in the non-monitor area, the systems exerciser will recover and proceed.

A manual recovery feature can also be invoked through the use of the systems reset button. Hit the systems reset button and step the computer switch through a step then to run, which resets some of the exerciser's internal pointers.

3-6 Systems Test Modification

The system exerciser maintains a series of tables containing all the data which reflects the state of the systems at any given time. The user has complete freedom to investigate and modify these tables in order to control the system exerciser. The user can select and/or deselect resource elements, modify their operating mode by restricting them to read only or write only modes or he can assign upper and lower limit constraints to the resource elements. When an error is

detected, these tables can be investigated to determine what other devices were active at the time of the failure, what area of memory was being accessed and other information necessary to determine the status of the system.

The tables of interest to the user are:

(1) ELEMENT TABLE

(2) CONTROL TABLE

(3) SYSTEM TABLE

(4) OPERATOR TABLE

(a) ELEMENT TABLE

The element table contains all the pertinent information related to each resource element in the system.

The table is structured as a matrix where the user can select any row or column for display or modifications. Each row contains all the data associated with a specific device and the columns contain specific data associated with all the device.

Example:

To investigate the data associated with the 7145 line printer.

H> DISPLAY, E:1, 0, 4 (CR)

000 7201

001 7231

002 7160

003 7445

004 7251

H> DISPLAY, ELEMENT, 3 (CR) (from entry 3 of E:1)

E:X E:1 E:2 E:3 E:4

003 7445 LP 2A4 07

H>

(b) CONTROL TABLE

The control table contains all the pertinent parameters required to service and drive the devices in the system. The table is structured as a matrix where the user can select any row or column for display or modifications. Each row contains all the pertinent parameters required to service and drive a specific device and the columns contain a given parameter for all the devices.

The control table is the table to use for selecting and de-selecting devices from the configuration. It can also be used to find the buffer address and address of the command pairs.

Example:

To deselect the line printer, with device address 02, from the configuration.

```
R> DISPLAY, C:1, 0, 3 (CR)
000  0F1
001  080
002  0E0
003  002
R> STORE, C:3, 3 (CR)
003 0, (CR)
R>
```

The device can be deselected by clearing the appropriate C:3 entry, entry 3 in this case.

To select the line printer:

```
R> STORE, C:3, 3 (CR)
003 02, (CR)
R>
```

(c) SYSTEM TABLE

The system table is a table which contains all pertinent program control parameters.

This table can be used to control the memory area under test or the block size of the buffers.

Example:

To change the starting memory area to 3A000.

```
R> DISPLAY, SYSTEM (CR)
BLKSIZ  STRTCORE  ENDCORE SM P PS  PA PH BON BOF REC PASSTIME MEMSIZ
000800  002A00.0 018000.0 01 1 00  00 00 000 000 000 00000000 01800

R> STORE, SYSTEM (CR)
BLKSIZ  STRTCORE   ENDCORE SM P PS PA PH BON BOF REC PASSTIME MEMSIZ
,'''''' 003A00.0 , (CR)
```

(d) OPERATOR TABLE

The operator table is a table containing all parameters concerning communication control and auditor and logger control.

Example:

To establish an observer andselect the Line Printer as the Logging device:

```
R> REPLACE, OPERATOR(CR)
 PW  MSG CH LOG L H TTY COC CS CL CN BAS SRS
0000 002 80 000 0 0 001 005 00 00 00 1FO 2FO
DICK,,''', ''2, '' (CR)
```

Output all error messages with message severity levels greater than 3 and halt the systems exerciser whenever the error conditions exceed a halt severity level greater than 5.

```
R> REPLACE, OPERATOR (CR)
 PW   MSG CH LOG L H TTY COC CS CL CN BAS SRS
DICK  002 80 002 0 0 001 005 00 00 00 1FO 2FO
,'''',___,___,__,___,3,5,(CR)
R>
```

SECTION IV

4-1 TABLE FORMATS

This section summarizes the table formats and their uses.

4-2 Control Table

The Control Table is output by the Systems Exerciser in the following format.

C:X C:1 C:2 C:3 C:4 C:5 C:6 C:7 C:8 :9 10 11 12 13

This table is an array containing all the data required to service the handlers in driving the devices. All entries, with the exception of C:6, are in hexadecimal. C:6 is in an address format (See C:6 description).

Elements of the array are:

C:X = Control Table Index. Refers to the position in the array, the row number, which contains all the pertinent data related to a specific device.

C:1 = Device Address

C:2 = Device selection for devices. This field is 8 bits wide and only those bits set to 1 will be selected. Each bit represents a unit, bit 0 = unit 1, bit 1 = unit 2, etc. Therefore, a single unit device will always be set to 80. Moreover, for multi-unit devices, 80 = unit 1 only, 40 = unit 2 only, C0 = units 1 and 2 and FF = units 1 through 8.

C:3 = Operation Selection. This field is 16 bits wide and has the following significance. (C:3 is preset to 8034)

X'8000' Controller is selected for use.

X'4000' Controller's operations repeated.

X'20' = Read only.

X'10' = Write only.

X'30' = Toggle: Read and write alternately.

X'100' = Controller on burst timer.

X'04' = RAD is addressed sequentially.

X'02' = Force Check: buffer must be checked.

X'01' = Device must have checked buffer.

Example:

8034 = Toggle sequentially.

8034 = Random (read or write) sequentially.

C:4 = Controller status. This field has the following significance.

X'8000' = Busy: controller is busy.

X'4000' = Foreground run: device is in foreground.

X'2000' = Source: device is read only.

X'1000' = Keying: device initialization.

X'0800' = Device is swapping foreground.

X'0400' = Peripheral: card reader.

X'0200' = Controller has 4-byte interface.

X'0100' = 7-track magnetic tape without packing option.

X'0040 = Wrapped: total surface is keyed.

X'0020' = Controller is waiting for a buffer.

X'0010' = Burst devices inactive.

X'0008' = Controller has manual device.

X'0004' = Previously failed.

X'0002' = Controller restricted

X'0001' = Initial startup for controller.

C:5 = Seek Address for rotating memory devices or record number for magnetic tape

C:6 = Buffer Address (XXXXX.Y, where XXXXX = word address and Y = byte position)

C:7 = Location of Command Doubleword.

C:8 = Location of Maps.

For RAD's, it is the location where the starting and ending sector number for a RAD are located (two words per RAD). For magnetic tape, it is the location where the following information can be found.

X'8000' = SIO accepted.

X'4000' = SIO pending.

X'2000' = Rewind accepted.

X'1000' = Rewind pending

C:9 = Fault timer

C:10 =Retry count

C:11 =Severity level assigned to this device.

C:12 = Element Table Index. Index where information related to the device can be found in the Element Table.

C:13 =Dual Access Controller Element Table Index. For future expansion.

Examples:

1. H>D, CON, 3, 4

C:X	C:1	C:2	C:3	C:4	C:5	C:6	C:7	C:8	C:9	10	11	12	13
003	080	C000	8000	8008	00000030	0BE00.0	01FF2	02034	80	08	0E	0B	00
004	0D1	C000	8000	8008	00000059	09E00.0	01FFC	02044	80	08	00	0B	00

H >

2. H > STO, C:3,6

006 0,

H>

3. R> REP, C:3,4

004 8034

004 8030 ,

R>

4-3 Element Table

The Element Table is output by the Systems Exerciser in the following format.

```
E:X E:1  :2  E:3  E:4
```

This table is an array containing all the information related to each element which makes up the systems resource. Elements of the array are:

E:X = Element Table Index. Refers to the position in the array, the row number, which contains the information related to an element.

E:1 = Model number in decimal.

E:2 = Device mnemonics in EBCDIC.

E:3 = Handler address in hexadecimal.

E;4 = Relative Parameter Index Table. Refers to the index where information related to the element can be found in the Relative Parameter Table.

4-4 Operator Table

The Operator Table is output by the Systems Exerciser in the following format.

PW MSG CH LOG L H TTY COC CS CL CN BAS SRS

This table contains operator parameters concerning communications control. Elements of the table are:

PW = Password for COC log-on in EBCDIC.

MSG = Message device address in hexadecimal.

CH = Character per line, in decimal, for control device.

LOG = Error message device address in hexadecimal.

L = Error message severity level in hexadecimal. Systems Exerciser will output error messages assigned severity level higher than that assigned in this entry.

H = Halt severity level in hexadecimal. Systems exerciser will halt on errors assigned severity levels higher than that assigned in this entry.

TTY = Address of local device in hexadecimal.

COC = Address of remote device in hexadecimal.

CS = Communications gear state. This field is 4 bits wide.

X'0' = COC inactive

X'1' = Sensing

X'2' = logging-on

X'3' = logging-on

X'4' = COC observer

X'8' = COC control

CL = Active COC line number

CN = COC channel.

BAS = Base Device

SRS = Source Device

4-5 Systems Table

The Systems Table is output by the Systems Exerciser in the following format.

BLKSIZ STRTCORE ENDCORE SM P PS PA PH BON BOF REC PASSTIME MEMSIZ

This table contains program control parameters, and the elements of the table are:

BLKSIZ = Number of bytes per buffer

STRTCORE = First available buffer byte address

ENCORE = Last byte address

SM = System modes. This field is 8 bits wide and has the following significance.

X'80' = Freeze mode

X'10' = Inhibit error log on freeze or loop

X'04' = Random data pattern

X'02' = Fixed patterns

X'01' = Sequential patterns

P = Current Pattern Indicator

PS = Pass Selector. An 8-bit field with the following significance.

X'80' = Pass 0

X'40' = Pass 1

X'01' = Manual pass

etc.

PA = Pass indicator

PH = Phase indicator

BON = Burst-on time, in seconds

BOF = Burst-off time, in seconds

REC = Maximum no. of records for magnetic tape

PASSTIME = Time remaining for current pass, in seconds

MEMSIZ = Size of memory in hexadecimal.

4-6 Data Table

This table contains the current date and time. The Systems Exerciser will output the table in the following format.

MO DY YR HR MN SC

MO = Month

DY = Date

YR = Year

HR = Hour

MN = Minutes

SC = Seconds

4-7 Relative Parameter Table

The Relative Parameter Table is output by the Systems Exerciser in the following format.

E:X R:1 :2 R:3 :4 R:5 R:6

This table contains controller parameters indexed by E:4 of the Element Table (See 4-3). All entries are in hexadecimal, and the elements of the table are:

E:X = Element Table Index

R:1 = Bytes per Sector for rotating memories

R:2 = Sectors per track for rotating memories

R:3 = Tracks per device for rotating memories

R:4 = Devices per controller for multi-unit devices

R:5 = Sector increment for current buffer size

R:6 = Buffers per device for current buffer size

4-8 Other Tables

There are two tables, ACCESS TABLE and PROGRAM TABLE which are tables reserved for future use.

5-1 OPERATIONAL GLOSSARY

5-2 Core Overview

The approximate program layout in core is as follows:

```
  2A -
       Boot Loader, XPSD Table
 140 -
       Initializer
 200 -
     - Auditor and Trap Handler

 450 -
       Real Time Clock 3 and 4
 500 -
       Pass Table Receivers, Phase Control
 600 -
       I/O Interrupt & I/O Handlers for different devices
 800 -
 900 -
       Resident User, Auditor Interface and Error Reporting Routines
 A00 -
       Communications Control Package (CCP)
 B00 -
 C00 -
 D00 -
 E00 -
       Table Build-Up
 F00 -
       Message Output Routine and Constants
1000 -
1100 -
       Directive Table and Destination Table
1200 -
       Table Pointers and Messages
1300 -
1400 -
       Working Area
1B00 -
       Temporary Storage
1C00 -
1D00 -
1E00 -
       Tables
1F00 -
```

3000 -

Configurator (destroyed after running to restore)

3100 -

Operational Configurator Messages

3200 -

3300 -

3400 -

5-3 Base Device

Base device is used to store the program and the data.

Changing of Base Device:

(a) After Configuration:

Change the contents of reg. 13 (X'D') to the address of the desired device.

(b) Anywhere else in the program:

(1) Reload the exerciser with data and restart (REL,0)

(2) Branch to the address of CONFIG3

(3) Do the same as (a)

5-4 Buffer

The starting address (in byte) of the buffer of each device is shown under C:6 of the Control Table. The first two words in buffer are buffer header.

Word 1:

Byte 1: Checksum

Byte 2: CT:X (index number in Control Table)

Byte 3: Unit number

Byte 4: Buffer status

X'20' = Buffer is being used
X'10' = Buffer has been checked
8 = Buffer needs refreshing
4 = Full buffer not used
1 = 7-Track tape unit (unpacked)

Word 2: Position information (e.g. track and sector of a RAD)

5-5 Configuration

The configuration process can be done through a console teletype instead of a card reader as shown in the following example:

```
R>
!!!LOAD CONFIGURATION CARDS (after 10 seconds if no card is found,
                             the following message will be output)
!!!003 CR IN REG.13 FAILED. STATUS IN REG.5
H>REP,R,D
00D 00000003
00D 1,
H>RU
R>
7445,2,
7120,3,
7160,4,
7160,D,
7120,E,
7445,F,
7611,10,
7320,80,
7320,DO,
7211,1FO,
7231,2FO,
0,''' ,
```

where the contents of register 13 (X D') is changed from 3 (card reader) to 1 (KSR/ASR) and the model numbers and addresses are entered in Data mode.

Whenever the user wishes to change the configuration, he doesn't have to reload the program. The following steps will branch the exerciser back to the configuration process:

(1) REL,0

(2) BRA,3000

5-6 Destinations

For a list of Destinations, type a (CR) after entering a directive and a comma.

5-7 Device Elimination

To eliminate any device from the exerciser:

(1) Issue HIO to the desired device or manually halt the device.

(2) Clear the contents of C:3 and C:4 of the device. In order to change the contents of any column other than C:2 and C:3, SSW3 must be set.

5-8 Directives

Use the EXPLAIN directive for explanation of any directive or destination.

For a list of directives type a Carriage Return (CR) immediately after a prompt character (>).

5-9 Maps

Maps provides the location for finding the starting and ending core, or the number of records on Mag Tape, or the starting and ending sector numbers of RAD used by the Systems Exerciser. This address is found in C:8 of the CONTROL Table. It is a pointer to a table of doublewords which are indexed by Unit Number. e.g. the Maps for Unit 3 would be in location (C:8) +6.

Altering the Map:

When the user wishes to narrow down the core memory to a smaller area (e.g. for checking parity error), or change the number of records used in Mag Tape, or use part of the surface area of a RAD (e.g. to avoid the bad area), he'll have to alter the corresponding Map.

(a) Core Memory:

Alter the contents of STRTCORE and ENDCORE in System Table.

(b) Magnetic Tape:

Alter the contents of MTLIMIT in the program. MTLIMIT has a default value of X'100'.

(c) RAD:

The starting and ending sector numbers of a RAD can be found from C:8 of the Control Table. The number of sector per track for different kinds of RAD can be found from Element Table and Parameter Table. This number is used to modify the current starting and ending sector numbers.

(C:8)+2* Unit number = Starting Sector Number

Starting Sector Number + 1 = Ending Sector Number

D,C:12,Q1 to get the element table index. Q1 is the CT:X of the RAD.

D,E:4,Q1 to get the parameter table index. Q1 is the previous output.

D,PAR,Q1 to get the number of sectors per track look in R:2. Q1 is the previous output.

The output, (R:2), contains this number of sectors per track of the device.

Starting sector number/ (R:2) = Starting track and sector

Ending sector number/ (R:2) = Ending track and sector

To alter the Map of a RAD, just opposite the procedure:

Desired starting track *(R:2) + desired starting sector = New starting sector number

Desired ending track *(R:2) + desired starting sector = New ending sector number

Store the starting and Ending sector numbers into the appropriate locations.

5-10 Definitions of Headings Used in Error Messages

IDENT = SIDCC

S = Severity level of failure

ID = Trap of Interrupt location

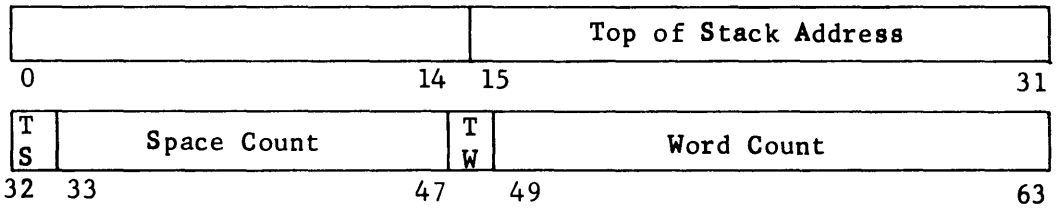
CC = Internal Code

TIME = Hour (2 digits), Minute (3 digits) and Second (3 digits).

PSW1 PSW2 = Program Status Doubleword

INSR = Instruction that failed

STACK 1 STACK 2 = Contents of stacks on a stack limit failure



where TS = Space Count overflow/underflow action

TW = Word Count overflow/underflow action

COUNT = Number of Parity Error encountered

LOC = Location of the first Parity Error

CONTENTS = Contents of LOC

CTX = Control Table Index

DEV = Device Address

SEEK = SEEK Address

SENSE = Position after transfer

POSITION = Expected position

BUFAD ERRAD = Buffer and Error Address (in byte) of a Data Error

ISSBMIM2

IS = Observed error byte

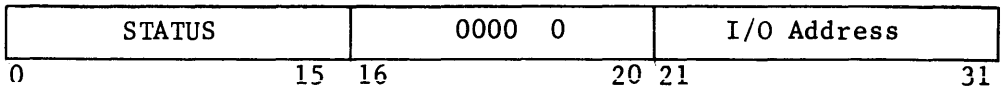
SB = Expected (should be) byte

Mi = Data pattern modifier

CØ = Data pattern constant

Bi+1 = Bi + Mi, Mi+1 = Mi + CØ where Bi = ith byte, Mi = ith Modifier, CØ = Constant

AIOR = AIO status reponse in register R. See 5-12 (a) for AIO status.



TIOR TIORU1 TIO status response in register R and RU1. See 5-12 (c)

Multiple lines following any error message output contain the following current status for active devices:

CTX DEV = Control Table index (3 digits) and Device Address (4 digits)

TIOR TIORU1 = TIOR and TIORU1

COM 1 = Order (2 digits) and Buffer Byte Address (6 digits)

SEEK = Position information (e.g. track and sector of a RAD)

SENSE = Position after transfer

5-11 Error Types and Format

(1) --UNIDENTIFIED TRAP

IDENT	TIME	PSW1	PSW2	INST
14A80	00030009	200001D1	07000000	068007C6

(2) -- SOFT-WARE TIME OUT

IDENT	TIME	AIOR	TIOR	TIORU1
45B00	00021026	00000081	20000FED	00000000

(3) --UNEXPECTED I/O INTERRUPT

IDENT	TIME	AIOR	TIOR	TIORU1
25C10	00001010	009000F1	20000EEEE	10800000

(4) --SIO FAILURE

IDENT	TIME	AIOR	TIOR	TIORU1
45C20	00002000	00000081	20000470	70000000

(5) --RECOVERABLE I/O ERROR

IDENT	TIME	AIOR	TIOR	TIO9
35C40	00000054	00D80080	20000FED	18C20000

CTX DEV	TIOR	TIORU1	COM1	SEEK	SENSE
0020080	20000FED	18C20000	02011000	00000078	00000000

(6) --NON-EXISTENT MEMORY ACCESS

IDENT	TIME	PSW1	PSW2	INST
F4040	00051003	20000AD6	00000000	F5E61BE1

H>D,M,1BE1

01BE1 00000997

H>D,R,3

003 0001D9A4

H>

1D9A4/4+997 = 8000 which runs over the memory of 32K.

(7) --NON-EXISTENT INSTRUCTION ACCESS

IDENT	TIME	PSW1	PSW2	INST
F4080	00000020	10003146	07000000	00000000

(8) --WATCHDOG TIMER RUN OUT

IDENT	TIME	PSW1	PSW2	INST
E4600	00000011	00000204	07000000	0B001014

(9) --I/O-MEMORY PARITY

IDENT	TIME	PSW1	PSW2	COUNT	LOC	CONTENTS	CTX DEV
85C00	00001045	20000AD7	00000000	00000	08000	00000000	00800F0

CTX DEV	TIOR	TIORU1	COM1	SEEK	SENSE
00100F0	20000FEB	182207CB	0101F800	01000000	00000000

(10) --POSITION ERROR

IDENT	TIME	CTX DEV	SEEK	SENSE	POSITION
ABC00	00007037	000300F1	01000000	01060600	3700201E

(12) --SYSTEM REGISTER STACK FAULT

IDENT	TIME	PSW1	PSW2	INST	STACK1	STACK2
E42F0	00003004	00000204	07000000	OB001C14	00001DFF	00000040

(13) --CPU-MEMORY PARITY

IDENT	TIME	PSW1	PSW2	COUNT	LOC	CONTENTS
85600	00001026	20000AD7	00000000	00003	1F002	1E000000
CTX DEV	TIOR	TIORU1	COM1	SEEK	SENSE	
00102F0	60000FEB	76000290	0107F800	01540000	00000000	

(14) --POWER FAILURE

IDENT	TIME	PSW1	PSW2		
E5100	0045015	80000A02	00000000		
CTX DEV	TIOR	TIORU1	COM1	SEEK	SENSE
00100F0	60000FF4	76000378	02008800	09400000	00000000
0020080	60000FF6	760002D8	0200A000	000000FD	00000000

5-12 References

(a) AIO status bits

Device Status Byte								Operational Status Byte								Significance for AIO
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	data overrun
-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Unique to the device and the device controller See 5-12 (b)
-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	
-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	
-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	
-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	Incorrect Length
-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	Transmission data error
-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	Zero byte count interrupt
-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	Channel end interrupt
-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	Unusual End Interrupt
-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	Unassigned
-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	

(b) SIGMA I/O TDV/AIO RESPONSES

Bit	TDV	AIO
	DISK STORAGE MOD. NO. 7242-43-44-46-47	
0	Data Overrun	Data Overrun
1	Flaw Mark	Unassigned (set to zero)
2	Sector Unavailable	
3	Unassigned (set to zero)	
4	Header Verification Error	Device Interrupt
5	On Cylinder	On Cylinder
6	Seek Timeout Error	Seek Timeout Error
7	Header Parity Error	Unassigned
	PAD STORAGE MOD. NO. 7201-02-03-04-31-32-11-12	
0	Data Overrun	Data Overrun
1	Unassigned (set to zero)	Unassigned (set to zero)
2	Sector Unavailable	Sector Unavailable
3	Write Protect Violation	Write Protect Violation
4	Unassigned (set to zero)	Unassigned (set to zero)
5		
6		
7		
	MAG TAPE MOD. NO. 7320-21-22-23-61-62-65-71-72-74	
0	Data Overrun	Data Overrun
1	Write Permitted	Device End
2	Write Protect Violation Error	Write Protect Violation Error
3	End of File	End of File
4	Unassigned *set to zero) (A)	(A)
5	Load Point	Unassigned (set to zero)
6	End of Tape	
7	Rewind On-Line	

(A) For 7361-62-65-71-72-74 only; for remaining models, Bit 4 is "Noncorrectable Read Error" for both TDV and AIO.

Bit	TDV	AIO
	LINE PRINTER MOD. NO. 7440-45-50	
0	Unassigned (set to zero)	Unassigned (set to zero)
1	Print Fault (B)	Data Transmission Complete
2	Paper Low	Unassigned (set to zero)
3	Top of Page	
4	Paper Moving	
5	Paper Runaway	
6	Unassigned (C)	
7	(set to zero) (D)	
	KEYBOARD/PRINTER MOD. NO. 7012-14-20-21-8091-92	
0	Unassigned (set to zero)	Unassigned (set to zero)
1		
2		
3	Reader, Manual Mode (SR)	
4	Off-Line (ASR)	
5	Unassigned (set to zero)	
6		
7		
	PAPER TAPE SYSTEM MOD. NO. 7060	
0	Rate Error	(No Status for AIO) (set tozero)
1	Punch, Tape Low	
2	Punch, Manual Mode	
3	Reader, Manual Mode	
4	Unassigned (set to zero)	
5		
6		
7		

(B) For 7440 and 7445 only; "Type Line In Odd Sector" on 7450. At present time not used or connected.

(C) "Print Order Expected" on 7450.

(D) "Maintenance Panel Used" on 7450.

BIT	TDV	AIO
	CARD READER MOD. NO. 7120-21-22-40	
0	Data Overrun	Data Overrun
1	Unassigned (set to zero)	Unassigned (set to zero)
2		
3		
4		
5		
6		
7		
	CARD PUNCH MOD. NO. 7160-65	
0	Rate Error	Rate Error
1	Unassigned (set to zero)	(E)
2	Read Check	(F)
3	Parity Error	
4	Row 15 (RC15)	Unassigned (set to zero)
5	Test Switch On	
6	Unassigned (set to zero)	
7		(G)
	CRAM MOD. NO. 7225-26-27	
0	Data Overrun	Data Overrun
1	Flaw Byte	Card In Min. Access Position
2	Illegal Seek Addr. (or Cyl. Overflow)	Unassigned (set to zero)
3	Write Protect	
4	Hdr. Non-Comparison	
5	Blank Card	
6	Seek Timeout (Hanger)	Seek Timeout (Hanger)
7	Hdr. Parity Error	Unassigned

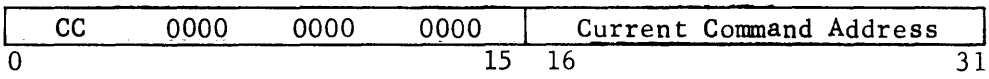
(E) "Data Transmission Complete" for 7165.

(F) "Punch Error" or "Read Check" for 7165.

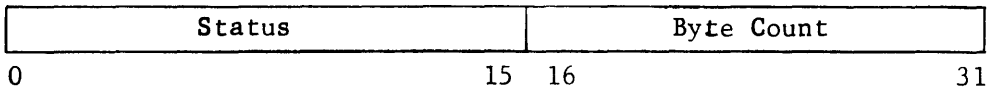
(G) "Interrupt Call" for 7165.

(c) TIO Status Response

Word into register R



Word into register Rul



CC = Condition Codes

Condition Code Settings:

1	2	3	4	Result of TIO
0	0	-	-	I/O address recognized and acceptable SIO is currently possible.
0	1	-	-	I/O address recognized but acceptable SIO is not current possible.
1	0	-	-	Busy SIOP or controller busy with another device
1	1	-	-	I/O address not recognized

Status:

Position and State in Register Rul

Device Status Byte								Operational Status Byte								Significance for
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	SIO, HIO, and TIO
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Interrupt pending
-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	device ready
-	0	1	-	-	-	-	-	-	-	-	-	-	-	-	-	device not operational
-	1	0	-	-	-	-	-	-	-	-	-	-	-	-	-	device unavailable
-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	device busy
-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	device manual
-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	device automatic
-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	device unusual end
-	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	device controller ready
-	-	-	-	-	0	1	-	-	-	-	-	-	-	-	-	device cont. not opera.
-	-	-	-	-	1	0	-	-	-	-	-	-	-	-	-	device controller unavil
-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	device controller busy
-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	unassigned
-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	incorrect length
-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	transmission data error
-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	transmission memory error
-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	memory address error
-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	IOP memory error
-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	IOP control error
-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	IOP halt
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	Selector IOP busy

5-13 Mode

(a) Statement Mode and Data Mode:

When the systems exerciser presents a prompt character (>), it is in the statement mode; if it prints out header and starts a new line and waits for input data, it is in Data Mode.

The last datum entered under Statement Mode need not be delimited with a comma. However, the last datum entered under Data Mode does require a comma if the datum is to be inserted.

(b) Message Mode:

The message goes back and forth between the controller and the observer without the knowledge of the Exerciser itself. The controller needs "(" and ")" to begin and end the message mode while the observer is in Message mode all the time.

(c) Halt Mode:

The exerciser is not running.

(d) Run Mode:

The exerciser is running.

5-14 Remote Terminal

There is only one remote terminal allowed in systems exerciser. Once the remote terminal is hooked up, either the terminal or the console teletype can be in control by simply typing SW(CR) to switch the control from the controller to the observer.

To start a remote terminal, do the following:

(a) Store PW and COC of the Operator Table with a 4-character password (at least one character must be a non-zero character) and the device address of the comm. gear. (if it is not specified during configuration).

(b) The remote observer dial the right telephone number, etc., to become on-line.

(c) LOG IN: will be typed out by the remote teletype and wait for the observer to type the Password within 10 seconds. (The Password will not show on the listing).

Once connected, the observer is always in the Message Mode thus need not use "(" to start sending message to the controller. This is not true for the controller. He has to use "(" to set the Message Mode. The controller should always enter ")>" to clear the buffer when he finishes his message.

When the remote terminal becomes the controller, type

RED,1(CR)

to save his status as the controller.

If the contents of TTY in Operator Table is set ot 0, the observer (local teletype) will be shut off. Whenever the controller is dead (e.g., lost carrier on remote or lost power on local TTY), the observer will automatically take over. If there is no observer, the system will hang.

5-15 Restart and Recovery

Different levels of error recovery features of the system exerciser are listed as follows:

(a) Halt:

Operator halts the program, or an error is encountered which has the same or higher severity level than the contents of H in Operator Table. The severity level of a failure is the first hex number under IDENT in error message printout. Type RUN to continue the exerciser.

(b) Restart the systems exerciser

Type RELOAD,Q1(CR) to reload the program and/or data from the base device and restart the systems exerciser.

Q1 = Ø reload the program and data and restart

Q1 = 1 reload program and restart

Q1 = 2 reload data and restart

Q1 = 3 restart (same as hit System Reset Button)

(c) If the exerciser somehow died and is not able to accept any instruction:

(1) set COMPUTE switch to IDLE

(2) hit SYS RESET/CLEAR button

(3) set COMPUTE switch to RUN

(d) If (c) does not work: boot the exerciser from the base device.

(1) set base device address on PCP.

(2) execute a LOAD from the PCP and restart the exerciser from scratch.

(3) When the "SYSTEM RESTARTED" message appears, execute a REL,Ø to reload the data.

5-16 Severity Level

The first character under IDENT in error message printout stands for the Severity Level of that failure. Different levels of failure are listed below:

0 Recoverable I/O errors on magnetic tape

2 Unexpected I/O Interrupt

3 Recoverable I/O Error - excluding magnetic tape

4 Software Time-Out

SIO Failure

Stack Limit Fault

8 I/O Memory Parity

I/O Memory Parity Uncorrectable

Uncorrectable I/O Error

Data Error

CPU Error

CPU Memory Parity

CPU Memory Parity Uncorrectable

A	Position Error
E	Watchdog Timer Run-Out
	System Return Stack Fault
	System Register Stack Fault
	Power Failure
F	Memory Protect Violation
	Priviledged Instruction Violation
	Non-Existant Memory Access
	Non-Existant Instruction Access
	Unimplemented Instruction Access

Note: The default value of Halt Severity Level in Operator Table (under H) is 4.

5-17 SNAP,Q1,Q2,Q3(CR)

(a) Q3 positive:

The contents of Q3 will be output whenever it is accessed during the execution of instructions in locations between Q1 and Q2.

Example:

H>SN,7C1,,5

H>RU

R>800007C1 5 20101

R>800007C1 5 20101

R>

H>RU

where in 800007C1, 8 is the condition code, 7C1 is the location where location (or register) 5 is accessed. The contents of 5 is 20101.

(b) Q3 Negative

The exerciser will be halt and the condition code and Q1 will be output.

Example:

H>SN,850,,-1

H>RU

R>E0000850

H>

It is not allowed to snap any location within CCP.

5-18 **Syntax**

>	reset input buffer
,	field delimiter
(	set message mode
)	reset message mode
<	reset field
:	decimal digits follow
+-*/	arithmetic operators (the order of operation depends on the appearance of the operator)
?	causes an explanation of the most recent operation to be outputted on the control device.
.	byte position follows
=	type arithmetic results (**must be in statement mode**)

MAGNETIC TAPE OPERATIONS

There are several options available in driving the tapes. The following shows the settings for C:3 and explains what the options do on 9-track and 7-track tape drives.

The letter "N" stands for the unit number. The letter "M" is the number of records on a tape.

C:3 = 8034 Toggle Orders - Positions Sequential

9T Writes M records and reads backwards M records on unit N. Repeats same operation for each unit until "N" is again encountered. Then reads forward M records on unit N and rewinds. Repeats same operation for each successive unit and overlaps unit N+1's read with unit N's rewind. The entire sequence is continuously repeated.

7T Writes M records on unit N and rewinds. Repeat same operation on each unit while overlaping unit N+1's write with unit N's rewind until unit N is again encountered. Then repeats same operation with a read forward. The entire sequence is continuously repeated.

C:3 = 8030 Toggle Orders - Positions Parallel

9T Write one record on each successive unit until M records have been written on each. Then read backward on each successive unit until M records read. Then read forward on each unit until M records read. Then rewind each unit. The entire sequence is continuously repeated.

7T Write one record on each unit until M records written then rewind each. Read one record on each unit until M records read then rewind each. The entire sequence is continuously repeated.

C:3 = 8024 Read Only - Position Sequential

9T Write M records and reads backwards M records on unit N. Repeats same operation for each unit until N is again encountered. Then reads forward M records and reads backwards M records on each unit. This read forward - read backward sequence is continuously repeated.

7T Writes M records and rewinds. Performs same operation on each unit overlapping the rewind with the write. Then read M records and rewinds. Performs same operation on each unit overlapping the read with the rewind. The read sequence is continuously repeated.

C:3 = 8020 Read Only - Position Parallel

9T Writes one record on each successive unit until M records have been written on each. Read backwards one record on each successive unit until M records is read on each and read forward one record on each successive unit until M records are read on each. The read back - read forward sequence is continuously repeated.

7T Writes one record on each successive unit until M records have been written on each. Then rewinds each unit and starts reading one record on each successive unit until M records have been read on each and rewinds each. The read - rewind sequence is continuously repeated.

C:3 = 8014 Write Only - Position Sequential

9T & 7T Writes M records and rewinds unit N. Repeats same operation on each successive unit overlapping the writes and rewinds. The write - rewind sequence is continuously repeated.

C:3 = 8010 Write Only - Position Parallel

9T & 7T Writes one record on each successive unit until M records are written then rewinds each. The sequence is continuously repeated.

C:3 = 8004 Special Order - Position Sequential

9T Writes 1 record, read backwards 1 record and reads forward 1 record.
Writes 2 " " " 3 " " " " 3 "
Writes 3 " " " 6 " " " " 6 "
Writes 4 " " " 10 " " " " 10 "

Continue until M records are read forward. Then rewinds and performs the same operation on each successive unit overlapping rewind on unit N with operation on unit N+1. The entire sequence is continuously repeated.

7T Writes 1 record. Rewinds. Reads 1 record.
Writes 2 " " " 3 "
Writes 3 " " " 6 "
Writes 4 " " " 10 "

Continues until M records are read. Then rewinds and performs the same operation on next unit overlapping unit N's rewind with unit N+1's operation. The entire sequence is continuously repeated.

C:3 = 8000 Special Order - Position Parallel.

9T Writes 1 record on each unit. Reads backward 1 on each unit. Reads forward 1 on each unit. Writes 2 records on each unit. Reads backward 3 on each unit. Read forward 3 on each unit Writes 3 records on each unit. Reads backward 6 on each unit. Read forward 6 on each unit. Writes 4 records on each unit. Reads backward 10 on each unit. Reads forward 10 on each unit.

Continues until M records read forward on each unit then rewinds and performs the same operation on each successive unit. Always overlapping the rewind of unit N with the operation of unit N+1. The entire sequence is continuously repeated.

7T Writes 1 record and rewinds each unit. Then reads 1 record on each.
Writes 2 " " " " " " " 3 " " "
Writes 3 " " " " " " " 6 " " "
Writes 4 " " " " " " " 10 " " "

Continues until M records read on each unit. Then rewinds. The entire sequence is continuously repeated.

It is possible in any of these tests for the units on a controller to get out of phase with each other resulting in some units reading backwards while others reading forwards, writing or rewinding. This is normal and will not adversely affect operation of the test.

5-20 TABLE OF MODEL NUMBERS FOR THE SIGMA SERIES

7211.....HR High Speed RAD Controller
7231.....ER Extended RAD Controller
7235.....4 - Byte Interface for 7231
7201.....SR Medium Speed RAD Controller
7205.....4 - Byte Interface for 7201

7240.....DPC Disc Pack Controller
7241.....4 - Byte Interface for 7240
7242.....Dual Access for 7240

7225.....CRAM Controller
7226.....CRAM Mech. & Device

7320.....9T Nine Track Tape Controller
7361.....7T Seven Track Tape Controller
7371.....7T Seven Track Tape Controller

7374.....PACKING OPTION

7441.....PR 1500 LPM Printer
7446.....PR 1250 LPM Printer
7445.....PR 1000 LPM Printer
7440.....PR 600 LPM Printer
7450.....PR 225 LPM Printer

7140.....CR 1500 Card Per Minute Reader
7122.....CR Uptime 400 CPM Reader
7120.....CR Univac 400 CPM Reader
7121.....CR 200 CPM Reader

7160.....CP 300 CPM Punch
7165.....CP 100 CPM Punch

7060.....PT Paper Tape Handler

7020.....TY ASR Type 35 TTY
7555.....TY Type 130 Keyboard Display
7012.....TY ASR Type 35 Keyboard
7010.....TY KSR Type 35 TTY
7580.....GD Graphic Display
7550.....GD Graphic Display

7670.....RB Remote Batch Terminal

7530.....GP Graph Plotter

7611.....CC COC Controller

8495.....Optional Console
8492.....CFE with Multiply-Add
8491.....CFE

5-20 Continued

8472.....8 I/O Channels
8476.....Eight Sub-Channels for MIOP
8475.....4 - Byte Interface for the IOP
8474.....Bus Sharing for other IOP's
8485.....Selector IOP
8477.....Bus Sharing MIOP
8473.....New MIOP
8471.....Obsolete MIOP
8457.....Six Way Memory Access
8456.....Three Way Access
8452.....4K Additional Memory Module
8451.....Basic 4K Memory Module
8422.....16 Priority Interrupt Channels
8421.....Interrupt Control Package
8419.....Decimal Option
8418.....Floating Point Option
8416.....Additional Register Block
8415.....Memory Map Option
8413.....Power Fail Safe Feature
8411.....Extra Clocks 1 and 2
8601.....Sigma 9 Computer
8401.....Sigma 7 Computer
8201.....Sigma 5 Computer

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