

DWG NO

REVISIONS

SYM	DESCRIPTION	APPROVED	DATE
A	Production Release EN 80109	<i>[Signature]</i>	8/10/71
B	REVISED & REDRAWN PER EN * 80851	<i>[Signature]</i>	4-27-72

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NOTE: THIS DOCUMENT CONTAINS 72 SHEETS OF 72 PLUS 72A

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CHK <i>[Signature]</i>	8-4-71
DSGN <i>[Signature]</i>	7/22/71
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APPD	



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TITLE

SOFTWARE PERFORMANCE SPECIFICATION
MOVING HEAD DISC TEST
(620-36; 37)

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SECTION 1: SYSTEM OVERVIEW

1.1 INTRODUCTION

The 620-37 Moving Head Disc Test Program (hereafter referred to as the test program) tests the disc controller and its associated disc storage units and reports any errors. The test program may be used on both the 620-37 and 620-36 disc memory systems. The test program consists of a series of subtests which provide a means of comprehensively testing the disc system, and provide an aid in isolating known faults. The test program also includes an initialization routine which allows the user to enter certain hardware dependent parameters prior to testing. The user can select the subtests he wishes to perform by entering the appropriate commands through the console teletype or through manual console operations if a console teletype is not available. The test program is designed to operate with the 620 Maintain II Test Executive Program (see document 98A9908 960 for information regarding the Test Executive). The test program overlays part of the Test Executive.

1.2 HARDWARE SUMMARY

The minimum hardware configuration for running the program is a 620 series computer with 4K or more of memory, a Buffer Interlace Controller (BIC), a Disc Control Unit (DCU), and one or more disc storage units.

An initialization dialogue prior to testing enables the program to modify itself to conform to most system configurations. The DCU device and the BIC device address may be specified. The occurrence of seek complete and data transfer complete events may be determined in either a sense or interrupt mode. If the occurrence of these events is to be determined in the interrupt mode, the interrupt mask, trap location and device address for the priority interrupt module associated with the interrupts may be specified. The test assumes that all interrupt lines associated with the disc are on one priority interrupt module. If on the system being tested the disc interrupts are on more than one priority interrupt module, the test program should be run in the sense mode. The disc control unit may control up to four disc storage units. The test program provides for the concurrent testing of up to four units in the multiple unit test.

Refer to the 620-36 Product Performance Specification (98A0842) or to the 620-37 Product Performance Specification (98A0726) for a description of the pertinent Disc Control Unit and the applicable 620 instruction set.



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1.3 SOFTWARE DESIGN SUMMARY

The test program consists primarily of an initialization routine and nine test routines. The initialization routine allows the user to enter run-time parameters describing the system to be tested. After it is used the space it occupies is allocated to data buffers, therefore, it may not be reused without reloading the program.

The nine test routines are the Write test, Read test, Echo test, Seek test, Unique Address test, Compatibility test, Data Transfer test, Multiple Unit test, and the Sense/Status test. Each of these tests is briefly described in the following paragraphs. The tests are described in greater detail in sections 2.4.1 through 2.4.9.

1.3.1 Write Test

The Write test allows the user to write a block of data of specified length, at a specified sector, on the specified disc storage unit. The user may also specify which status bits are to be checked, and whether a fixed or random data pattern is to be used.

1.3.2 Read Test

The Read test allows the user to read and verify a block of data of specified length, at a specified sector, on the specified disc storage unit. The user may also specify which status bits are to be checked.

1.3.3 Echo Test

The Echo test allows the user to write, read and verify a block of data. The test is essentially a combination of the Write and Read tests.

1.3.4 Seek Test

The Seek Test allows the user to perform a seek to track 0, then to the designated track on the specified disc storage unit. The user may also specify the status bits to be checked.

1.3.5 Unique Address Test

The Unique Address test writes the track and sector address of each sector in the first two words of the sector until each sector on the disc storage device has been written. It then reads each sector and verifies the address. The test verifies the uniqueness of address for each sector on the disc storage unit.

1.3.6 Compatibility Test

The Compatibility test allows the user to check the interchangeability of packs among the disc storage units. The test is essentially the read portion of the Unique Address test.



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1.3.7 Data Transfer Test

The Data Transfer test seeks to a random track on the specified disc storage unit and writes a block of random data, of random length, at a random sector address. It then reads and verifies the block, reporting any errors. The test makes 512 seek/write/read passes each time it is selected. If the Unique Address test has been run immediately prior to this test, the track address will be verified during the Data Transfer test. (When moving from one unit to another in testing, always execute a Write test on the new unit prior to running the Data Transfer test).

1.3.8 Multiple Unit Test *

The Multiple Unit test verifies that concurrent disc operations can be performed. While the program is transferring data on one disc storage unit, the other units will be seeking or will be idle, having completed a previous seek. The test makes 512 write/read/verify passes each time it is selected.

1.3.9 Sense/Status Test

The Sense/Status test performs a series of disc operations on the specified disc, producing those error conditions that can be programmably generated, and verifying that the error conditions are correctly reported. It also verifies that the sense conditions and the equivalent status bits agree.

1.4 USER FACILITIES

The Program provides the following features:

- Provides cross-sector and partial sector write/read verification.
- Assures unique addressability of tracks and sectors.
- Allows execution of concurrent disc storage unit operations.
- Assures data transfer accuracy.
- Allow interchangeability of packs to be checked.
- Provides initialization dialogue so test program can conform to most system configurations.

*The Multiple Unit Test may be used to test concurrent operation of 2 disc drive units on the 620-36 system but not 2 discs on the same drive unit.



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SECTION 2: EXTERNAL SPECIFICATION

2.1 GENERAL

The external specification describes the operating procedures needed to use the various features of the test program and contains the information needed to interpret their results. The 620 Maintain II Test Executive Program must be loaded before the test program can be executed. The test program is normally loaded and its various features executed by commands issued through the console teletype keyboard and errors reported through the console teletype printer. The Test Executive is the software interface for accomplishing this. If a teletype is not available, certain features of the program can be used by manual console operation (console mode).

2.2 LOADING PROCEDURE

Load the 620 Maintain II Test Executive Program, followed by the Moving Head Disc Test Program using the procedure described in chapter 2 of the 620 Test Program Manual Volume 1. Alternate loading procedure which may be used in the absence of a console teletype are described.

2.3 INITIALIZATION

The following paragraphs describe the initialization routine for systems having a console teletype. Section 2.4.12 describes how the user interfaces with the initialization routine on systems which must use the console mode (in the absence of a teletype).

When the test program is loaded and execution begins, it identifies itself and enters an initialization dialogue with the user. This allows the user to specify certain hardware-dependant parameters.

The following example shows the teletype input/output messages generated during a typical initialization dialogue along with some pertinent comments. Those messages which are underscored are typed by the user.



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THIS IS THE 620 TEST EXECUTIVE
MEMORY SIZE IS 16K

L.

620-37 MOVING HEAD DISC TEST

DISC CONTROLLER 16.

BIC 20.

INTERRUPTS? (Y/N) Y N

PIM DEVICE ADDRESS 41. 40

TRANSFER COMPLETE TRAP LOCATION 130. 100

BIC COMPLETE USED? (Y/N) N

SEEK COMPLETE TRAP LOCATIONS 134.136. 110.112.114.116

PIM INTERRUPT MASK 057. 016.

* A0 Fix w/R 2 min

A1 Rem wR 2 min

D0

D1

~~CI~~ Rem Part of A0
CI



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The test program was loaded under control of the Maintain II Test Executive, identified itself and requested the disc controller and BIC device addresses. After these had been entered the routine inquired if the program was to be run in the interrupt or sense mode. The user responded with a Y indicating the interrupt mode was to be used. (If the sense mode was to have been used, the user would have responded with an N and the initialization would then be complete). The user then entered the device address of the priority interrupt module associated with the disc interrupts. The user then entered the address of the trap location associated with the transfer complete interrupt. (This interrupt may be generated by the BIC complete signal or the controller ready signal). The user then responded with an N to the 'BIC COMPLETE USED?' inquiry to indicate that controller ready rather than the BIC complete signal was used. The user then entered the addresses of the trap location associated with the seek complete interrupts for disc units 0 and 1. The user then entered the interrupt mask to complete the initialization dialogue. The initialization dialogue may be restarted by toggling sense switch 3 at any point where input is requested.

2.4 OPERATING PROCEDURE

Before running any test on a unit, the unit must have a pack mounted, the front door closed and the START/STOP toggle switch must be in the START position. (When the unit is in the ready condition, the left light will be lit.)

The test monitor enables the user to input a command string which selects a particular test for execution and provides a parameter list to be associated with the test. The test monitor prints an asterisk to notify the user it is awaiting input. The first character of the command string identifies the test to be executed. Some of the fields of the command string are validated, others are not checked so that error conditions may be produced. An example of this would be issuing a seek to an illegal track address. If, in the fields that are checked, an invalid parameter is specified, the program will print a question mark, carriage return, line feed, asterisk and wait for a new command string to be entered. Each command string is terminated by a period.

The following is a list of parameters used in the command string and their meaning:

unit =	address of the disc storage unit on pack [$0 \leq \text{unit} \leq 3$]
track =	track address (decimal field)
sector =	sector address (decimal field)
length =	size of the data block in words (decimal field) [$1 < \text{length} < 570$]
status mask =	status mask word (in octal) specifies which status bits are to be examined when the status word is checked. (The status word is discussed in section 2.4.11.)
pattern =	(octal field) denotes this fixed pattern will be used on data transfers. If omitted, random data patterns will be used.
C =	if entered, the test will be run continuously until terminated by sense switch 3. If omitted, the test will be run one time.

Optional parameters are enclosed in brackets.



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The following paragraphs describe the various tests, the command strings needed to execute them and give examples of each.

2.4.1 Write Test

W unit, sector, length, status mask [, pattern, C].

The test will write a block of data beginning at the specified sector. When the operation has completed, the device status is checked. If in continuous mode, the operation will be executed repeatedly. If not in continuous mode, control is returned to the test monitor.

W 3, 28, 120, 1760,,C.

A 120 word block (one sector) of random data will be continuously written at sector 28 of the current track on unit 3. The error bits of the status word will be checked.

W 0, 9, 64, 125252.

A 64 word block of data of the fixed pattern 125252 will be written at sector 9 of the current track on unit 0. In addition to the error bits, the write protect bit of the status word will be checked.

2.4.2 Read Test

R unit, sector, length, status mask [, pattern, C].

The test will read a block of data beginning at the specified sector. When the operation has completed, the device status is checked. The block of data read is compared against the contents of the write buffer and any differences noted.

R 0, 23, 240, 1760, 0,C.

A 240 word block (two sectors) will be continuously read beginning at sector 23 of the current track on unit 0. A block of data read will be compared against a block of zeros which will be inserted in the write buffer.

R 1, 0, 26, 1760.

A 26 word block of data will be read from sector 0 of the current track on unit 1. The block of data read will be compared against the current contents of the write buffer.



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2.4.3 Echo Test

E unit, sector, length, status mask [, pattern, C].

The test will write a block of data beginning at the specified sector. The data is then read and verified. The device status is checked at the completion of both the write and read operations. The test is essentially a combination of the Write and Read test.

E 0, 12, 128, 1760,,C.

A 128 word block of random data is written at sector 12 of the current track on unit 0. The data is then read and verified. The test is run continuously, however, the random block of data is only generated once.

2.4.4 Seek Test

S unit, track, status mask [,C].

The test will seek to track 0, then to the specified track on the designated unit. At the completion of both seek the device status will be checked.

S 1, 53, 1760.

The test will seek to track 0, then to track 53 on unit 1.

S 2, 0, 1760.

The test will execute two seeks to track 0 on unit 2. (The second seek complete will be immediate since the unit is already on track).

S 0, 199, 1761.

The test will seek to track 0, then to track 199 on unit 0. In addition to the error bits, the seek complete bit for device 0 will be checked, and if on, the status displayed.

2.4.5 Unique Address Test

A unit [,C].

The test writes a one sector block of data in each sector on the specified unit. The first word of the block contains the track address, the second word the sector address and the remainder a random data pattern. After the entire disc storage unit has been written, each sector is read and the track address, sector address and random data verified. Any errors are noted. The writing and reading of sectors is interfaced to reduce the execution time of the test.

A 1.

The Unique Address test will be executed on unit 1.



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2.4.6 Compatibility Test

C unit [,C].

The test is essentially the read portion of the Unique Address test and provides a mean of checking the interchangeability of packs among units. The Unique Address test would be run on one unit, the pack move to a second unit and the Compatibility test run on the second unit to verify the data could be recovered.

C 0,C.

The test is run continuously on unit 0.

2.4.7 Data Transfer Test

D unit [,C].

During one execution of the test it will make 512 passes of the following operations: a seek to a random track address, the writing of a block of random data of random length beginning at a random sector, and the reading and verification of the block. Any errors are noted (The test checks if the random sector and length will produce an End of Track error. If it will, another random sector is chosen).

D 3,C.

The test is run continuously on unit 3.

2.4.8 MULTIPLE UNIT TEST

M unit [,unit,unit,unit,C].

The test checks the ability of the controller and disc storage units to perform concurrent operations. While the controller is reading or writing on one unit, the other units may be in the process of seeking. The routine uses random track and sector addresses, and a fixed data pattern. The test makes 512 passes each time it is selected.

M 0,2.

The test will be executed one time (512 passes) on units 0 and 2.

2.4.9 Sense/Status Test

T unit [,C].

The test will perform a series of operations on the specified unit and check that the expected status is returned. Where the status bits have a corresponding sense condition, a check is made that the two agree. Among the condition tested are Controller Busy, Seek Complete, Illegal Sector, Illegal Track, End of Track, and Error. If the test finds the unit not ready or write protected the remainder of this test is aborted.

T 3.

The test will be run on unit 3.



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2.4.10 Error Message

When an error condition is detected by the program, an associated error type number is printed. Most of the error type numbers will be followed by message extension words containing information for determining the specific cause of the error. Table 2-1 contains the description of the individual error messages. The first three messages may occur in any test, while the remainder occur only in the Sense/Status test.

<u>Error type number</u>	<u>Description</u>
1	A disc controller timeout error occurred. The error type number will be followed by the unit address and the location in the program where the timeout error occurred. (The remainder of the test will be aborted).
2	An apparent status error occurred. The error type number will be followed by the unit address, the status read, the track address, and, if a data transfer operation, the sector address and size of the data block. [The status word is logically anded with the status word mask, and if the result non-zero, the status is displayed.]
3	A data comparison error occurred. The error type number will be followed by the unit address, the status, the track address, sector address, and the size of the data block. (Each type 3 message will be followed by one or more typeouts which contain the address in the read buffer where the data error occurred, the read buffer word (was), the address in the write buffer of the corresponding word, and the write buffer word (should be).
4	The status word indicated an error while the sense error instruction did not. The error type number will be followed by the unit address and the last status read.
5	The status word indicated the unit not ready while the sense selected unit not ready instruction did not. The error type number will be followed by the unit address and the last status read.
6	The status word indicated the unit write protected while the sense selected unit write protected instruction did not. The error type number will be followed by the unit address and the last status read.



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Error type numberDescription

- | | |
|----|---|
| 7 | A seek was performed on the unit but the status word did not indicate a seek in progress. The error type number is followed by the unit address and the last status read. |
| 8 | A seek was performed on the unit but the sense seek complete instruction did not indicate a seek in progress. The error type number is followed by the unit address and the last status read. |
| 9 | The status word falsely indicated a seek in progress. The error type number is followed by the unit address and the last status read. |
| 10 | The sense seek complete instruction falsely indicated a seek in progress. The error type number is followed by the unit address and the last status read. |
| 11 | A read was performed on the unit but the sense controller busy instruction did not indicate a busy condition. The error type number is followed by the unit address and the last read. |
| 12 | The sense controller busy instruction falsely indicated a busy condition. The error type number is followed by the unit address and the last status read. |
| 13 | A seek to an illegal track address was attempted but the status word did not indicate this. The error type number is followed by the unit address and the last status read. |
| 14 | While the status word indicated an illegal address error the sense error instruction did not indicate an error. The error type number is followed by the unit address and the last status read. |
| 15 | A read was attempted to an illegal sector but the status word did not indicate this. The error type number is followed by the unit address and the last status read. |
| 16 | While the status word indicated an illegal sector error the sense error instruction did not indicate an error. The error type number is followed by the unit address and the last status read. |



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<u>Error type number</u>	<u>Description</u>
17	A write was performed which should have resulted in an end of track error but the status word did not indicate this. The error type number is followed by the unit address and the last status read.
18	While the status word indicated an end of track error the sense error instruction did not indicate an error. The error type number is followed by the unit address and the last status read.

Table 2-1

2.4.11 Status Word

The status word is provided by the disc controller in response to the program request for status. The status word, with the exception of the seek complete bits, pertains to the disc currently selected. The status word in the command string specify which bits are to be included when the status is checked. The meaning of the bits in the status word is defined in Table 2-2. Comments in parentheses refer to the 620-36.

<u>Bit</u>	<u>Meaning if bit on</u>
0	Unit 0 Seek Complete (Unit 0, Pack 0 Seek Complete)*
1	Unit 1 Seek Complete (Unit 0, Pack 1 Seek Complete)*
2	Unit 2 Seek Complete (Unit 1, Pack 0 Seek Complete)*
3	Unit 3 Seek Complete (Unit 1, Pack 1 Seek Complete)*
4	Selected Unit Illegal Sector **
5	Selected Unit Illegal Address *
6	Selected Unit Malfunction *
7	Selected Unit Timing Error **
8	Selected Unit Read Parity Error **
9	Selected End of Track Error **
10	Selected Write Protect *
11	Selected Unit - Unit Not Reddy*
12	Not Used
13	Not Used
14	Not Used
15	Not Used

Error

* Originate at the disc unit.

** Reset by "Initialize"

Table 2-2



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2.4.12 Console Mode

If a teletype is not available, the tests, with the exception of the Multiple Unit test, may be run in the sense mode by using the following procedure.

2.4.12.1 Loading

Load the program using the console mode loading procedure described in the Maintain II Test Executive. After the Test Executive and the test program have been loaded start the test program at location 0500.

2.4.12.2 Initialization

The program will halt with the instruction register = 01. Enter the device address of the disc controller in the A register and the BIC device address in the B register. (All parameters entered are right-justified). Press RUN (START) to continue.

The program will now go through the initialization process and transfer control to the main body of the test program. Here the program will halt twice to allow the user to select a test to be executed, and to enter parameters such as track and sector addresses. After a test has completed execution, the test program will return to these halts to allow a new test to be selected or new parameters to be specified. All entries should be right justified. Test selection is described below.

2.4.12.3 Test Execution

The program will halt with the instruction register = 02. Enter the test number in the A register, the unit address in the B register, and the track address in the X register. The test number specifies the test to be run, and is coded as follows:

- 00 = Write Test
- 01 = Read test
- 02 = Echo test
- 03 = Seek test
- 04 = Unique Address test
- 05 = Compatibility test
- 06 = Data Transfer test
- 07 = Sense/Status test

Press RUN (START) to continue



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The program will then halt with the instruction register = 03. Enter the sector address in the A register, the size of the data block (in number of words) in the B register, and a non-zero value in the X register if the test is to be run in the continuous mode. (For some tests certain registers setting will be meaningless, i.e., the Unique Address test needs only the test number and unit address). Press RUN (START) to continue.

When executing a test in the console mode, sense switch 2 should be set and sense switch 1 reset to halt on errors. There are two program halts to notify the user of the occurrence of error conditions. When the program halts with the instruction registers = 010 the A register will contain the error type number. When the program halts with the instruction register = 020 it indicates a data comparison error and the A register will contain the actual value while the B register contains the expected value. After either halt press RUN (START) to resume execution.

2.4.13 Console Switches

SSW1	Set - Inhibit error printout Reset - Enable error printout
SSW2	Set - Halt on error Reset - Do not halt on error
SSW3	Set - Terminate test Reset - Continue test



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SECTION 3: INTERNAL SPECIFICATION

3.1 INTRODUCTION

The Maintain II Test Executive Program must be loaded before the test program can be run. The test program makes use of the Test Executive subroutines for teletype input/output, sense switch testing, etc. The test program overlays part of the Test Executive, however, the memory location display/alter and the load object ~~type~~ utility function are not disturbed.

The area occupied by the initialization routine is allocated to buffer storage once the initialization routine has completed, therefore, it cannot be reused without reloading the test program.

3.1.1 Memory Map

0000 - 0277	Interrupt area
0300 - 0375	Constants
0400 - 0477	Test Executive Tables
0500 - 0501	Entry to Test Program
0502 - 0521	Test Routines
02522 - 03612	Subroutines
[03613 - 04432]	Initialization routine
03613 - 04704	Write buffer
04705 - 05777	Read buffer
06023 - 07553	Test Executive routines

3.2 INTERNAL DESCRIPTION

The routine descriptions assume the availability of a teletype for user/program communication. Wherever teletype input/output is mentioned in these descriptions, there is an equivalent console mode operation for receiving or displaying information.

Subroutine names in parentheses indicate the subroutine is part of the Maintain II Test Executive.



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Title: Initialization Routine

Symbolic Name: INIT

Purpose: To allow the user to enter the hardware - dependant parameters of the system to be tested.

Description: The routine identifies itself and requests the disc controller and BIC device addresses. After these have been entered the routine inquires if interrupts are to be used. If the program is to be run in the interrupt mode, the PIM device address, the PIM interrupt mask, and the trap locations for the seek complete and controller ready interrupts will be requested. The routine then modifies the device address field of the disc I/O instructions, change the entry point in the program, and transfers control to SCAN.

Entry Points: INIT

Calling Sequence: The routine can be entered from the Maintain II Test Executive program, or from the transfer vector at location 0500. Once the initialization routine has been completed, the transfer vector at 0500 is changed to point to the SCAN routine.

Entrance Parameters: Not applicable

Exit Point: The routine, when completed transfers control to SCAN.

Exit Parameters: Not applicable

Tables or Files Modified or Read: The I/O instruction pointer table (ITAB) and the interrupt routine pointer table (IRET) is read by this routine.

Tables or Files Created: The interrupt address table (IADT) is created by this routine.

Called By: Normally entered from the Maintain II Test Executive

Called From: (OUTC), (OUTD), (INPB), (INPG), IMOD

Exception Conditions: Not applicable

Timing: Not applicable



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Size: 400 words

Comments: The initialization routine overlays part of the Maintain II Test Executive program. After the routine has been executed, the area it occupies is allocated to buffer storage, and the initialization routine is destroyed. The entry point to the routine at 0500 is changed to point to SCAN.

Special Notation: Not applicable

Hardware Details: The initialization routine is prepared to modify the program to run in interrupt mode provided all interrupts associated with the disc are on one priority interrupt module.

Flowcharts: See section 3.3



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Title: Command Monitor

Symbolic Name: SCAN

Purpose: To initialize software flags and variables, and to allow selection of a test for execution.

Description: The routine initializes a block of memory which is comprised of software flags, and then waits for user input. The user may enter a one character mnemonic which specifies the test to be executed, the unit (or units) on which the test is to be executed, and for certain tests additional parameters, such as track, sector, data pattern, etc. The user may also specify whether the test is to be executed once, or continuously.

Entry Points: SCAN is entered from the initialization routine when it has completed, when the program is restarted at location 0500, and at the termination of each test.

Calling Sequence: Not applicable

Entrance Parameters: Not applicable

Exit Point: The normal exit from SCAN is a transfer of control to the selected test routine at SCN3. At each call for teletype input the current input dialogue may be terminated, and control returned to the beginning of SCAN, by toggling sense switch 3.

Exit Parameters: If the specified test is to be executed continuously, the continuous flag (CFLG) will be set upon exiting.

Tables or Files Modified or Read: Reads the test routine address table (CTAB). This table created at assembly time.

Tables or Files Created: Not applicable

Called By: Not applicable

Called From: (OUTA), (OUTC), (INPB), (INPG), CMSH, IDEC

Exception Conditions: Certain input parameters are validated. If an invalid parameter is detected, a question mark is typed and control is returned to the beginning of SCAN to await new input.



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Timing: Not applicable

Size: 186 words

Comments: An optional input parameter will cause the selected test to be run in the continuous mode. If this mode is specified the test will be executed indefinitely until interrupted by sense switch 3.

Special Notation: Not applicable

Hardware Details: Not applicable

Flowcharts: See section 3.3



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Title: Unique Address Test

Symbolic Name: XA

Purpose: To verify the uniqueness of track/sector addressing for each track/sector on the disc.

Description: The routine writes the track/sector address in the first two words of each sector (and random data in the remainder of the sector) for the entire disc; it then reads each sector, verifying they contain the correct address information. The data in the remainder of these sector is also verified. When the entire disc has been checked, the routine determines if the test should be run continuously.

Entry Points: XA

Calling Sequence: Control is transferred to this routine by SCAN.

Entrance Parameters: Not applicable

Exit Point: Control is returned to the SCAN routine

Exit Parameters: Not applicable

Tables or Files Modified or Read: Not applicable

Tables or Files Created: Not applicable

Called By: SCA N

Called From: XX

Exception Conditions: The test may be aborted if an intolerable error, such as a timeout, is encountered.

Timing: Approximately 11 minutes for one pass on the 620/1.

Size: 17 words

Comments: The routine reset the random number generator each time it is used so that the same sequences of random data blocks are generated each time. The compatibility test also does this to produce the same data for its check. The unique address routine also sets the address flat (AFLG) to indicate that track/sector address information has



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been placed on the disc.

Special Notation: Not applicable

Hardware Details: Not applicable

Flowcharts: See section 3.3



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Title: Write Test

Symbolic Name: XW

Purpose: To allow the write operation to be executed.

Description: The routine initiate the write operation on the disc, monitors its progress and checks the device status upon completion. It will execute the write operation repeatedly if the continuous mode has been specified.

Entry Points: XW

Calling Sequence: Control is transferred to this routine by SCAN

Entrance Parameters: Not applicable

Exit Point: The routine, when completed, returns control to SCAN.

Exit Parameters: Not applicable

Tables of Files Modified or Read: Not applicable

Tables of Files Created: Not applicable

Called By: SCAN

Called From: WX

Exception Conditions: The test may be aborted if an intolerable error, such as a timeout, is encountered.

Timing: Not applicable

Size: 9 words

Comments: This routine resets the address flag (AFLG) since it may destroy track/sector address information.



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Special Notation: Not applicable

Hardware Details: Not applicable

Flowcharts: See section 3.3



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Title: Read Test

Symbolic Name: XR

Purpose: To allow the read operation to be executed.

Description: The routine initiates the read operation on the disc, monitors its progress and checks the device status upon completion. It then compares the contents of the write buffer against the block of data just read. It will execute the read operation (and data comparison) repeatedly if the continuous mode has been specified.

Entry Points: XR

Calling Sequence: Control is transferred to this routine by SCAN

Entrance Parameters: Not applicable

Exit Point: The routine when completed, returns control to SCAN.

Exit Parameters: Not applicable

Table or Files Modified or Read: Not applicable

Tables or Files Created: Not applicable

Called By: SCAN

Called From: RX

Exception Conditions: The test may be aborted if an intolerable error, such as a timeout, is encountered.

Timing: Not applicable

Size: 7 words

Comments: Not applicable

Special Notation: Not applicable



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Hardware Details: Not applicable

Flowcharts: See section 3.3



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Title: Echo Test

Symbolic Name: XE

Purpose: To allow the writing, reading and verification of a block of data to be performed.

Description: The routine initiates a write operation and checks the device status upon completion. It then initiates a read operation, check the device status upon completion and compare the block of data read with the contents of the write buffer. It will executed the write/read/data verification operations repeatedly if the continuous mode has been specified.

Entry Points: XE

Calling Sequence: Control is transferred to this routine by SCAN.

Entrance Parameters: Not applicable

Exit Point: The routine, when completed returns control to SCAN.

Exit Parameters: Not applicable

Table or Files Modified or Read: Not applicable

Tables or Files Created: Not applicable

Called By: SCAN

Called From: WX, RX

Exception Conditions: The test may be aborted if an intolerable error, such as a timeout, is encountered.

Timing: Not applicable

Size: 11 words

Comments: This routine resets the address flag (AFLG) since it may destroy track/sector address information.



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Special Notation: Not applicable

Hardware Details: Not applicable

Flowcharts: See section 3.3



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Title: Seek Test

Symbolic Name: XS

Purpose: To allow the seek operation to be executed.

Description: The routine initiate a seek to track 0, and checks the device status when the seek has completed. It then initiates a seek to the track specified by the user, waits for the seek to complete and again check the device status. It will execute these two seeks repeatedly if the continuous mode has been specified.

Entry Points: XS

Calling Sequence: Control is transferred to this routine by SCAN

Entrance parameters: Not applicable

Exit Point: The routine, when completed, returns control to SCAN.

Exit Parameters: Not applicable

Table or Files Modified or Read: Not applicable

Tables or Files Created: Not applicable

Called By: SCAN

Called From: (TOUT), S, ERRP

Exception Condions: The test may be aborted if an intolerable error, such as a timeout is encountered.

Timing: Not applicable

Size: 42 words

Comments: Not applicable

Special Notation: Not applicable

Hardware Details: Not applicable

Flowcharts: See section 3.3



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Title: Compatibility Test

Symbolic Name : XC

Purpose: To provide a method of verifying that packs recorded on one unit may be read on another.

Description: The unique address test is first run on some unit. The pack is then moved to another unit and the compatibility test is run in order to verify that the recorded data can be recovered. The compatibility test is essentially the read portion of the unique address test.

Entry Points: XC

Calling Sequence: Control is transferred to this routine by SCAN.

Entrance Parameters: Not applicable

Exit Point: The routine, when completed, returns control to SCAN

Exit Parameters: Not applicable

Table or Files Modified or Read: Not applicable

Tables or Files Created: Not applicable

Called By: SCAN

Called From: XX

Exception Conditions: The test may be aborted if an intolerable error, such as a timeout is encountered.

Timing: Approximately 8 minutes for one pass on the 620/1.

Size: 16 words

Comments: The routine resets the random number generator in order to produce the same sequence of random data blocks as does the unique address test.

Special Notation: Not applicable

Hardware Details: Not applicable



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Flowcharts:

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Title: Data Transfer Test

Symbolic Name: XD

Purpose: To verify that random data can be written on and recovered from the disc.

Description: The routine speaks to a random track. When the seek has completed, a block of random data, of random length, is written at a random sector. A check is made so the write will not produce an end of track error. The block that was written is then read and verified. For each execution of the data transfer test, the routine makes 512 seek/ write/ read passes. The test will be executed repeatedly if the continuous mode has been specified.

Entry Points: XD

Calling Sequence: Control is transferred to this routine by SCAN.

Entrance Parameters: Not applicable

Exit Point: The routine, when completed, returns control to SCAN

Exit Parameters: Not applicable

Table or Files Modified or Read: Not applicable

Tables or Files Created: Not applicable

Called By: SCAN

Called From: S, RAND, RT, RS, FILL, USK, STAT, ERRP, R, W, CBSY, CHECK, (TOUT)

Exception Conditions: The test may be aborted if an intolerable error, such as a timeout is encountered.

Timing: Approximately 1-1/2 minutes for one pass on the 620/1.

Size: 150 words

Comments: If the unique address test is run prior to the data transfer test (and no test capable of destroying the track/sector address information is previously run), the test will read and verify the track.



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location after the seek has been completed.

Special Notation: Not applicable

Hardware Details: Not applicable

Flowcharts: See section 3.3



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Title: Multiple Unit Test

Symbolic Name: XM

Purpose: To provide a means of verifying that concurrent disc operations may be performed .

Description: The various routines which comprise the multiple unit test are driven from the state vector table (MDU) . A unit may be one of the following status:

- a. Waiting to seek
- b. Seeking
- c. Waiting to write
- d. Writing
- e. Waiting to read
- f. Reading (or verifying data)

A small routine scans the state vector table and transfers control to the appropriate routine for each unit. If the controller is not currently reading or writing when a unit completes a seek to some random track, a one-sector write to some random sector is initiated on that unit. When the write is completed, the sector is read and the data verified. This permits concurrent seeks to be performed while a data transfer is taking place. For each execution of the multiple unit test, the routine make 512 write/read passes.

Entry Points: XM

Calling Sequence: Control is transferred to this routine by SCAN

Entrance Parameters: Not applicable

Exit Point: The routine, when completed returns control to SCAN

Exit Parameters: Not applicable

Tables or Files Modified or Read: Not applicable

Tables or Files Created: Not applicable



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Called By: **SCAN**

Called From: **FILL, RT, CBSY, S, W, R, USK, STAT, RS, ERRP, CHEK.**

Exception Conditions: **The routine may be aborted if an intolerable error, such as a timeout, is encountered**

Timing: **Approximately 1 minute for one pass on the 620/1, using one disc unit.**

Size: **191 words.**

Comments: **Not applicable**

Special Notation: **Not applicable**

Hardware Details: **Not applicable**

Flowcharts: **See section 3.3**



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Title: Sense/Status Test

Symbolic Name: XT

Purpose: To verify that the sense instructions associated with the disc function properly and that programmably producable status condition are detected.

Description: The routine initializes the disc controller and tests for any outstanding error status. If an error status exists, the remainder of the test is aborted. The routine initiates a seek and verifies than both sense and status conditions reflect the seek in progress. It initiates a read and verifies that the controller goes busy during the transfer. It produced illegal track address, illegal sector address, and end of track conditions and verifies that both the sense and status conditions report the error. If an error is detected, it is reported and the remainder of the test is aborted.

Entry Points: XT

Calling Sequence: Control is transferred to this routine by SCAN

Entrance Parameters: Not applicable

Exit Point: The routine, when completed returns control to SCAN

Exit Parameters: Not applicable

Tables or Files Modified or Read: Not appliable

Tables or Files Created: Not applicable

Called By: SCAN

Called From: STAT, ERRP, TERR, S, TSIP, TBSY, R, (TOUT), (TDLY)

Exception Conditions: If any error is detected in this routine, the remainder of the test is aborted.

Timing: ~~Approximately~~ 15 seconds for one pass on the 620/1.



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Size: 307 words

Comments: ~~This test cannot~~ be run if the BIC complete interrupt is used to indicate transfer complete.

Special Notation: Not applicable

Hardware Details: Not applicable

Flowcharts: See section 3.3



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REV

Title: Write Execute

Symbolic Name: WX

Purpose: To initiate and monitor write operations

Description: The routine fill a block of the write buffers with fixed or random data, initiates a write operation, and checks the device status at its completion.

Entry Points: WX

Calling Sequence: CALL WX

Entrance Parameters: SECT contains the sector address and BLOK contains the length, in number of words, of the data block to be transferred.

Exit Points: Control is returned to the calling routine.

Exit Parameters: Not applicable

Tables or Files Modified or Read: Not applicable

Tables or Files Created: Not applicable

Called By: XW, XE

Called From: FILL, W, CBSY, STAT, ERRP, (TOUT)

Exception Conditions: The test may be aborted if an intolerable error, such as a timeout, is encountered.

Timing: Not applicable

Size: 26 words

Comments: Not applicable

Special Notation: Not applicable

Hardware Details: Not applicable

Flowcharts: See section 3.3



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Title: Read Execute

Symbolic Name: RX

Purpose: To initiate and monitor read operations.

Description: If a fixed pattern has been specified, a block of the write buffer is filled with this pattern. The routine then initiates a read operation, checks the device status at completion, and compares the block of data read with the contents of the write buffer.

Entry Points: RX

Calling Sequence: CALL RX

Entrance Parameters: SECT contains the sector address and BLOK contains the length, in number of words, of the data block to be transferred.

Exit Points: Control is returned to the calling routine

Exit Parameters: Not applicable

Tables or Files Modified or Read: Not applicable

Tables or Files Created: Not applicable

Called By: XR, XE

Called From: FILL, R, CBSY, STAT, ERRP, CHEK, (TOUT)

Exception Conditions: The test may be aborted if an intolerable error, such as a timeout, is encountered.

Timing: Not applicable

Size: 31 words

Comments: Not applicable

Special Notation: Not applicable



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Hardware Details: Not applicable

Flowcharts: See section 3.3



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Title: Disc I/O

Symbolic Name: MDIO

Purpose: To perform the I/O instructions necessary for initiating disc operations.

Description: Upon entry the routine calls SSWT to see if the current test should be aborted, and if so, transfers control to SCAN. If not, it initializes the disc controller, set its to either seek or sector mode and outputs the track or sector address. If the operation to be performed is a seek, the routine sets the seek flag for the appropriate unit and returns control to the calling routine. If the operation to be performed is a data transfer, the routine sets up and activates the BIC, selects the read or write mode, set the data transfers flag and returns control to the calling routine.

Entry Points: MDIO

Calling Sequence: CALL MDIO

Entrance Parameters: The A register will contain a select seek or a select sector mode instruction, the B register will contain a track or sector address, and the X register will be zero for a seek and non-zero for a data transfer operation. CDU will contain the address (right justified) of the unit on which the operation is to be performed.

Exit Point: Control is returned to the calling routine.

Exit Parameters: Not applicable

Tables or Files Modified or Read: Not applicable

Tables or Files Created: Not applicable

Called BY: R, W, S

Called From: (SSWT)

Exception Conditions: Any test may be aborted here by using sense switch 3.



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Timing: Not applicable

Size: 33 words

Comments: Not applicable

Special Notation: Not applicable

Hardware Details: The device address field of the I/O instructions in this routine are modified at initialization.

Flowcharts: See section 3.3



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Title: Read/Write Entire Disc

Symbolic Name: XX

Purpose: To provide a routine capable of reading or write each sector on the disc.

Description: The routine will write, or verify the existence of, track/sector address information (and additional random data) in each sector of a track. When all sectors of a track have been checked, the routine will seek to the next track until the entire disc has been checked. In order to reduce execution time, the reading or writing of sectors is interlaced with three sectors serviced each revolution.

Entry Points: XX

Calling Sequence: CALL XX

Entrance Parameters: The calling routine will modify XX4A to point to the read or write routine. If the read routine is used, the read flag (RFLG) will be non-zero.

Exit Points: Control is returned to the calling routine.

Exit Parameters: Not applicable

Tables or Files Modified or Read: Not applicable

Tables Or Files Created: Not applicable

Called By: XA, XC

Called From: S, FILL, W, R, CHEK, (TOUT)

Exception Conditions: The routine may be aborted if an intolerable error, such as a timeout, is encountered.

Timing: Not applicable

Size: 91 words



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Comments: Not applicable

Special Notation: Not applicable

Hardware Details: Not applicable

Flowcharts: See section 3.3



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Title: Controller/Device Status

Symbolic Name: STAT

Purpose: To acquire the controller and device status for a specified device.

Description: The routine first tests if the controller is busy and if so, returns control to the calling routine through the busy exit. If the controller is not busy, a select instruction for the specified disc is constructed and executed, the status read and control is returned to the calling routine through the normal exit.

Entry Points: STAT

Calling Sequence: LDA Current device address
CALL STAT
DATA busy transfer vector
: normal

Entrance Parameters: The A register must contain the address (right justified) of the unit to be interrogated.

Exit Points: The busy exit is to the calling instruction + 1; the normal return is to the calling instruction + 2.

Tables or Files Modified or Read: Not applicable

Tables or Files Created: Not applicable

Called By: WX, RX, XS, XM, XT, XX

Called From: CBSY

Exception Conditions: Not applicable

Timing: Not applicable

Size: 19 words



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Comments: Not applicable

Special Notation: Not applicable

Hardware Details: Not applicable

Flowcharts: See section 3.3



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Title: Controller Busy Check

Symbolic Name: CBSY

Purpose: To provide a common routine for determining if the disc controller is busy.

Description: The routine determines if the program is being run in the interrupt mode. If it is, the routine checks the data transfer flag and if the flag is set, returned control to the calling routine through the busy exit. If the flag has been reset (by an interrupt level routine), control is returned to the calling routine through the normal exit. If the program is not being run in the interrupt mode, a sense controller busy instruction is executed and the busy or normal return is taken as a result of this.

Entry Points: CBSY

Calling Sequence: CALL STAT
DATA busy transfer vector
: normal return

Entrance Parameters: Not applicable

Exit Points: The busy exit is to the calling instruction +1; the normal return is to the calling instruction + 2.

Tables or Files Modified or Read: Not applicable

Tables or Files Created: Not applicable

Called By: STAT, XT

Called From: Not applicable

Exception Conditions: Not applicable

Timing: Not applicable

Size: 26 words



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Comments:

If the program is running in the interrupt mode the routine checks if the data transfer flag has been reset. If it is reset, the routine checks the interrupt flag to determine if the interrupt which reset this flag was caused by the controller coming ready or the BIC completing. If caused by BIC complete the routine then goes to the sense controller busy instruction (since the BIC may complete while the controller is still busy).

Special Notation: Not applicable

Hardware Details: Not applicable

Flowcharts: See section 3.3



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Title: Unit Seek Check

Symbolic Name: USK

Purpose: To provide a common routine for determining if a specified unit is currently seeking.

Description: The routine determines if the program is being run in the interrupt mode. If it is, the routine check the seek flag for the appropriate unit and if the flag is set, returns control to the calling routine through the busy exit. If the flag has been reset (by an interrupt level routine), control is returned to the calling routine through the normal exit. If the program is not being run in the interrupt mode, a sense seek complete instruction for the appropriate unit is constructed and executed, and the busy or normal return is taken as a result of this.

Entry Point: USK

Calling Sequence:

LDA	Current device address
CALL	STAT
DATA	Unit seeking transfer vector
:	normal return

Entrance Parameters: The A register must contain the address (right justified) of the unit to be interrogated.

Exit Points: The busy exit is to the calling instruction +1; the normal return is to the calling instruction +2.

Tables or Files Modified or Read: Not applicable

Tables or Files Created: Not applicable

Called By: XS, XD, XM, XX

Called From: Not applicable

Exception Conditions: Not applicable

Timing: Not applicable

Size: 24 words



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Comments: Not applicable

Special Notation: Not applicable

Hardware Details: Not applicable

Flowcharts: See section 3.3



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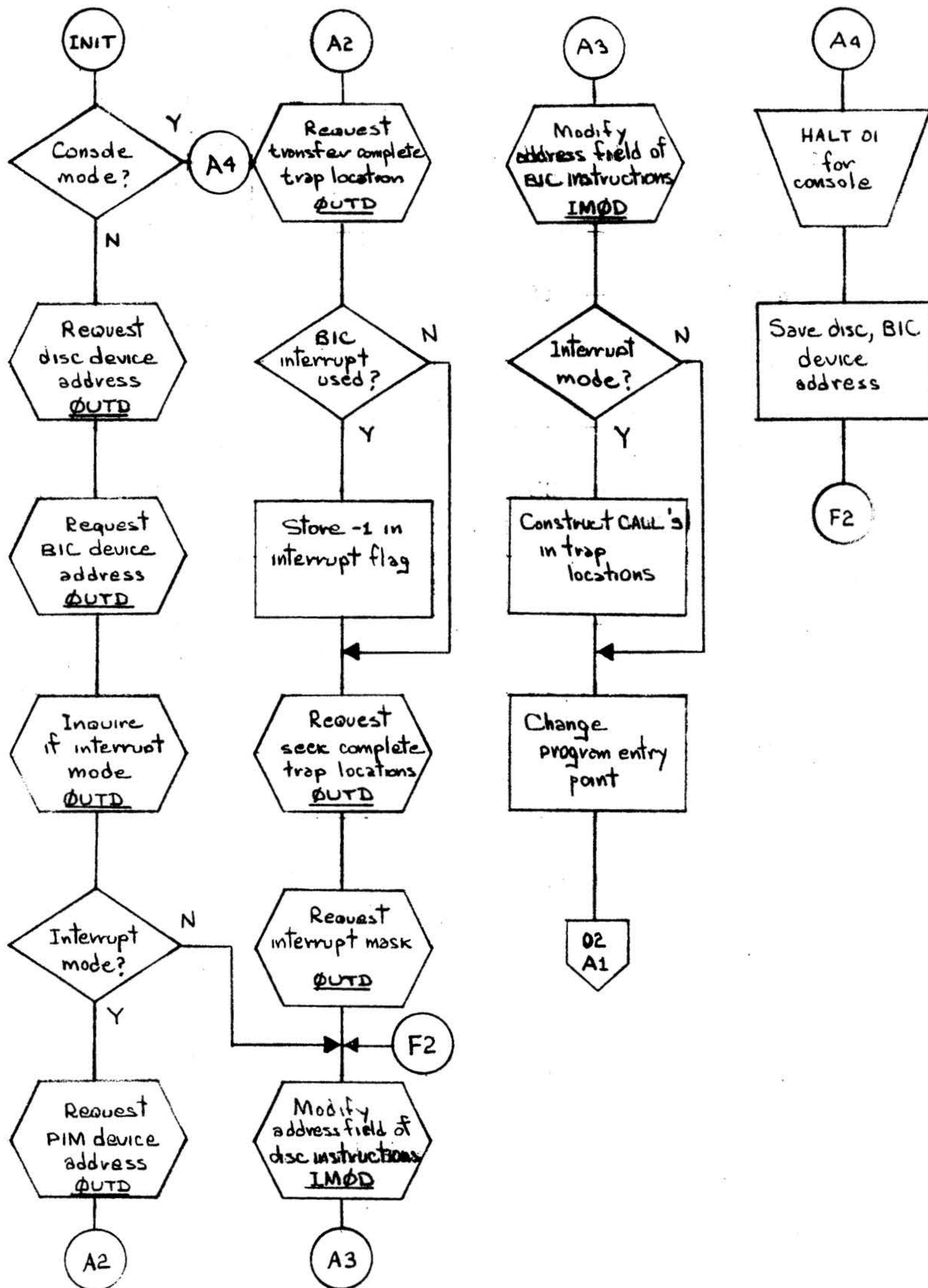
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3.3 FLOWCHARTS



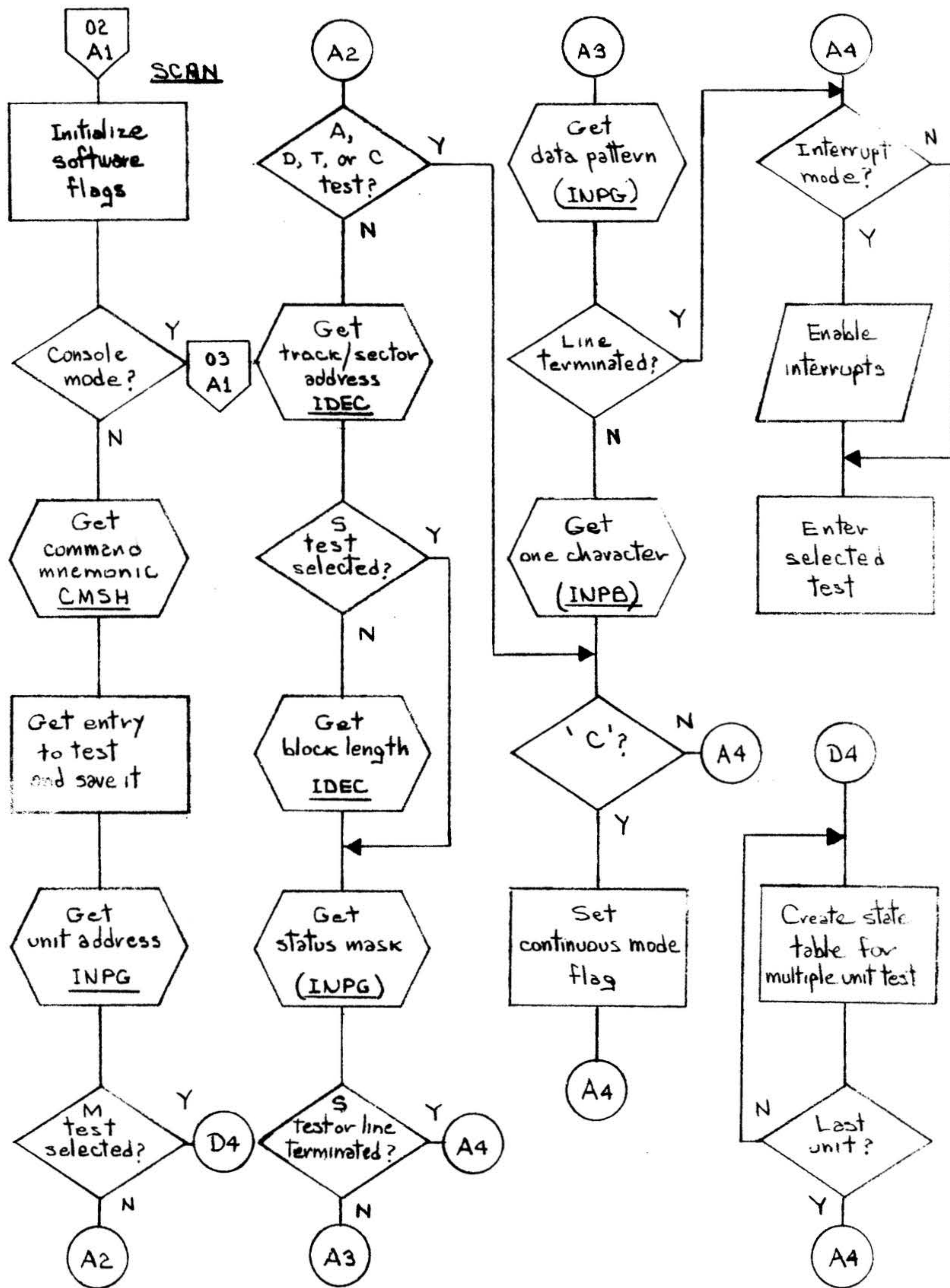
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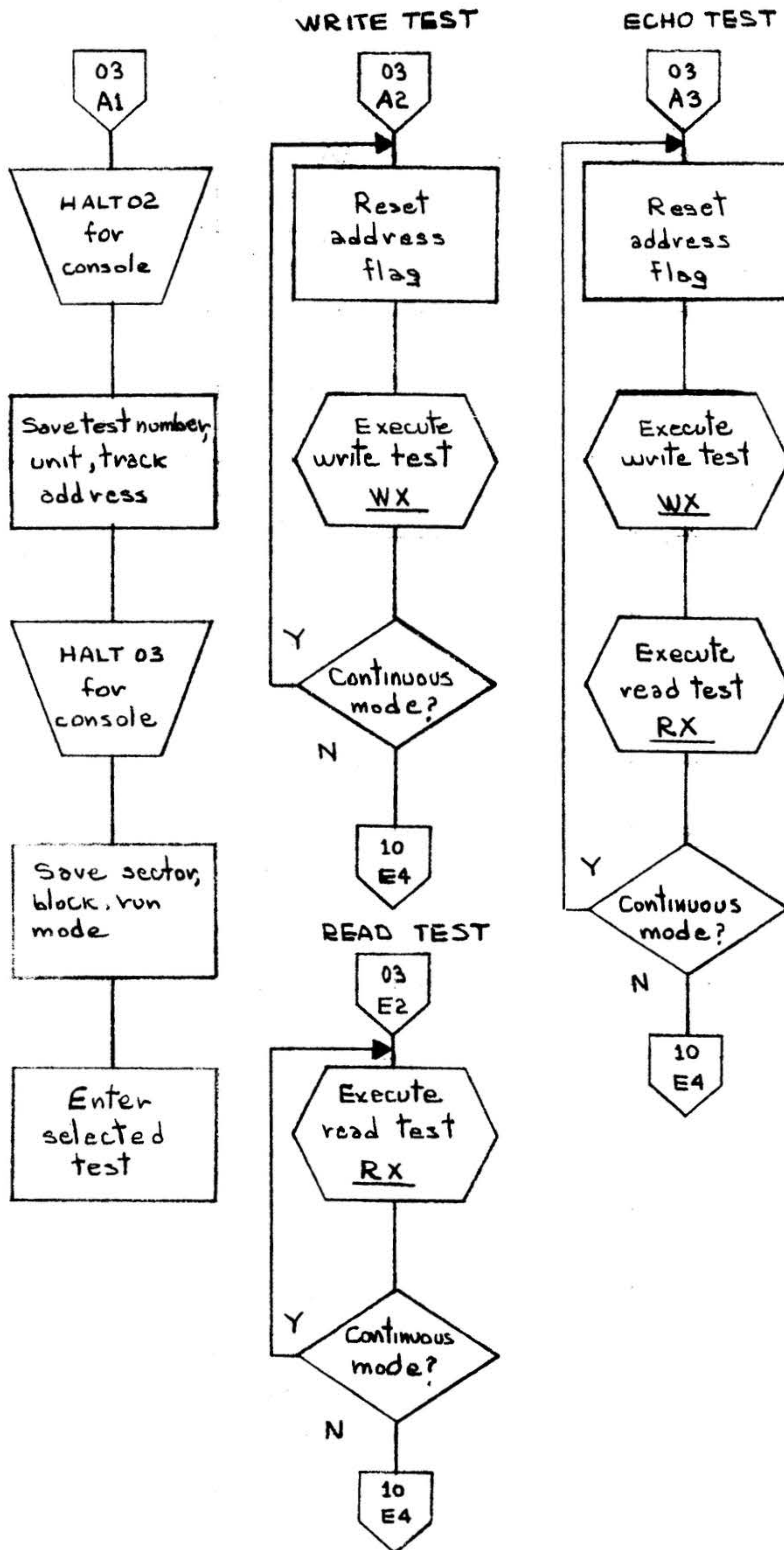
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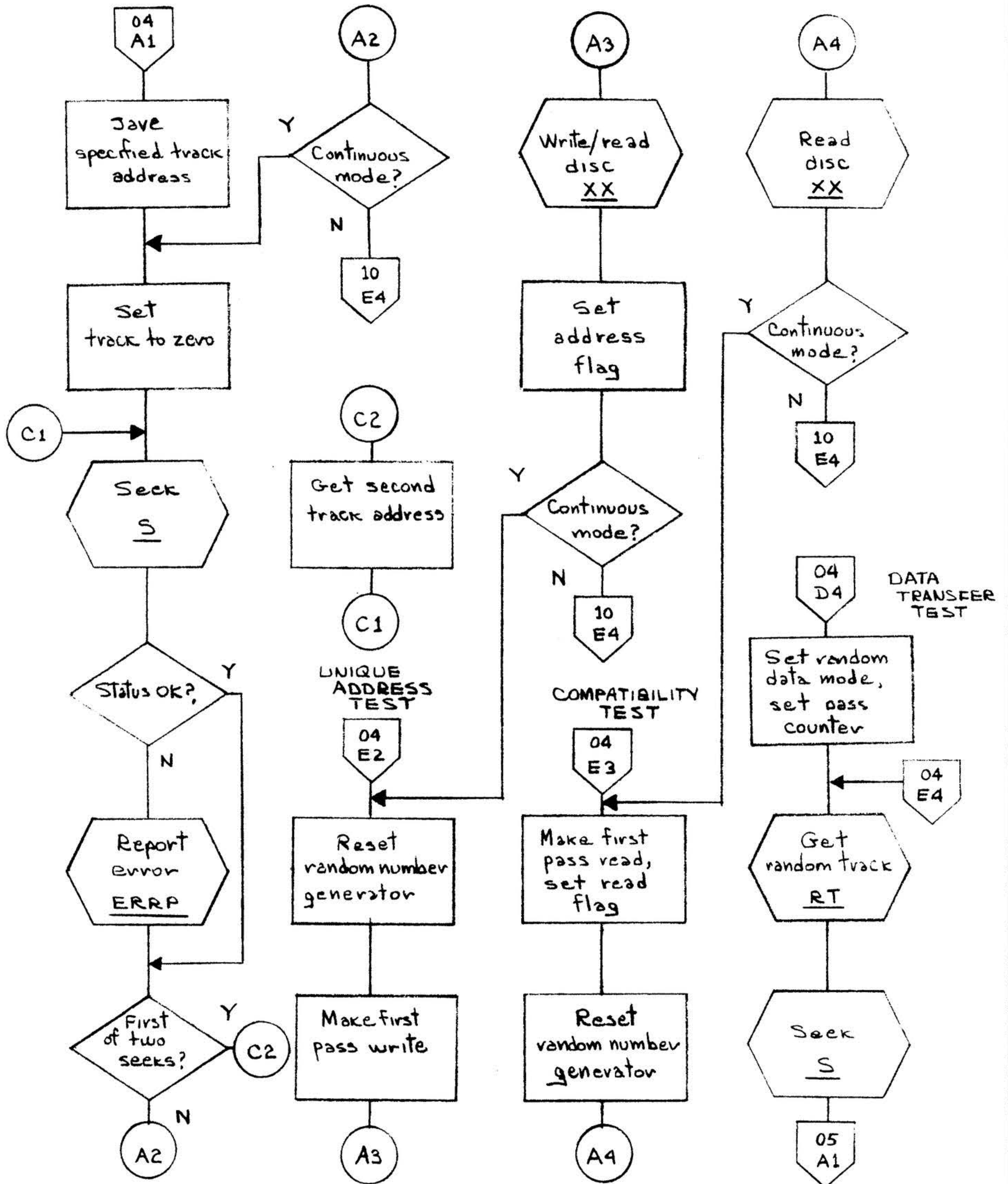
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SEEK TEST



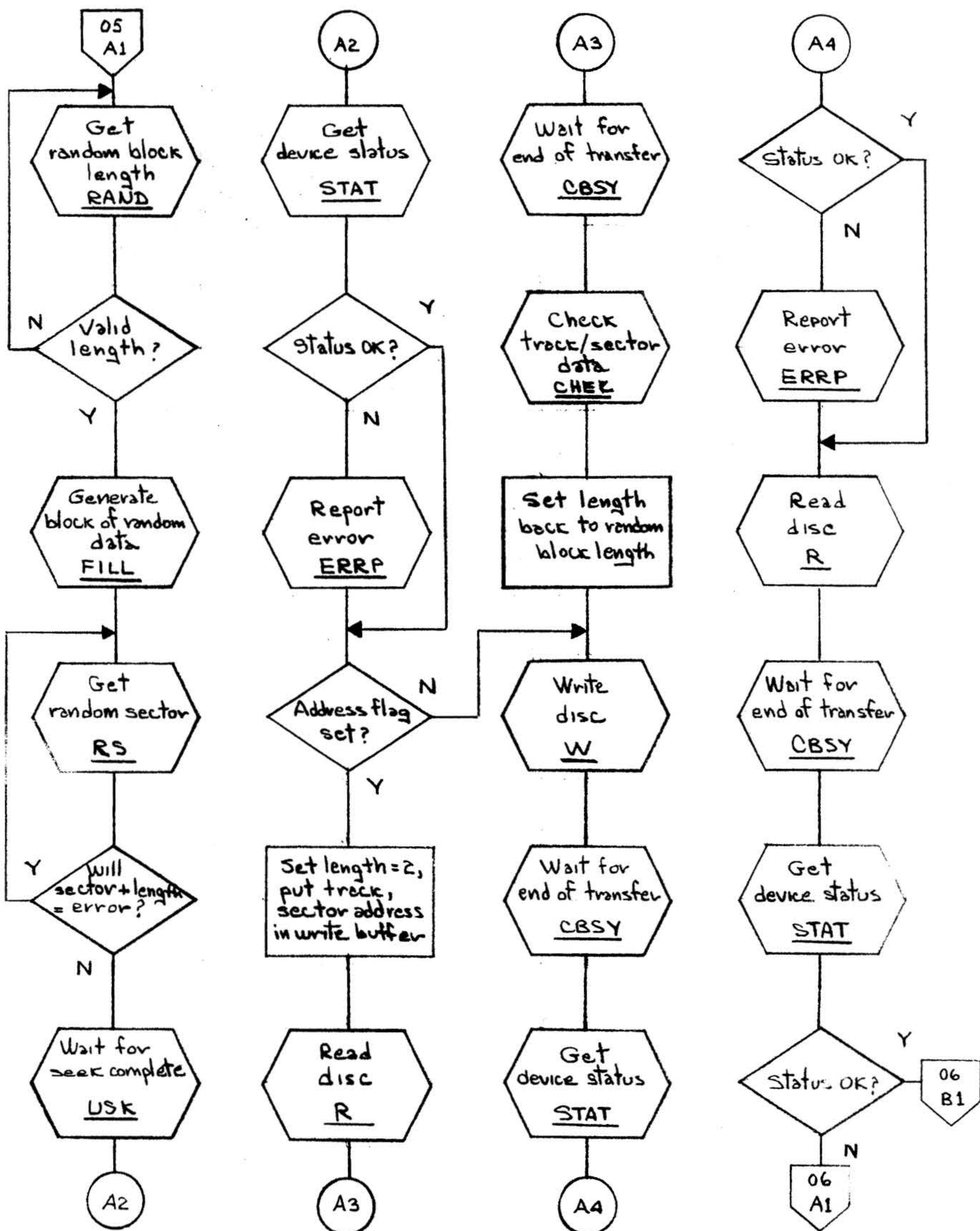
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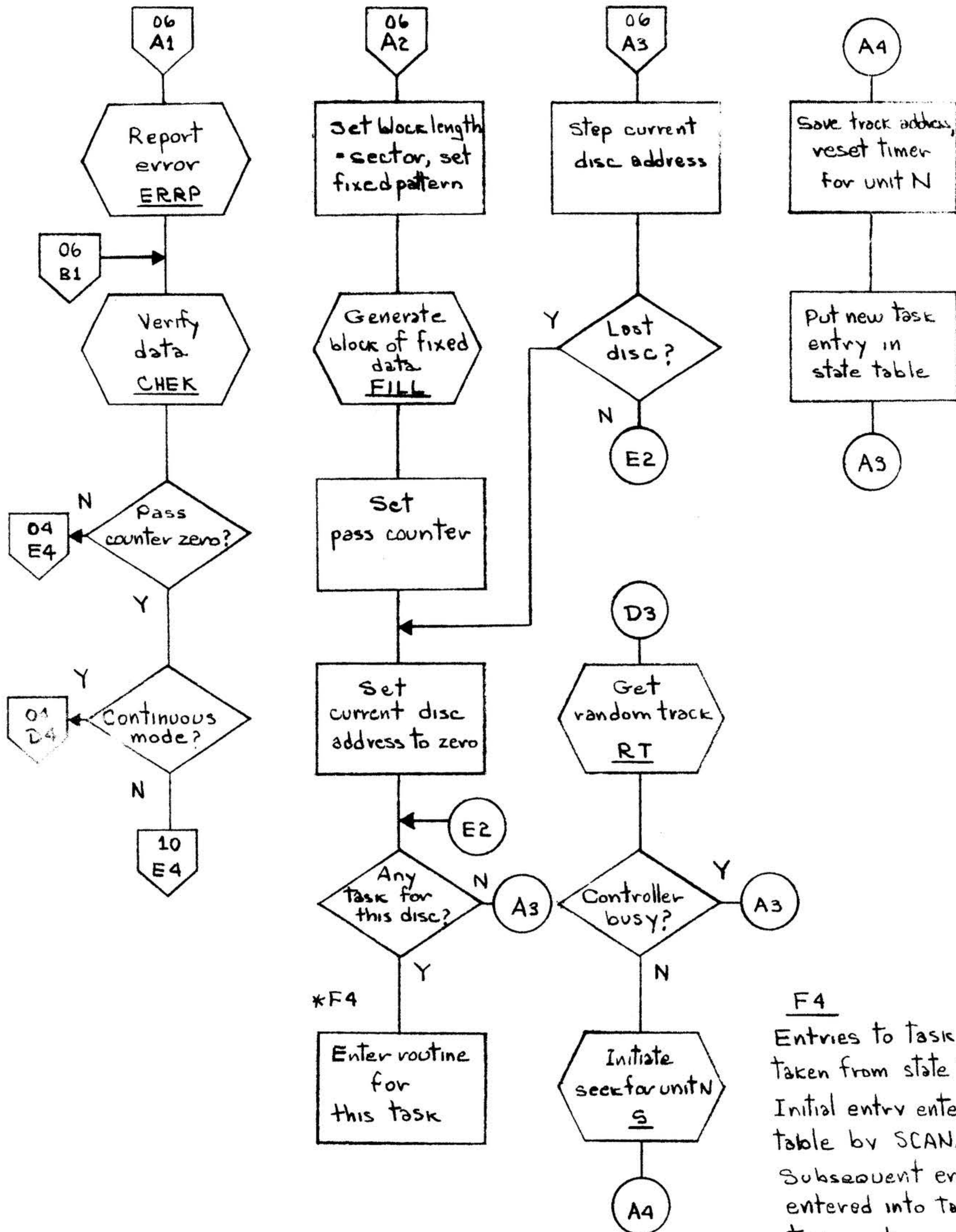
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MULTIPLE UNIT TEST



F4

Entries to task routines taken from state table. Initial entry entered into table by SCAN. Subsequent entries entered into table by task routines.



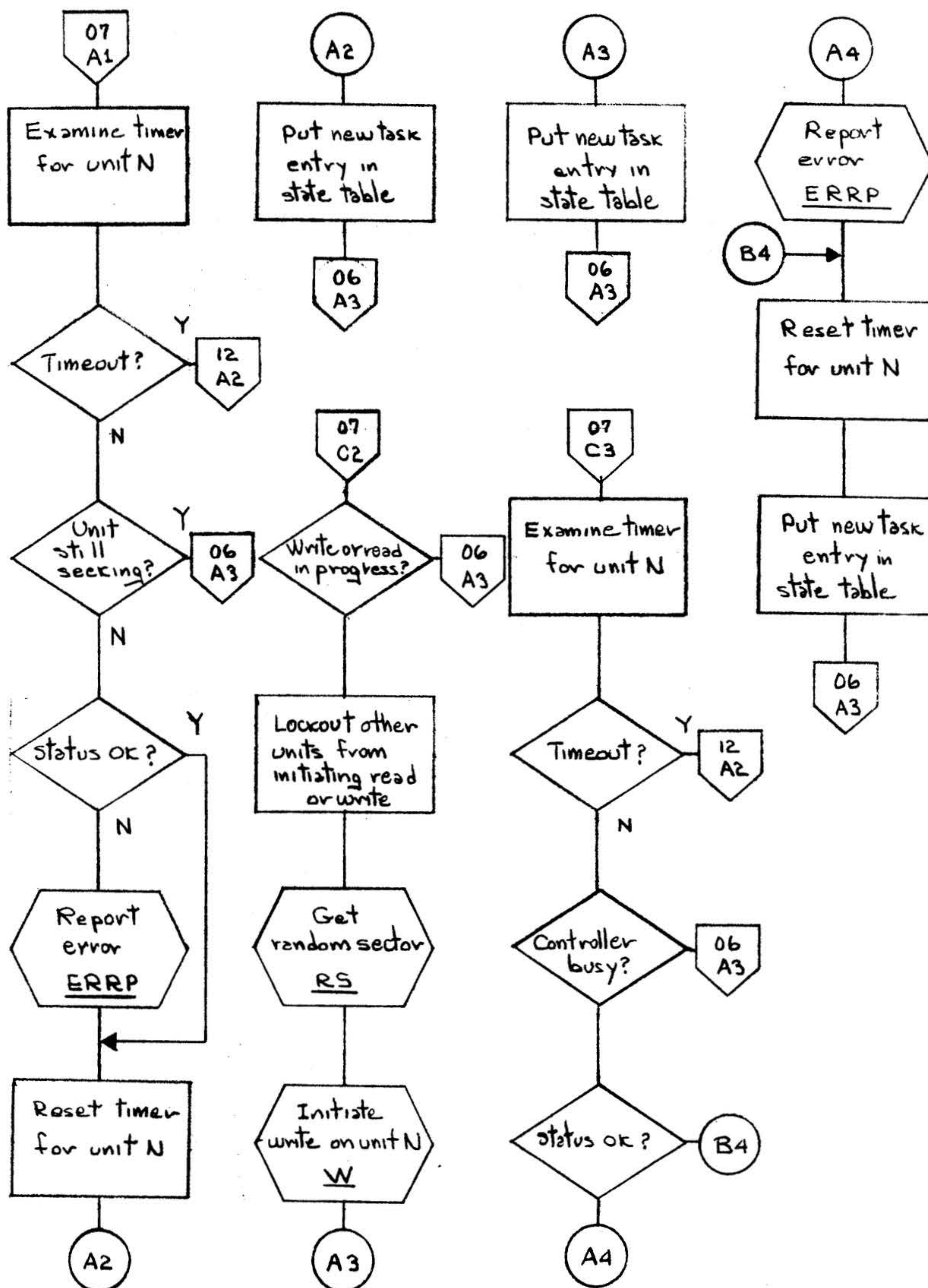
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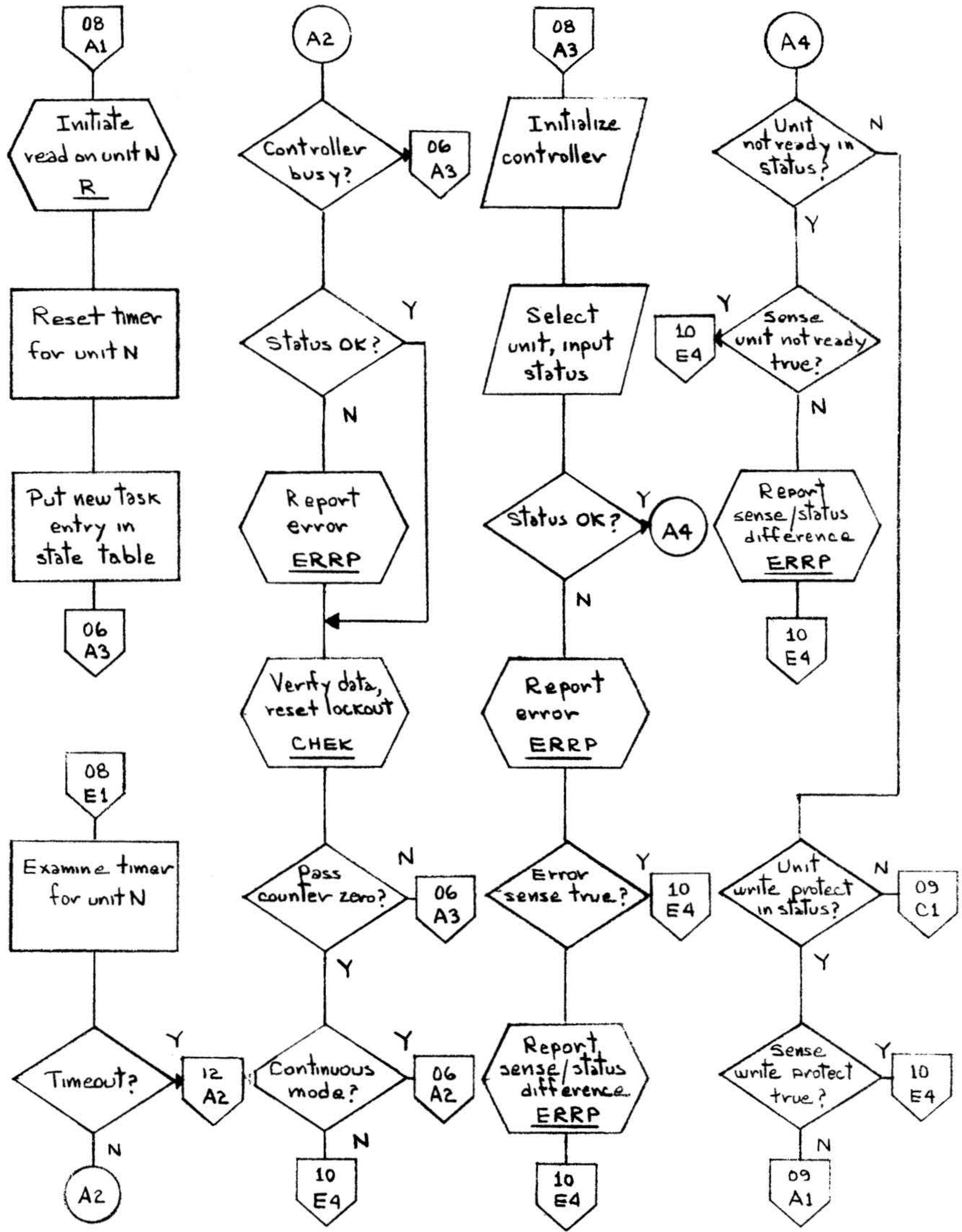
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SENSE/STATUS TEST



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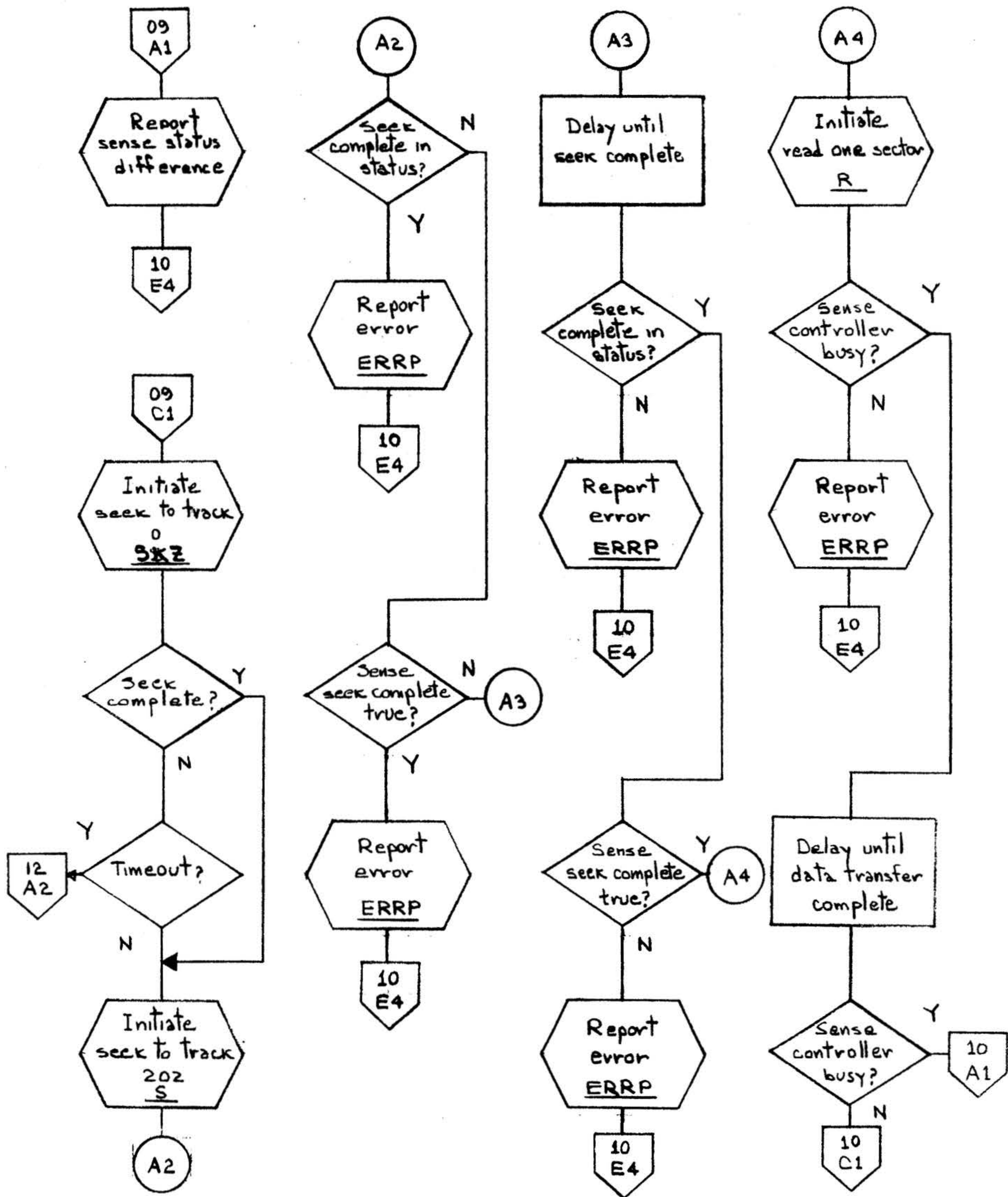
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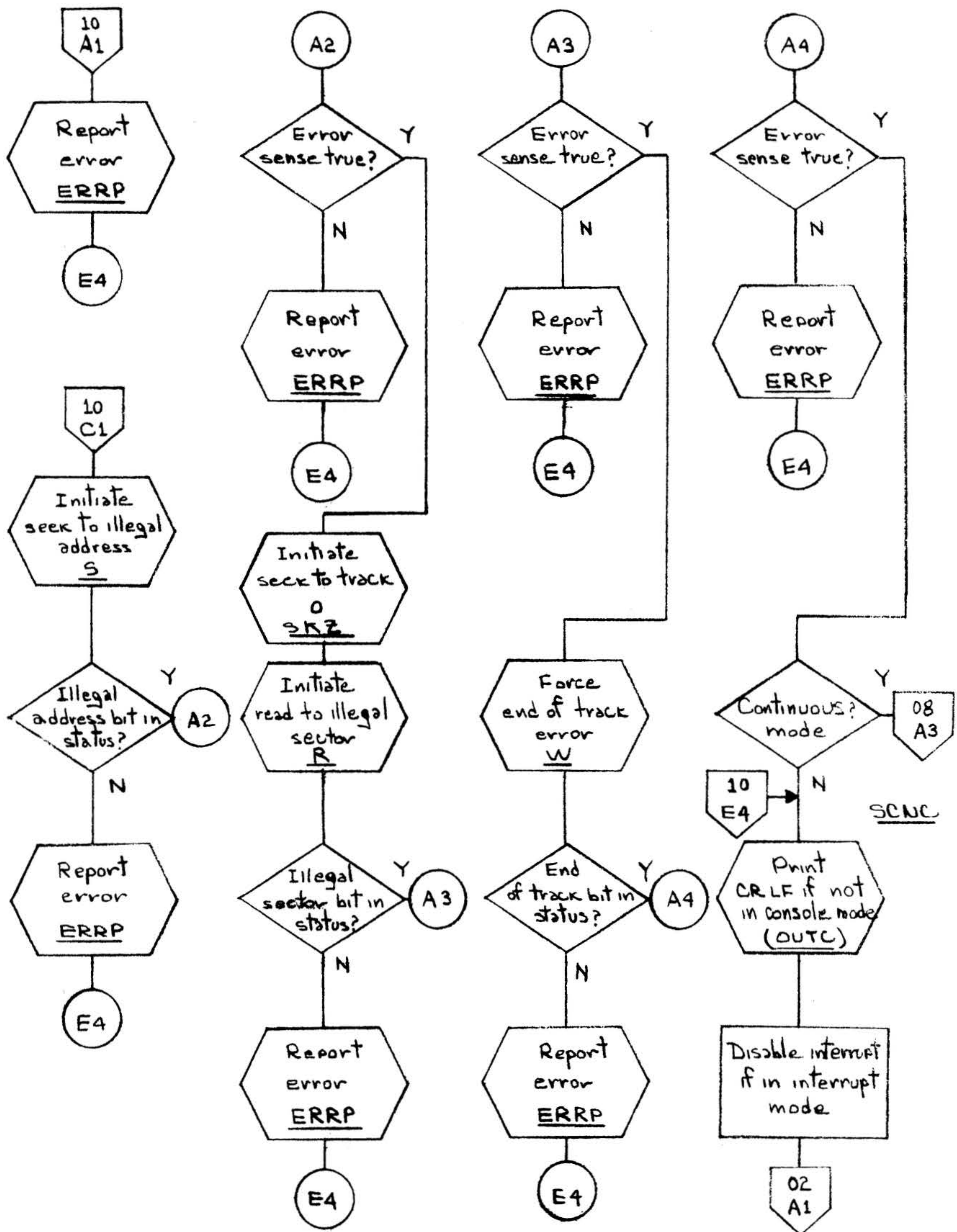
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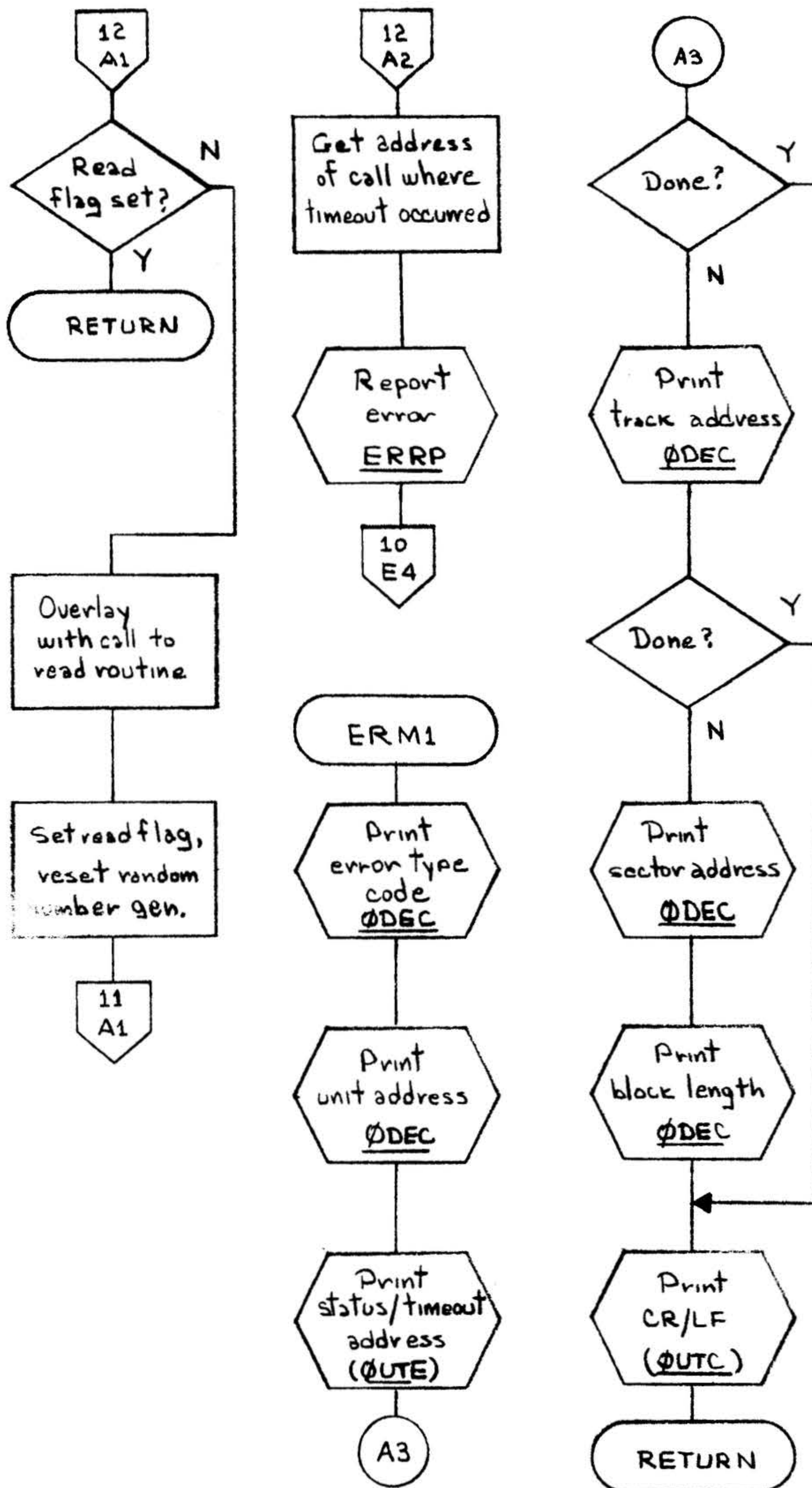
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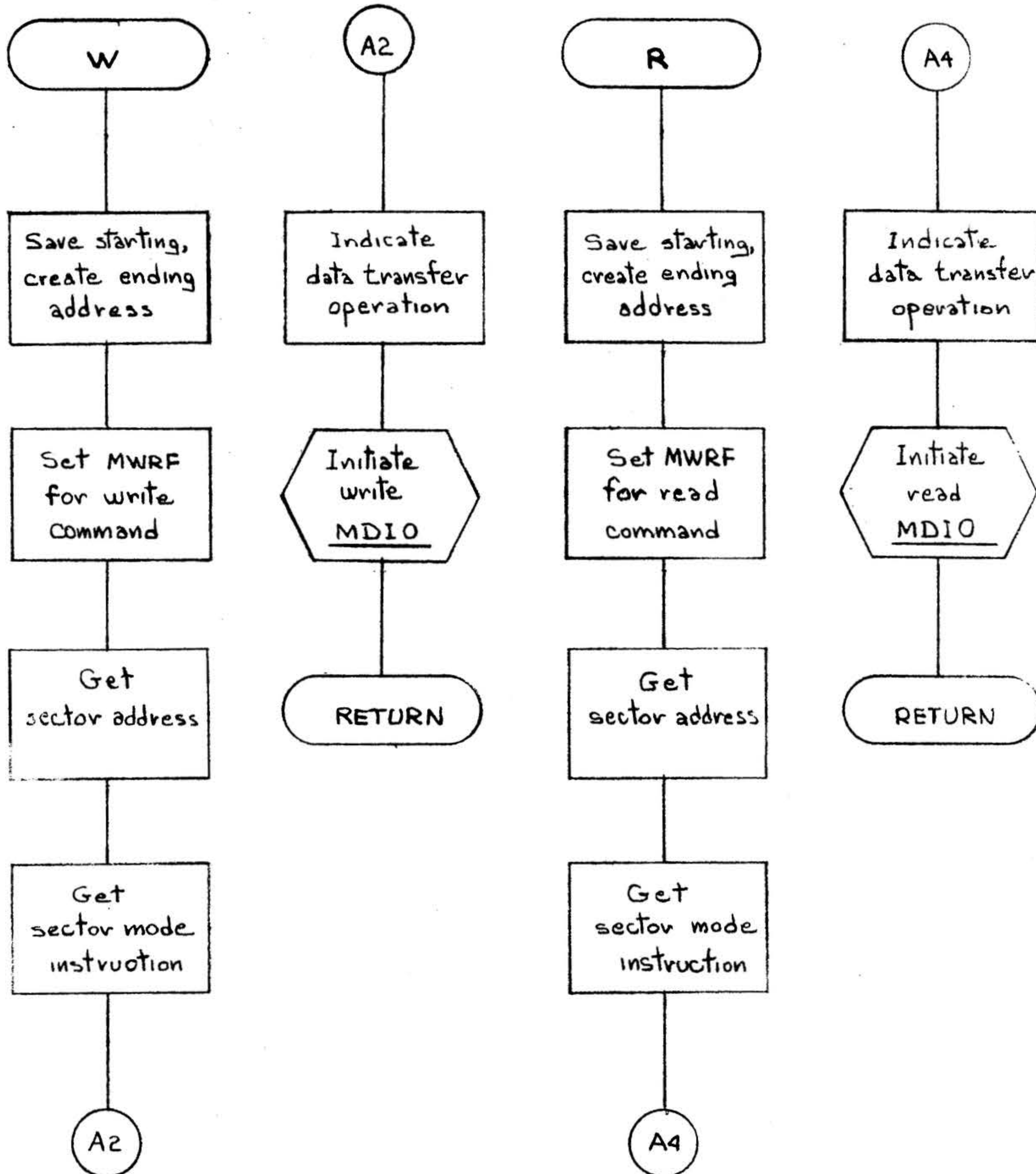
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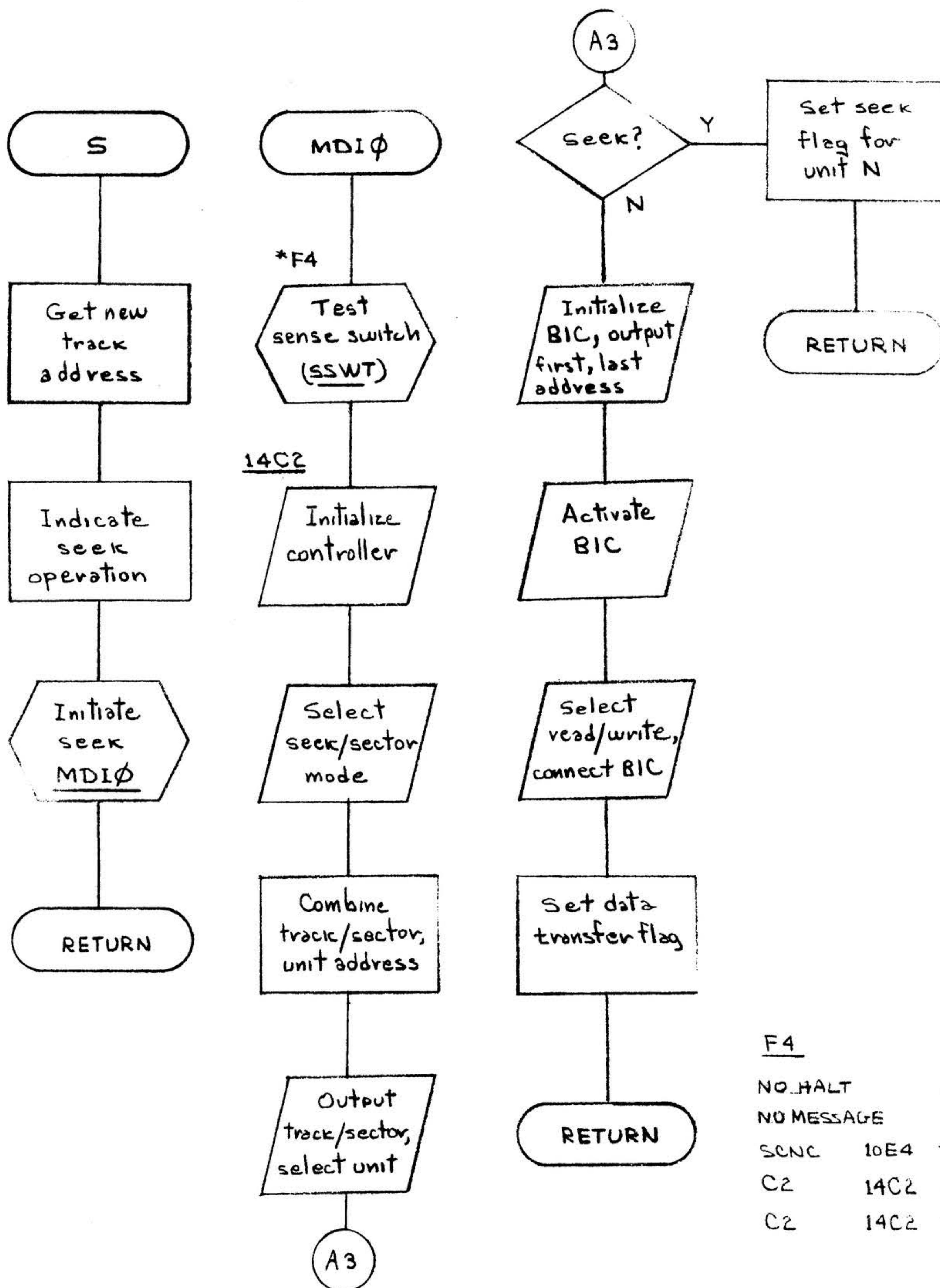
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F4

NO HALT	HALT
NO MESSAGE	MESSAGE
SCNC 10E4	TERMINATE
C2 14C2	LOOP
C2 14C2	CONTINUE



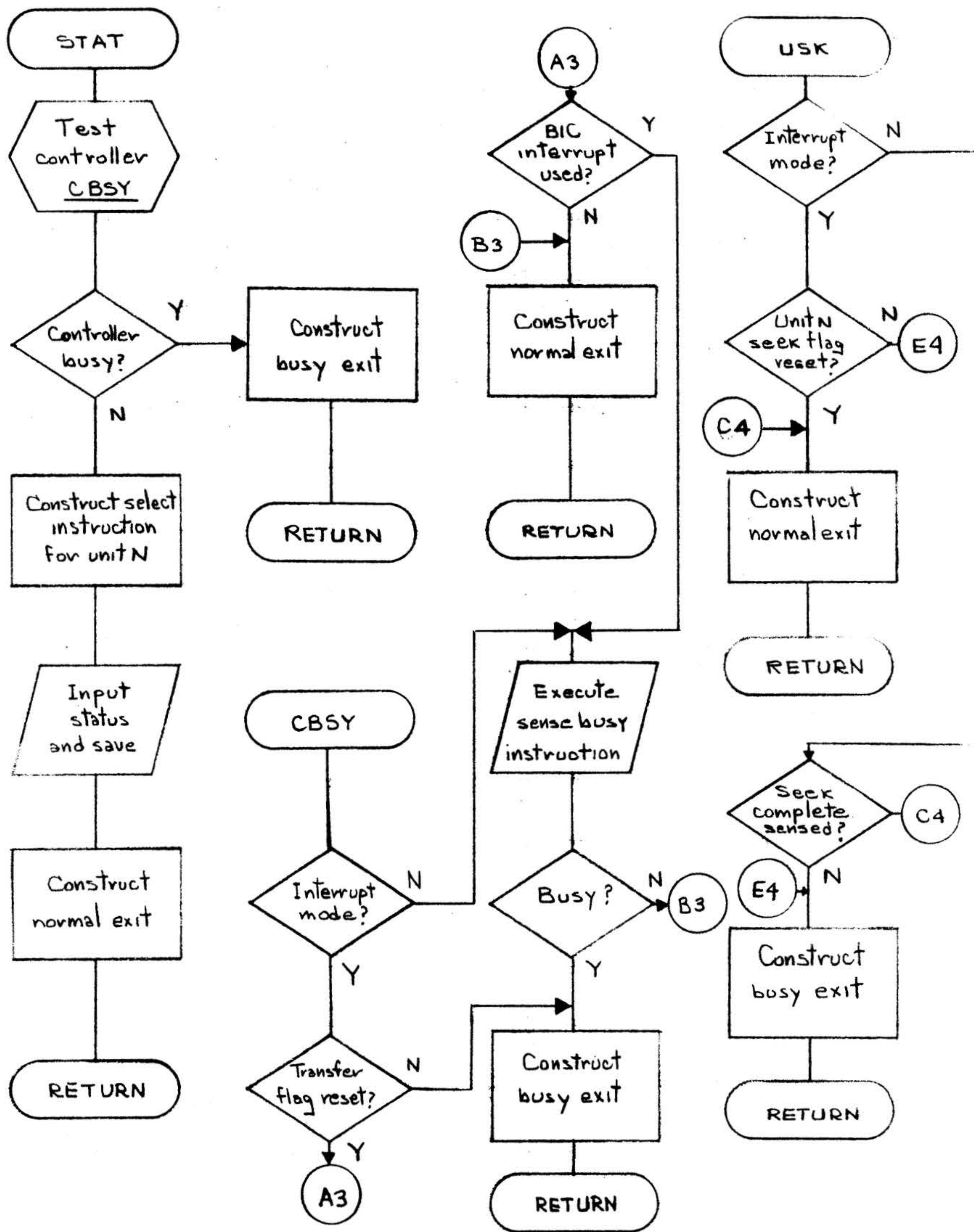
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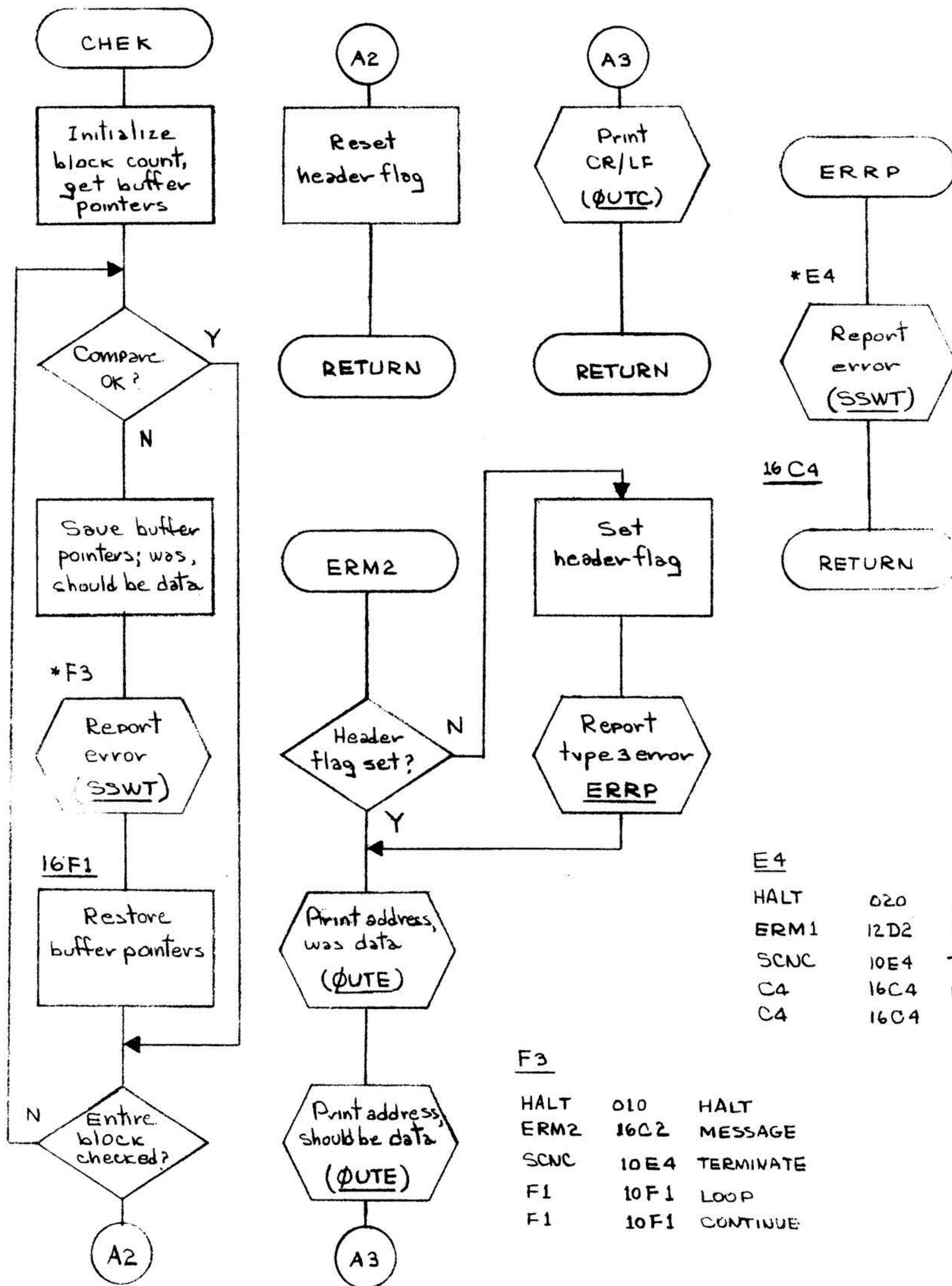
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SECTION 4: TEST SPECIFICATION

4.1 INTRODUCTION

The purpose of the software test procedure is to demonstrate to the extent possible, that the test program achieves its stated aims. This is done by making several passes through the test program, exercising its various features and inducing hardware or procedural errors which the program should detect. The result is the annotated printout which is included in the following section. This printout should also provide additional insight into how to use the test and interpret its results. The software test procedure will also define the hardware configuration used in testing.

4.2 SOFTWARE TEST PROCEDURE

The following test was run on a 620/i with 4K of core, a model 33 ASR teletype, a high-speed paper tape reader, a BIC controller, a priority interrupt module, a 620-37 disc control unit and one disc storage unit assigned as unit 0. The BIC complete interrupt was on PIM line 0, the controller ready interrupt on line 5, and the seek complete interrupt on line 6. (See below for 620-36)

THIS IS THE 620 TEST EXECUTIVE
MEMORY SIZE IS 4K

L.
620-37 MOVING HEAD DISC TEST

DISC CONTROLLER 16.
BIC 20.
INTERRUPTS? (Y/N) N

*W 0,28,120,1760.

*R 0,28,120,1760.

*E 0,12,128,1760.

*S 0,199,1760.

*A 0.

*C 0.



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*D 0.

*M 0.

*T 0.

*

The Maintain II Test Executive program was first loaded. The test program was then loaded using a utility feature of the Test Executive. The sense mode of testing was specified in the initialization dialogue. All of the tests were then executed successfully. [Note that the multiple unit test may be run with a single unit]. The Test Executive was then re-entered through console operations.

THIS IS THE 620 TEST EXECUTIVE
MEMORY SIZE IS 4K

L.

620-37 MOVING HEAD DISC TEST

DISC CONTROLLER 16.

BIC 20.

INTERRUPTS? (Y/N) Y

PIM DEVICE ADDRESS 40.

TRANSFER COMPLETE TRAP LOCATION 112.

BIC COMPLETE USED? (Y/N) N

SEEK COMPLETE TRAP LOCATIONS 114.

PIM INTERRUPT MASK 237.

* 0, 28, 120, 1760.

*R 0, 28, 120, 1760.

*E 0, 12, 128, 1760.

*S 0, 199, 1760.

*A 0.

*C 0.

*D 0.

*M 0.

*T 0.

*



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The test program was reloaded. The program was then run in the interrupt mode. The seek complete interrupt was used, and the completion of data transfers was detected by using the controller ready interrupt. All of the tests were then executed successfully. The Test Executive was then re-entered through console operations.

THIS IS THE 620 TEST EXECUTIVE
MEMORY SIZE IS 4K

L.

620-37 MOVING HEAD DISC TEST

DISC CONTROLLER 16.

BIC 20.

INTERRUPTS? (Y/N) Y

PIM DEVICE ADDRESS 40.

TRANSFER COMPLETE TRAP LOCATION 100.

BIC COMPLETE USED? (Y/N) Y

SEEK COMPLETE TRAP LOCATIONS 114.

PIM INTERRUPT MASK 276.

*W 0,28,120,1760.

*R 0,28,120,1760.

*E 0,12,128,1760.

*S 0,199,1760.

*A 0.

*C 0.

*D 0.

*M 0.

The test program was reloaded. The program was again run in the interrupt mode. For this run the completion of data transfers was detected by using the BIC complete interrupt. All of the tests, with the exception of the sense/status test, were then executed successfully. The sense/status cannot be run using the BIC complete interrupt.



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erase
unit
track
sector
disk block
*W 0,13,120,1760,11111.

*R 0,13,2,1760,22222.

03 00 170017 000 013 008
004705 011111 003613 022222
004706 011111 003614 022222

*R 0,13,120,1760,22222.

*R 0,13,120,1760,22222.
03 00 170017 000 013 120
004705 011111 003613 022222
*
*
*

Data errors were forced by writing one pattern on the disc and checking for another. The second error printout was suppressed by sense switch 1. The third error printout was terminated by sense switch 3.

*R 0,13,1,1760,22222,C.
03 00 170017 000 013 001
004705 011111 003613 022222
03 00 170017 000 013 001

004705 011111 003613 022222

03 00 170017 000 013 001
004705 011111 003613 022222
03 00 170017 000 013 001
004705 011111 003613 022222
*
*

The read test was run in continuous mode and terminated by sense switch 3.

*S 0,216,1760.
02 00 170057 216

*S 0,0,1760.

A seek to an illegal track address was issued to the unit, producing the status shown in the printout. Note that the selected unit illegal address bit is set. [The four high-order bits in the status word will always be on.] A valid seek was then executed to reset this error.



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*W 0, 13, 120, 3760, 33333.
02 00 172017 000 013 120

*W 0, 13, 120, 1760, 33333.

*W 0, 13, 120, 3760, 33333.

The unit was write-protected and an attempt was made to write on this unit. The write protect bit is on in the resultant status word. On the second attempt the write-protect bit was excluded from the status mask in the command string so that this bit was not tested at the completion of the operation. The unit was then write-enabled and the write operation completed.

*R 0, 13, 571, ?
*R 0, 13, 700, ?
*G?

Invalid block lengths and an invalid test mnemonic were entered.

The following test was run on a 620/i with 4K of core, a model 33 ASR teletype, a BIC controller, a 620-36 disc control unit and one disc storage unit assigned as unit 0 (Pack 0 and 1).

This is the 620 Test Executive
Memory size is 4K

L.
620-37 Moving Head Disc Test

Disc Controller 16.
BIC 20.
Interrupts? (Y/N) N

*W 0, 28, 120, 1760.

*R 0, 28, 120, 1760.

*E 0, 12, 128, 1760.

*S 0, 199, 1760.

*A 0.



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*C 0.

*D 0.

*M 0.

*T 0.

*W 1, 28, 120, 1760.

*R 1, 28, 120, 1760.

*E 1, 12, 128, 1760.

*S 1, 199, 1760.

*A 1.

*C 1.

The test program was loaded using the utility feature of the Maintain II Test Executive. The sense mode of testing was specified in the initialization dialogue. All of the tests were then executed successfully on unit 0, pack 0. Several of the tests were then executed on unit 0, pack 1.



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