```
.REM @
```

IDENTIFICATION

PRODUCT CODE: AC-S830E-MC

PRODUCT NAME: CZUDCE0 UDA & DISK DRV DIAG

PRODUCT DATE: 04-OCT-83

MAINTAINER: DIAGNOSTIC ENGINEERING

AUTHOR: MATT TEDONE


```
.REM @
.REM @
```

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1.0 GENERAL INFORMATION

1.1 PROGRAM ABSTRACT

This is the only diagnostic program provided for testing the UDA-50 Unibus Disk Controller and the disk drives connected to it. There are four tests within this diagnostic:

Test # 1 - Unibus Addressing Test. Runs the UDA-50 ROM resident diagnostics, then further tests the Unibus address interface.

Test # 2 - Disk Resident Diagnostic Test. Executes the diagnostics in each disk drive.

Test # 3 - Disk Function Test. Functionally tests each disk drive to ensure the disk can seek, read, write and format.

Test # 4 - Disk Exerciser. Exercises the disk drives in a manner similar to normal operating systems. This test should be used to gain confidence in the reliability of the disk drive.

This program is designed to handle all future disk drives that are attached to the UDA-50 without modifying or rereleasing. This is possible because the disk drives are programmed to tell this diagnostic about all their characteristics that make them different from other drives, such as number of cylinders, sectors per cylinder, etc.

Two other PDP-11 diagnostic programs are provided for the UDA-50 disk subsystem:

CZUDED0 - UDA-50 Disk Drive Formatter.

CXUDFT0 - UDA-50 Disk Drive Formatter Data File

DEC X11 - Unibus Exerciser can be run on the UDA-50 using the UDA-50 module DUBC0.

This diagnostic has been written for use with the Diagnostic Runtime Services Software (Supervisor). These services provide the interface to the operator and to the software environment. For a complete description of the Runtime Services, refer to the XXDP+ User's Manual. There is a brief description of the Runtime Services in section 2 of this document.

This diagnostic will test UDA-50's with modules M7485 and M7486. Whenever a fault is detected in a UDA-50 and the fault can be isolated to one of the two modules in the UDA-50, Replace that module.

1.2 SYSTEM REQUIREMENTS

This program was designed using the PDP-11 Diagnostic Runtime Services revision C. Run time environments are determined by the Runtime Services and may change as new versions of the Services are developed. This program requires the following:

PDP-11 Unibus processor
28K words of memory (minimum)
Console terminal
XXDP+ load media containing this program and the ZUDDEO.PAK data file
One or more UDA50 subsystems. The subsystem controller must be type UDA50-A with microcode level 3 or greater.
Line clock - either Type L or P

The line clock is used for all timed loops in the program. The diagnostic will run on a system with no clock but will hang whenever an event for which the program is waiting does not happen (i.e., a time-out error message will not result).

This diagnostic program requires that the data file ZUDDEO.PAK be on the XXDP+ system device. This data file is ordered under the name CZUDDEO. The XXDP+ system device must remain on-line during the execution of this diagnostic.

2.0 OPERATING INSTRUCTIONS

This section contains a brief description of the Runtime Services. For detailed information, refer to the XXDP+ User's Manual (CHQUS).

2.1 COMMANDS

There are eleven legal commands for the Diagnostic Runtime Services (Supervisor). This section lists the commands and gives a very brief description of them. The XXDP+ User's Manual has more details.

COMMAND	EFFECT
START	Start the diagnostic from an initial state
RESTART	Start the diagnostic without initializing
CONTINUE	Continue at test that was interrupted (after ^C)
PROCEED	Continue from an error halt
EXIT	Return to XXDP+ Monitor (XXDP+ OPERATION ONLY!)
ADD	Activate a unit for testing (all units are considered to be active at start time
DROP	Deactivate a unit
PRINT	Print statistical information (see section 4.0)
DISPLAY	Type a list of all device information
FLAGS	Type the state of all flags (see section 2.3)
ZFLAGS	Clear all flags (see section 2.3)

A command can be recognized by the first three characters. So you may, for example, type "STA" instead of "START".

2.2 SWITCHES

There are several switches which are used to modify supervisor operation. These switches are appendnd to the legal commands. All of the legal switches are tabulated below with a brief description of each. In the descriptions below, a decimal number is designated by "DDDDD".

SWITCH	EFFECT
/TESTS:LIST	Execute only those tests specified in the list. List is a string of test numbers, for example - /TESTS:1:5:7-10. This list will cause tests 1,5,7,8,9,10 to be run. All other tests will not be run.
/PASS:DDDDD	Execute DDDDD passes (DDDDD = 1 to 64000)
/FLAGS:FLGS	Set specified flags. Flags are described in section 2.3.
/EOP:DDDDD	Report end of pass message after every DDDDD passes only. (DDDDD = 1 to 64000)
/UNITS:LIST	TEST/ADD/DROP only those units specified in the list. List example - /UNITS:0:5:10-12 use units 0,5,10,11,12 (unit numbers = 0-63).

Example of switch usage:

```
START/TESTS:1-5/PASS:1000/EOP:100
```

The effect of this command will be: 1) tests 1 through 5 will be executed, 2) all units will tested 1000 times and 3) the end of pass messages will be printed after each 100 passes only. A switch can be recognized by the first three characters. You may, for example, type "/TES:1-5" instead of "/TESTS:1-5".

Below is a table that specifies which switches can be used by each command.

	TESTS	PASS	FLAGS	EOP	UNITS
START	X	X	X	X	X
RESTART	X	X	X	X	X
CONTINUE		X	X	X	
PROCEED			X		
DROP					X
ADD					X
PRINT					
DISPLAY					X
FLAGS					
ZFLAGS					
EXIT					

2.3 FLAGS

Flags are used to set up certain operational parameters such as looping on error. All flags are cleared at startup and remain cleared until explicitly set using the flags switch. Flags are also cleared after a START or RESTART command unless set using the flag switch. The ZFLAGS command may also be used to clear all flags. With the exception of the START, the RESTART and ZFLAGS commands, no commands affect the state of the flags; they remain set or cleared as specified by the last flag switch.

FLAG	EFFECT
HOE	Halt on error - control is returned to runtime services command mode
LOE	Loop on error
IER*	Inhibit all error reports
IBE*	Inhibit all error reports except first level (first level contains error type, number, PC, test and unit)
IXE*	Inhibit extended error reports (those called by PRINTX macro's)
PRI	Direct messages to line printer
PNT	Print test number as test executes
BOE	"BELL" on error
UAM	Unattended mode (no manual intervention)
ISR	Inhibit statistical reports
IDU	Inhibit program dropping of units
LOT	Loop on test

*Error messages are described in section 3.1

See the XXDP+ User's Manual for more details on flags. You may specify more than one flag with the FLAG switch. For example, to cause the program to loop on error, inhibit error reports and type a "BELL" on error, you may use the following string:

```
/FLAGS:LOE:IER:BOE
```

2.4 HARDWARE QUESTIONS

When a diagnostic is STARTed, the Runtime Services will prompt the user for hardware information by typing "CHANGE HW (L) ?" . When you answer this question with a "Y", the Runtime Services will ask for the number of units (in decimal). You will then be asked the following questions for each unit. When you answer this question with an "N", the Runtime Services will use the answers built into the program by the SETUP utility (see chapter 6 of the XXDP+ User's Manual). If you have never run the SETUP utility on this program file, the default values listed below (just before the question mark) will be used.

UNIBUS ADDRESS OF UDA (O) 172150 ?

Answer with the address of the UDAIP register of one UDA as addressed by the processor with memory management turned off (i.e., an even 16-bit address in the range of 160000 to 177774).

VECTOR (O) 154 ?

Answer with the interrupt vector address of the UDA. A vector address in the range of 4 to 774 may be specified. The UDA does not have a vector "hard wired" to it, so any vector not being used by this program and XXDP+ may be used.

BR LEVEL (D) 5 ?

Answer with the interrupt priority used by the UDA. Levels 4 to 7 are accepted. This level must match the level "hard wired" in the UDA by the priority plug.

UNIBUS BURST RATE (D) 63 ?

The UDA allows the ability to control the maximum number of words transferred across the UNIBUS each time the UDA becomes master. The default answer of 63 will allow for the fastest execution of this diagnostic program. You may answer with the value your operating system uses or use zero which will tell the UDA to supply a value that should work on any system. A decimal number in the range of 0 to 63 may be specified and all values should work on any system. A larger value will allow for a faster running program. The value will be passed directly to the UDA during initialization.

DRIVE NUMBER (D) 0 ?

Answer with the drive number of the drive you wish to test. This is the number which appears on the "unit plug" on the front of the disk drive. On a multi-unit drive, each sub-unit on the drive must be tested as a separate unit to completely test the drive. A maximum of eight logical drives may be tested on one UDA at a time (UDA configuration limit).

EXERCISE ON CUSTOMER DATA AREA IN TEST 4 (L) N ?

Answer "N" to have test 4 (drive exerciser) run on the diagnostic area of the disk. Answer "Y" to run on the customer data area. A "Y" answer will destroy any customer data that may be on the disk. A warning message will be printed before testing begins if this question is answered "Y".

CUSTOMER DATA WILL BE DESTROYED ON:

UNIT	UDA AT	DRIVE
xx	xxxxxx	xxx

Unless the diagnostic is being run in unattended mode (i.e., START/FLAG:UAM command), a confirmation will also be required as follows:

ARE YOU SURE CUSTOMER DATA CAN BE DESTROYED (L) ?

If the above question is answered "N", the entire diagnostic will stop and the Runtime Services prompt will be displayed. No default answer is provided for this question.

2.5 SOFTWARE QUESTIONS

After you have answered the hardware questions or after a RESTART or CONTINUE command, the Runtime Services will ask for software parameters. You will be prompted by "CHANGE SW (L) ?" If you wish to change any parameters, answer by typing "Y". The software questions and the default values are described in the next paragraphs.

ENTER MANUAL INTERVENTION MODE FOR SPECIAL DIAGNOSIS (L) N ?

Tests 2 and 4 have manual intervention modes which allow additional parameters to be input to alter the normal testing of a disk drive. This question should normally be answered "N" when this diagnostic is first run. Then, depending on the errors detected, it may be desirable to change this answer to "Y" and alter the testing to further isolate the problem. If this question is answered "Y", and the UAM (unattended mode operation) flag is set, tests 2 and 4 will print a warning message that the mode cannot be entered and will proceed as if answered "N". See the description of the individual tests in section 5 for more information.

REMAINING SOFTWARE QUESTIONS APPLY TO TEST 4 ONLY

This informational message is printed to describe the use of the remaining questions. If test 4 is not being run, a "CONTROL Z" can be typed to bypass them.

ERROR LIMIT (D) 32 ?

Enter the number of hard errors allowed before a drive is dropped from exercise by test 04. A number in the range of 1 to 65535 will be accepted.

READ TRANSFER LIMIT IN MEGABYTES - 0 FOR NO LIMIT (D) 0 ?

When the specified number of bytes have been read from a drive by test 04, the drive will be dropped from testing. When all drives are dropped, an end of pass will be indicated and the selected tests will be run again. This is the method used to determine how long test 04 is to run. Answer with a zero to prevent test from ending. The only other way test 04 can end is to have all drives dropped because the error limit on each is exceeded. Of course, the operator can always stop test 04 by typing a control-C.

SUPPRESS PRINTING SOFT ERRORS (L) Y?

When test #4 needs to perform retries, soft error reports will be printed to give as much information as possible. These actions are considered normal operation and are not error conditions until the retries fail. When the test is being run only to see how reliable the drive performs, this question should be answered "Y" so they are not confused with hard errors. The number of these soft errors is always reported in the statistical report. Answer "N" to see all the soft error reports.

DO INITIAL WRITE ON START (L) Y ?

If test #4 is to do data compares, the drive will need to be written with data patterns readable by the program.

If the diagnostic area is selected for testing, the initial write is always performed (regardless of how this question is answered).

If the customer data area is selected for testing, the initial write will be performed when all of the following are true:

1. This question is answered "Y".
2. This is the first time test #4 is being run after a START command.
3. The disk is write enabled.

Answering this question "N" when testing on the customer data area will normally result in data comparison errors if the disk was not previously written by this diagnostic or the formatter.

Note that write checks are not performed during the initial write.

ENABLE ERROR LOG (L) N ?

A "Y" answer will cause error messages in test #4 to be stored in a log buffer. Once the log buffer is full, additional error information is lost. The contents of the log buffer will be printed when test #4 is stopped and a statistical report requested. This log feature is intended to allow the Digital Diagnosis Center (DDC) to start test #4 then hang up from the system and let it run for some period of time. DDC can call the system back later, type control-C, then CONT and see the errors that have occurred (up to the limit of the log buffer). A message will be printed to indicate no errors have occurred if the log buffer is empty. Test #4 will not be allowed to end while the error log is enabled until the error log is printed. The log buffer will hold 30 error messages when one disk unit is being tested. The log buffer will decrease in size as more units are tested.

2.6 EXTENDED P-TABLE DIALOGUE

When you answer the hardware questions, you are building entries in a table that describes the devices under test. The simplest way to build this table is to answer all questions for each unit to be tested. If you have a multiplexed device such as a mass storage controller with several drives or a communication device with several lines, this becomes tedious since most of the answers are repetitious.

To illustrate a more efficient method, suppose you are testing a fictional device, the XY11. Suppose this device consists of a control module with eight units (sub-devices) attached to it. These units are described by the octal numbers 0 through 7. There is one hardware parameter that can vary among units called the Q-factor. This Q-factor may be 0 or 1. Below is a simple way to build a table for one XY11 with eight units.

```
# UNITS (0) ?  8<CR>

UNIT 1
CSR ADDRESS (0) ?  160000<CR>
SUB-DEVICE # (0) ?  0<CR>
Q-FACTOR (0) 0 ?  1<CR>

UNIT 2
CSR ADDRESS (0) ?  160000<CR>
SUB-DEVICE # (0) ?  1<CR>
Q-FACTOR (0) 1 ?  0<CR>

UNIT 3
CSR ADDRESS (0) ?  160000<CR>
SUB-DEVICE # (0) ?  2<CR>
Q-FACTOR (0) 0 ?  <CR>

UNIT 4
CSR ADDRESS (0) ?  160000<CR>
SUB-DEVICE # (0) ?  3<CR>
Q-FACTOR (0) 0 ?  <CR>

UNIT 5
CSR ADDRESS (0) ?  160000<CR>
SUB-DEVICE # (0) ?  4<CR>
Q-FACTOR (0) 0 ?  <CR>

UNIT 6
CSR ADDRESS (0) ?  160000<CR>
SUB-DEVICE # (0) ?  5<CR>
Q-FACTOR (0) 0 ?  <CR>

UNIT 7
CSR ADDRESS (0) ?  160000<CR>
SUB-DEVICE # (0) ?  6<CR>
Q-FACTOR (0) 0 ?  1<CR>
```

```
UNIT 8
CSR ADDRESS (O)  160000<CR>
SUB-DEVICE # (O) ?  7<CR>
Q-FACTOR (O) 1 ?  <CR>
```

Notice that the default value for the Q-factor changes when a non-default response is given. Be careful when specifying multiple units!

As you can see from the above example, the hardware parameters do not vary significantly from unit to unit. The procedure shown is not very efficient.

The Runtime Services can take multiple unit specifications however. Let's build the same table using the multiple specification feature.

```
# UNITS (D) ?  8<CR>

UNIT 1
CSR ADDRESS (O) ?  160000<CR>
SUB-DEVICE # (O) ?  0,1<CR>
Q-FACTOR (O) 0 ?  1,0<CR>

UNIT 3
CSR ADDRESS (O) ?  160000<CR>
SUB-DEVICE # (O) ?  2-5<CR>
Q-FACTOR (O) 0 ?  0<CR>

UNIT 7
CSR ADDRESS (O) ?  160000<CR>
SUB-DEVICE # (O) ?  6,7<CR>
Q-FACTOR (O) 0 ?  1<CR>
```

As you can see in the above dialogue, the runtime services will build as many entries as it can with the information given in any one pass through the questions. In the first pass, two entries are built since two sub-devices and q-factors were specified. The Services assume that the CSR address is 160000 for both since it was specified only once. In the second pass, four entries were built. This is because four sub-devices were specified. The "-" construct tells the Runtime Services to increment the data from the first number to the second. In this case, sub-devices 2, 3, 4 and 5 were specified. (If the sub-device were specified by addresses, the increment would be by 2 since addresses must be on an even boundary.) The CSR addresses and Q-factors for the four entries are assumed to be 160000 and 0 respectively since they were only specified once. The last two units are specified in the third pass.

The whole process could have been accomplished in one pass as shown below.

```
# UNITS (D) ?  8<CR>

UNIT 1
CSR ADDRESS (0) ?  160000<CR>
SUB-DEVICE # (0) ?  0-7<CR>
Q-FACTOR (0) 0 ?  0,1,0,,,,1,1<CR>
```

As you can see from this example, null replies (commas enclosing a null field) tell the Runtime Services to repeat the last reply.

2.7 QUICK START-UP PROCEDURE

To start-up this program:

1. Boot XXDP+
2. Give the date and answer the LSI and 50HZ (if there is a clock) questions
3. Type "R ZUDCEO"
4. Type "START"
5. Answer the "CHANGE HW" question with "Y"
6. Answer all the hardware questions
7. Answer the "CHANGE SW" question with "N"

When you follow this procedure you will be using only the defaults for flags and software parameters. These defaults are described in sections 2.3 and 2.5.

Sample of terminal dialogue to test two disks on one UDA-50:

```
DR>STA/FLA:PNT

CHANGE HW (L)  ? Y

# UNITS (D)  ? 2

UNIT 0
UNIBUS ADDRESS OF UDA (O)  172150 ?
VECTOR (O)  154 ?
BR LEVEL (D)  5 ?
UNIBUS BURST RATE (D) ?
DRIVE NUMBER (D) 0,1
EXERCISE ON CUSTOMER DATA AREA IN TEST 4 (L) N ?

CHANGE SW (L)  ? N

TST: 001
TESTING INTERRUPT ABILITY OF UDA AT ADR 172150 VEC 154...COMPLETED

TST: 002
TST: 003
TST: 004

UNIT 0 UDA AT 172150 DRIVE 0   RUNTIME 0:02:43
INITIAL WRITE COMPLETE

UNIT 1 UDA AT 172150 DRIVE 1   RUNTIME 0:05:31
INITIAL WRITE COMPLETE

TEST 4 IN PROGRESS.     RUNTIME 0:15:00

UNIT DRIVE      SERIAL-NUMBER SEEKS MBYTES  MBYTES  HARD    SOFT    ECC
                              X1000 READ    WRITTEN ERRORS ERRORS
   0     0                0     3      9       6       0       0       0
   1     1                1     3      8       6       0       0       0
```

Sample of terminal dialogue going through software questions to specify transfer limit (one disk being tested).

```
DR>STA/FLA:PNT

CHANGE HW (L)  ? N

CHANGE SW (L)  ? Y

ENTER MANUAL INTERVENTION MODE FOR SPECIAL DIAGNOSIS (L) N ?

REMAINING SOFTWARE QUESTIONS APPLY TO TEST 4 ONLY

ERROR LIMIT (D)  32 ?
READ TRANSFER LIMIT IN MEGABYTES - 0 FOR NO LIMIT (D)  0 ? 5
SUPPRESS PRINTING SOFT ERRORS (L) Y ?
DO INITIAL WRITE ON START (L) Y ?
ENABLE ERROR LOG (L) N ?

TST: 001
TESTING INTERRUPT ABILITY OF UDA AT ADR 172150 VEC 154...COMPLETED

TST: 002
TST: 003
TST: 004

UNIT 0 UDA AT 172150 DRIVE 0   RUNTIME 0:02:43
INITIAL WRITE COMPLETE

UNIT 0 UDA AT 172150 DRIVE 0   RUNTIME 0:09:41
REACHED TRANSFER LIMIT - TESTING STOPPED

TEST 4 IN PROGRESS.    RUNTIME 0:09:41

UNIT DRIVE      SERIAL-NUMBER SEEKS MBYTES  MBYTES  HARD    SOFT    ECC
                              X1000 READ  WRITTEN ERRORS ERRORS
   0     0                     0     2       5       4       0       0     0

CZUDC EOP     1
    0 CUMULATIVE ERRORS
TST: 001
TESTING INTERRUPT ABILITY OF UDA AT ADR 172150 VEC 154...COMPLETED

TST: 002
.
.
.
```

3.0 ERROR INFORMATION

3.1 TYPES OF ERROR MESSAGES

There are three levels of error messages that may be issued by a diagnostic: general, basic and extended. General error messages are always printed unless the "IER" flag is set (section 2.3). The general error message is of the form:

```
NAME  TYPE  NUMBER  ON UNIT NUMBER  TST NUMBER PC:XXXXXX
error message
```

where: NAME = diagnostic name
TYPE = error type (SYS FTL ERR, DEV FTL ERR, HRD ERR or SFT ERR)
NUMBER = error number
UNIT NUMBER = 0 - N (N is last unit in PTABLE)
TST NUMBER = test and subtest where error occurred
PC:XXXXXX = address of error message call

System fatal errors (SYS FTL ERR) are used to report errors that are fatal to the entire diagnostic program. The diagnostic stops and the Runtime Services prompt is printed.

Device fatal errors (DVC FTL ERR) are used to report errors that are fatal to the device (may be either a UDA-50 or disk drive). Testing stops on that device for the remainder of the current test.

Hard errors (HRD ERR) reports most of the errors detected. Testing will normally continue after the printing of the error.

Soft errors (SFT ERR) are used only in test 4. They present information about an error for which recovery will be attempted. These are printed only if the SUPPRESS PRINTING SOFT ERRORS software question is answered "N" and are used only to provide a greater detail of information. During the error recovery attempt, several soft errors may be printed. Unless the soft errors are followed by a hard error message, the error condition was corrected and testing proceeds.

Basic error messages are messages that contain some additional information about the error. These are always printed unless the "IER" or "IBE" flags are set (section 2.3). These messages are printed after the associated general message.

Extended error messages contain supplementary error information such as register contents or good/bad data. These are always printed unless the "IER", "IBE" or "IXE" flags are set (section 2.3). These messages are printed after the associated general error message and any associated basic error messages.

The general and basic error messages from this diagnostic are always one line each. The basic message defines what program detected the error, the drive being tested and the time of the error.

The PDP-11 program that is loaded into memory when you give the "R ZUDCE0" command to the XXDP+ monitor is only a small part of this diagnostic. A data file called ZUDDE0.PAK on the system load device (the same device from which the "R" command read the PDP-11 program) contains four programs which are read from the file and loaded into the UDA-50 for execution. These programs are called "diagnostic machine" or DM programs. The "diagnostic machine" is the facility in the UDA-50 which executes a PDP-11 like pogram. The large majority of the testing is done by these four "diagnostic machine" programs. Once the PDP-11 program has loaded and started the "diagnostic machine" program, all it does is respond to requests from that program. These requests include such things as telling the "diagnostic machine" which disks on that UDA-50 are to be tested, printing an error message and updating statistics which are printed in the statistical report (see section 4.0).

The basic message (the second line of every error message) will be one of the following:

HOST PROGRAM UDA AT xxxxxx RUNTIME hhh:mm:ss

The host program (PDP-11) detected the error. UDA AT xxxxx identifies the address of the UDA-50 being tested. It may be omitted if the error is not specific to one UDA-50.

UNIBUS ADDRESSING DM PC:xxxx UDA AT xxxxxx RUNTIME hhh:mm:ss

The "diagnostic machine" program loaded in test 1 detected the error. DM PC xxxx identifies the address in the "diagnostic machine" program where the error message is reported.

DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss

The "diagnostic machine" program loaded in test 2 detected the error. DM PC xxxx identifies the address in the "diagnostic machine" program where the error message is reported. DRIVE xxx identifies the drive number.

DISK FUNCTIONAL DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss

The "diagnostic machine" program loaded in test 3 detected the error.

DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss

The "diagnostic machine" program loaded in test 4 detected the error.

Sample error message:

```
CZUDC DVC FTL ERR  00021 ON UNIT 00 TST 001 SUB 003 PC: xxxxxx      - general message
HOST PROGRAM  UDA AT 172150  RUNTIME 0:00:12                        - basic message
UDA RESIDEN. DIAGNOSTICS DETECTED FAILURE                          \
  UDASA CONTAINS 104041                                             )- extended message
REPLACE UDA MODULE M7485                                           /
```

Informational messages are also printed by this program. They are usually one or two lines in length. They are printed as extended messages and are always printed unless the "IER", "IBE" or "IXE" flags are set.

Sample informational message:

```
UNIT 0  UDA AT 172150  DRIVE 0  RUNTIME 0:02:43
INITIAL WRITE COMPLETE
```

3.2 SPECIFIC ERROR MESSAGES

Following is a list of the error messages that may be printed by the diagnostic program. In the list, some of the numbers that may vary with execution or program version are shown as "xxx". These include program counters and runtime. Other numbers, such as unit number, drive number, UDA-50 address and data in registers are filled with sample numbers. Additional information about the error may follow the error message.

3.2.1 HOST PROGRAM ERROR MESSAGES (00001 to 00999)

00001 CZUDC SYS FTL ERR 00001 ON UNIT 00 TST xxx SUB 000 PC: xxxxxx
HOST PROGRAM UDA AT 172150 RUNTIME x:xx:xx
I DON'T LIKE THE ANSWERS YOU GAVE TO THE HARDWARE QUESTIONS
UDA HAS MORE THAN ONE VECTOR, BR LEVEL OR BURST RATE

When the hardware questions were answered, two units were selected with the same UNIBUS address but with a different vector, BR level or burst rate. A single UDA-50 can have only one vector, BR level or burst rate. The program is aborted and returns to the Runtime Services prompt so that you can change the hardware questions.

00002 CZUDC SYS FTL ERR 00002 ON UNIT 00 TST xxx SUB 000 PC: xxxxxx
HOST PROGRAM UDA AT 172150 RUNTIME x:xx:xx
I DON'T LIKE THE ANSWERS YOU GAVE TO THE HARDWARE QUESTIONS
TWO UNITS SELECT THE SAME DRIVE

The hardware questions for two units were exactly the same. The program is aborted and returns to the Runtime Services prompt so that you can change the hardware questions.

00003 CZUDC SYS FTL ERR 00003 ON UNIT 00 TST xxx SUB 000 PC: xxxxxx
HOST PROGRAM UDA AT 172150 RUNTIME x:xx:xx
I DON'T LIKE THE ANSWERS YOU GAVE TO THE HARDWARE QUESTIONS
MORE THAN EIGHT DRIVES SELECTED ON THIS UDA

Up to four physical disk drives can be attached to a UDA-50 at one time. A physical disk drive may be from one to four logical disk drives. Each logical disk drive is considered one unit to the diagnostic program. Even though more than eight logical disk drives can be attached to one UDA-50, the UDA-50 only supports eight. The program is aborted and returns to the Runtime Services prompt so that you can change the hardware questions.

00004 CZUDC SYS FTL ERR 00004 ON UNIT 00 TST xxx SUB 000 PC: xxxxxx
HOST PROGRAM RUNTIME x:xx:xx
NOT ENOUGH ROOM IN MEMORY TO TEST THE UNITS SELECTED
PLEASE START PROGRAM OVER AND TEST FEWER UNITS AT A TIME

This program does not limit the number of units that can be tested by specifying a maximum number. What limits the number is the amount of memory used to store data on each unit. You have exceeded the number of units that are testable at one time. Start program over and select fewer units.

00005 CZUDC SYS FTL ERR 00005 ON UNIT 00 TST xxx SUB 000 PC: xxxxxx
HOST PROGRAM RUNTIME x:xx:xx
CHECKSUM ERROR IN DM PROGRAM FILE

As a DM program is read from the load media, a checksum is calculated. If the checksum contained in the file does not match what is calculated, an error reading the data file is declared. Restore the data file ZUDDE0.PAK to your load media.

00006 CZUDC SYS FTL ERR 00006 ON UNIT 00 TST xxx SUB 000 PC: xxxxxx
HOST PROGRAM RUNTIME x:xx:xx
TABLE INCONSISTANCY ERROR. PLEASE RE-LOAD PROGRAM

When the host program is started, controller tables are set according to the P-tables. Error 00006 will occur if the tables were corrupted after restarting the diagnostic. Load and start your program again.

00007 CZUDC SYS FTL ERR 00007 ON UNIT 00 TST xxx SUB 000 PC: xxxxxx
HOST PROGRAM RUNTIME x:xx:xx
ERROR IN DM PROGRAM FILE. DM PROGRAM NOT FOUND

The host program was not able to read the DM program from the load media properly. Restore the data file ZUDDE0.PAK to your load media.

00008 CZUDC SYS FTL ERR 00008 ON UNIT 00 TST xxx SUB 000 PC: xxxxxx
HOST PROGRAM UDA AT 172150 RUNTIME x:xx:xx
I DON'T LIKE THE ANSWERS YOU GAVE TO THE HARDWARE QUESTIONS
TWO UDA'S USE THE SAME VECTOR

The hardware questions for two units specified different UDA-50 Unibus addresses but identical vector addresses. The program is aborted and returns to the Runtime Services prompt so that you can change the hardware questions.

00010 CZUDC DVC FTL ERR 00010 ON UNIT 00 TST xxx SUB 000 PC: xxxxxx
HOST PROGRAM UDA AT 172150 RUNTIME x:xx:xx
WRONG APT DIAGNOSTIC IS BEING USED WITH THIS CONTROLLER
USE CIUDx

The APT diagnostics are designed to run with one type of UDA-50 board set (either M7161-2 or M7485-6). For example, If the user is running CIUDA with a UDA-50 M7485-6 type, this error will occur. In that case the user will be told to use CIUDF. The following is a detailed description of which test is used with what configuration.

CIUDF - UDA-50 with M7485-6 modules runs tests 1-3
CIUDG - UDA-50 with M7485-6 modules runs test 4
CIUDH - UDA-50 with M7485-6 modules runs tests 1-3
CIUDI - UDA-50 with M7485-6 modules runs test 4

00014 CZUDC DVC FTL ERR 00014 ON UNIT 00 TST xxx SUB xxx PC: xxxxxx
HOST PROGRAM UDA AT 172150 RUNTIME x:xx:xx
UDA50 CONTROLLER IS AT A REVISION LEVEL NO LONGER SUPPORTED
BY THIS DIAGNOSTIC PROGRAM. THIS PROGRAM REQUIRES A UDA50-A
CONTROLLER (MODEL 6) WITH MICROCODE REVISON AT 3 OR GREATER.

CONTROLLER REPORTED MODEL CODE xx AND MICROCODE VERSION xx

All UDA50-0's (modules M7161-2) are not supported by this diagnostic. The module set M7485-6 is the only one that can be tested by this diagnostic. If the controller is a UDA50-0 (M7161-2) it will not be tested. If the controller is a UDA50-A (M7485-6) and it has old microcode (the microcode version is less than 3) this message will be printed but testing will go on. If the controller consists of the M7161-2 modules, install one with M7485-6 modules. Do not intermix the two, it will not work!

00021 CZUDC DVC FTL ERR 00021 ON UNIT 00 TST 001 SUB 003 PC: xxxxxx
HOST PROGRAM UDA AT 172150 RUNTIME x:xx:xx
UDA RESIDENT DIAGNOSTICS DETECTED FAILURE
UDASA CONTAINS 105154
REPLACE UDA MODULE M7486

The UDA Resident diagnostic detected a failure. The error is displayed in the UDASA. Here are the possible error values and their meaning:

104000 - Fatal sequncer error
104040 - D processor ALU error
104041 - D proc ROM parity error
105102 - D proc with no Board #2 or RAM parity error
105105 - D proc RAM buffer error
105152 - D proc SDI error
105153 - D proc write mode wrap SERDES error
105154 - D proc read mode SERDES, RSGEN, and ECC error
106040 - U proc ALU error
106041 - U proc Control Register error
106042 - U proc DFAIL/ROM parity error/Board #1 test count is wrong
106047 - U proc Constant ROM error with D proc running SDI test
106055 - Unexpectant trap found, aborted diagnostic
106071 - U proc ROM error
106072 - U proc ROM parity error
106200 - Step 1 data error (MSB not set)
107103 - U proc RAM parity error
107107 - U proc RAM buffer error
107115 - Board #2 test count was wrong
112300 - Step 2 error
122240 - NPR error
122300 - Step 3 error
142300 - Step 4 error

Replace the board specified. M7485 is the Unibus interface board. M7486 is the SDI interface board.

00022 CZUDC DVC FTL ERR 00022 ON UNIT 00 TST 001 SUB 003 PC: xxxxxx
HOST PROGRAM UDA AT 172150 RUNTIME x:xx:xx
STEP BIT DID NOT SET IN UDASA REGISTER DURING INITIALIZATION
STEP BIT EXPECTED 004000
UDASA CONTAINS 000000
REPLACE UDA MODULE M7485

The UDA did not respond as expected during the initialization sequence which communicates using data in the UDASA register. A normal response from the UDA contains either a STEP bit or an ERROR bit defined as follows:

Bit 15 (100000)	Error bit
Bit 14 (040000)	Step 4 bit
Bit 13 (020000)	Step 3 bit
Bit 12 (010000)	Step 2 bit
bit 11 (004000)	Step 1 bit

The expected step bit nor the error bit set within the expected time.

00023 CZUDC DVC FTL ERR 00023 ON UNIT 00 TST 001 SUB 005 PC: xxxxxx
HOST PROGRAM UDA AT 172150 RUNTIME x:xx:xx
UDA DID NOT CLEAR RING STRUCTURE IN HOST MEMORY DURING INITIALIZATION
6 WORDS WERE TO BE CLEARED STARTING AT ADDRESS 040644
FIRST SEVERAL WORDS NOT CLEARED (UP TO 6):

ADDRESS	CONTENTS
040644	000010
040650	000010
040652	000010

REPLACE UDA MODULE M7485

The UDA is to clear the ring structure (a communications area used by the UDA to talk to the host) in host memory before Step 4 of initialization. If the UDA diagnostics did not clear memory and did not flag an error, then error message 00023 is displayed. The contents of each word in memory is set to 177777 before the test. Failure of the UDA to clear each word indicates a fault in the address interface to the Unibus.

00024 CZUDC DVC FTL ERR 00024 ON UNIT 00 TST 001 SUB 006 PC: xxxxxx
HOST PROGRAM UDA AT 172150 RUNTIME x:xx:xx
UDASA REGISTER DID NOT GO TO ZERO AFTER STEP 3 WRITE OF INITIALIZATION
PURGE/POLE DIAGNOSTICS WERE REQUESTED
UDASA CONTENTS 004400

For better testing, the host can test the PURGE and POLE mechanism of the UDA. To do so the host sets bit15 of the step 3 data and sends the data to the UDA. The UDA must go to zero and wait for the purge and pole. If the UDA never went to zero, then error message 00024 is displayed. The UDA may have a bad M7485 module or the UNIBUS maybe broken.

00025 CZUDC DVC FTL ERR 00025 ON UNIT 00 TST xxx SUB 000 PC: xxxxxx
HOST PROGRAM UDA AT 172150 RUNTIME x:xx:xx
UDA DID NOT RETURN CORRECT DATA IN UDASA REGISTER DURING INITIALIZATION
UDASA EXPECTED 004400
UDASA CONTAINS 004000
REPLACE UDA MODULE M7485

For each step of initialization, specific data is expected to be displayed in the UDASA. If the UDASA does not match the expected data, then error message 00025 is displayed. Replace UDA module M7485.

00026 CZUDC DVC FTL ERR 00026 ON UNIT 00 TST xxx SUB 000 PC: xxxxxx
HOST PROGRAM UDA AT 172150 RUNTIME x:xx:xx
DATA COMPARISON ERROR DURING DIAGNOSTIC PORT LOOP TEST
DATA SENT TO UDASA 000001
RECEIVED FROM UDASA 000000
REPLACE UDA MODULE M7485

The UDA can be put into a mode where the UDASA acts as a wrap port. While the UDA is in this mode, any data being sent to the UDASA will be displayed in the UDASA within a small period of time. If the data in the UDASA does not match the data that was sent to the UDASA, then error message 00026 is displayed. Replace UDA module M7485.

00027 CZUDC DVC FTL ERR 00027 ON UNIT 00 TST xxx SUB 000 PC: xxxxxx
HOST PROGRAM UDA AT 172150 RUNTIME x:xx:xx
UDASA REGISTER DID NOT CHANGE AFTER WRITING TO IT
IN PORT LOOP DIAGNOSTIC
UDASA CONTAINS 004400
REPLACE UDA MODULE M7485

The UDA can be put into a mode where the UDASA acts as a wrap port. While the UDA is in this mode, any data being sent to the UDASA will be displayed in the UDASA within a small period of time. After the host program sent data to it while it was in diagnostic wrap mode, the UDA did not change the contents of the UDASA. Error message 00027 is displayed. Replace UDA module M7485.

00028 CZUDC DVC FTL ERR 00028 ON UNIT 00 TST 001 SUB 004 PC: xxxxxx
HOST PROGRAM UDA AT 172150 RUNTIME x:xx:xx
UDA DID NOT INTERRUPT THE PDP-11
REPLACE UDA MODULE M7485

The host program timed out while waiting for an interrupt that had to occur. The UDA was told to use interrupts during the initialization process. The UDA then waited for the interrupt but it did not occur. Replace the UDA module M7485.

00029 CZUDC DVC FTL ERR 00029 ON UNIT 00 TST 001 SUB 004 PC: xxxxxx
HOST PROGRAM UDA AT 172150 RUNTIME x:xx:xx
UDA INTERRUPTED AT DIFFERENT BR LEVEL THAN SPECIFIED IN HARDWARE QUESTIONS. INTERRUPT WAS AT BR LEVEL 5
CHECK PRIORITY PLUG ON UDA MODULE M7485
OR CHANGE HARDWARE QUESTIONS

The priority plug on the UDA and the BR LEVEL specified during the hardware questions do not match. Either change the plug number or reanswer the hardware question. If all these have been done and there is still a problem replace UDA module M7485.

00030 CZUDC DVC FTL ERR 00030 ON UNIT 00 TST xxx SUB 000 PC: xxxxxx
HOST PROGRAM UDA AT 172150 RUNTIME x:xx:xx
UDA REPORTED FATAL ERROR IN UDASA REGISTER WHILE RUNNING DM PROGRAM
UDASA CONTAINS 100004

A message from the UDA firmware reports an unexpected failure. An error code is presented in the UDASA. Here is a list of the codes and their meanings:

004400 - UDA has been inited by either a bus init or by writing into the UDAIP.
100001 - UNIBUS envelope/packet read error (parity or timeout)
100002 - UNIBUS envelope/packet write error (parity or timeout)
100003 - UDA ROM and RAM parity error
100004 - UDA RAM parity error
100005 - UDA ROM parity error
100006 - UNIBUS ring read error
100007 - UNIBUS ring write error
100010 - UNIBUS interrupt master failure
100011 - Host access timeout error
100012 - Host exceeded credit limit
100013 - UDA SDI hardware fatal error
100014 - DM XFC fatal error
100015 - Hardware timeout of instruction loop
100016 - Invalid virtual circuit identifier
100017 - Interrupt write error on UNIBUS

00031 CZUDC DVC FTL ERR 00031 ON UNIT 00 TST xxx SUB 000 PC: xxxxxx
HOST PROGRAM UDA AT 172150 RUNTIME x:xx:xx
NO INTERRUPT RECEIVED FROM DM PROGRAM FOR 3 MINUTES
ASSUME PROGRAM IS HUNG

All DM programs are required to communicate with the host program; so as to assure the host program that the DM program is not hung up or in an endless loop. If the DM program has not done so, the host program assumes the DM is hung and this message appears.

00032 CZUDC DVC FTL ERR 00032 ON UNIT 00 TST xxx SUB 000 PC: xxxxxx
HOST PROGRAM UDA AT 172150 RUNTIME x:xx:xx
MESSAGE BUFFER RECEIVED FROM DM PROGRAM WITH UNKNOWN REQUEST NUMBER
MESSAGE BUFFER CONTAINS:
000001 000002 000003 000004 000005 000006 000007
000008 000009 000010 000011 000012 000013 000014
000015 000016 000017 000018 000019 000020 000021
000022 000023 000024 000025 000026 000027 000028
000029 000030 000031 000032 000033 000034 000035

The DM program and the host program communicate with each other using packets. Each packet must have a request number set up by the DM program and interpreted by the host program. This request number is not a known request number. The problem may be the UNIBUS or either one of the UDA modules or a corrupted DM program. Word 1 contains the DM request number, and word 2 typically contains the drive number. The rest of the buffer contains information specific to a DM request. The numbers in the example show the order in which words are displayed.

00033 CZUDC DVC FTL ERR 00033 ON UNIT 00 TST xxx SUB 000 PC: xxxxxx
HOST PROGRAM UDA AT 172150 RUNTIME x:xx:xx
RESPONSE PACKET FROM UDA DOES NOT CONTAIN EXPECTED DATA
EITHER UDA RETURNED ERROR STATUS OR PACKET WAS NOT RECEIVED CORRECTLY

COMMAND PACKET SENT	RESPONSE PACKET RECEIVED
000000 000020	000000 000020
000000 000000	000000 000000
000000 000002	000000 000202
000000 014336	000000 014336
000000 034674	000000 034674
000000 00000C	000000 000000
000000 000000	000000 000000
000000 051232	000000 051232
000000 000000	000000 000000
000000 000000	000000 000000
000000 000000	000000 000000
000000 000000	000000 000000

The host program inspected the response packet which was given by to UDA. The response packet may have been in error with one of the following points:

1) The end code was not as expected.
2) The status code showed an error occurred with the last command.
3) The command reference numbers (the first word) did not match.

If 1 or 3 occurred, there may have been a transmission problem between the UDA and the host program. If 2 occurred, check the error code in the MSCP specification for further information. The packets are displayed two words per line, low order word and byte to the right (corresponding to the MSCP long-word entity).

00036 CZUDC DVC FTL ERR 00036 ON UNIT 00 TST xxx SUB 000 PC: xxxxxx
HOST PROGRAM UDA AT 172150 RUNTIME x:xx:xx
NO INTERRUPT RECEIVED FROM UDA FOR 30 SECONDS
WHILE LOADING DM PROGRAM

After a DM program has been sent to the UDA, the host program expects an interrupt within 30 seconds. The interrupt is used to assure the host program that the DM program is sane. If no interrupt occurred, then error message 00036 is displayed and the DM program is assumed to be hung.

00037 CZUDC DVC FTL ERR 00037 ON UNIT 00 TST xxx SUB 000 PC: xxxxxx
HOST PROGRAM UDA AT 172150 RUNTIME x:xx:xx
UDA REPORTED FATAL ERROR IN UDASA REGISTER WHILE LOADING DM PROGRAM
UDASA CONTAINS 100004
REPLACE UDA MODULE M7485

While loading the DM program to the UDA, the UDASA became non-zero. When this occurs, it signifies that the UDA microcode has run across a fatal error. The displayed value is in octal. Check the error code with the list included with error number 00030.

00038 CZUDC DVC FTL ERR 00038 ON UNIT 00 TST 001 SUB 002 PC: xxxxxx
HOST PROGRAM UDA AT 172150 RUNTIME x:xx:xx
MEMORY ERROR TRYING TO READ UDA REGISTERS
CHECK UNIBUS SELECTION SWITCHES ON UDA MODULE M7486
OR UNIBUS
OR REPLACE UDA MODULE M7485

A non-existant memory error occurred when the host program tried to access the UDAIP and UDASA registers while in subtest 2 of test 1. The UDA is at another address (check the UNIBUS selection switches) or module M7485 is broken or the UNIBUS is broken.

3.2.2 TEST 1 ERROR MESSAGES (01000 TO 01999)

01000 CZUDC HRD ERR 01000 ON UNIT 00 TST 001 SUB 007 PC: xxxxxx
UNIBUS ADDRESSING DM PC:xxxx UDA AT xxxxxx RUNTIME hhh:mm:ss
NON-EXISTANT MEMORY ERROR TRYING TO READ FROM UNIBUS.

	OCTAL	HEX
ADDRESS	000000	0000

The host has given the DM routine the range of accessible host memory. While reading one location within the range, it appeared non-existant to the UDA. Since everything within the bounds were believed to be accessible this error message will be printed. The message prints the address in octal and hex.

01001 CZUDC HRD ERR 01001 ON UNIT 00 TST 001 SUB 007 PC: xxxxxx
UNIBUS ADDRESSING DM PC:xxxx UDA AT xxxxxx RUNTIME hhh:mm:ss
PARITY ERROR ON READ FROM UNIBUS.

	OCTAL	HEX
ADDRESS	000000	00000
DATA READ	000000	0000
DATA EXPECTED	000000	0000

The host has given the DM routine the range of accessible host memory. While reading one location within the range, the DM routine has found a location with bad parity. Every location was accessed by the host program. The host program filled a location with its address. The message prints the address, the data it actually received, and the expected data it should have received in octal and hex.

01002 CZUDC HRD ERR 01002 ON UNIT 00 TST 001 SUB 007 PC: xxxxxx
UNIBUS ADDRESSING DM PC:xxxx UDA AT xxxxxx RUNTIME hhh:mm:ss
UNIBUS ADDRESSING ERROR - INCORRECT DATA READ.
MEMORY LOCATION SHOULD CONTAIN OWN ADDRESS.

	OCTAL	HEX
DATA READ	000000	0000
DATA EXPECTED	000000	0000

The host has given the DM routine the locations of accessible host memory. Every location was accessed by the host program. The host program filled a location with its address. The DM program read from one location and found that the data it read was not equal to its address. The message prints the address, the data it actually received, and the expected data it should have received in octal and hex.

01003 CZUDC HRD ERR 01003 ON UNIT 00 TST 001 SUB 007 PC: xxxxxx
UNIBUS ADDRESSING DM PC:xxxx UDA AT xxxxxx RUNTIME hhh:mm:se
NON-EXISTANT MEMORY ERROR TRYING TO READ FROM UNIBUS WITHIN BUFFER.

	OCTAL	HEX
STARTING ADDESS OF BUFFER	123456	0A72E
BUFFER SIZE	001234	029C

After reading every accessible location of host memory, the DM routine breaks up memory into buffers. The DM routine writes and reads data patterns from each host buffer into its DM buffer. While reading one of these buffers, a non-existant memory error occurred. The message prints out the starting address of the buffer and the size of the buffer in octal(for PDP-11 users) and in hex(for VAX users) so the user can determine about where the non-existant memory location occurred.

01004 CZUDC HRD ERR 01004 ON UNIT 00 TST 001 SUB 007 PC: xxxxxx
UNIBUS ADDRESSING DM PC:xxxx UDA AT xxxxxx RUNTIME hhh:mm:ss
PARITY ERROR ON READ FROM UNIBUS WITHIN BUFFER.

	OCTAL	HEX
STARTING ADDESS OF BUFFER	123456	0A72E
BUFFER SIZE	001234	029C

After reading every accessible location of host memory, the DM routine breaks up memory into buffers. The DM routine writes and reads data patterns from each host buffer into its DM buffer. While reading one of these buffers, a parity error occurred. The message prints out the starting address of the buffer and the size of the buffer in octal(for PDP-11 users) and in hex(for VAX users) so the user can determine about where the non-existant memory location occurred.

```
01005   CZUDC HRD ERR  01005 ON UNIT 00 TST 001 SUB 007 PC: xxxxxx
        UNIBUS ADDRESSING DM PC:xxxx  UDA AT xxxxxx  RUNTIME hhh:mm:ss
        DATA COMPARE FAILED AFTER WRITE THEN READ FROM UNIBUS.
         BUFFER SIZE = 005302(O)     0AC2(X)     2754.(D)
         STARTING ADDRESSES OF BUFFERS
              OCTAL           HEX
             044232          0489A
             057056          05E2E
             071676          073BE
             104512          0894A
         CURRENT DATA PATTERN READ                      0
         LAST PATTERN WRITTEN                           0
         STARTING ADDRESS OF LAST BUFFER WRITTEN   104512(O)   0894A(X)
         NUMBER OF ERRORS FOUND                    2754.(D)
            LOCATION        DATA EXPECTED      DATA RECEIVED
          OCTAL   HEX         OCTAL   HEX       OCTAL   HEX
        057056  05E2E        111111  9249      002472  053A
        057060  05E30        044444  4924      005302  0AC2
        057062  05E32        022222  2492      000000  0000
```

After reading an entire buffer, the DM program checks each location. If any or all of the locations did not contain the expected data, this message appears. It contains the buffer size in octal, hex and decimal. The reason it appears in decimal is so the user can correlate this value with the number of errors which is printed in decimal. The starting addresses of the buffers are printed in octal and hex. There will always be at least two buffers and up to four buffers printed. The current data pattern read is printed. DM program will be testing the buffer with this data pattern. The last data pattern written by the DM program is printed. The address of the last buffer written is printed in octal and hex. As many as three errors are presented in the message. This portion presents the location of the error, the expected data and the actual data all in octal and hex.

01006 CZUDC HRD ERR 01006 ON UNIT 00 TST 001 SUB 007 PC: xxxxxx
UNIBUS ADDRESSING DM PC:xxxx UDA AT xxxxxx RUNTIME hhh:mm:ss
UNIBUS ADDRESSING ERROR, TWO ADDRESSES READ SAME LOCATION.

	OCTAL	HEX
KNOWN GOOD ADDRESS	625252	32AAA
ERROR ADDRESS	425252	22AAA
ADDRESS BIT IN ERROR	200000	10000

The UDA can only write to a small portion of memory because there is a PDP-11 program running in the memory. To verify it can address all of memory, it uses one location that it is permitted to write which it calls a "known good address". By changing only one bit in the address of this location it selects a "test address". Different patterns are written to the "known good address", each followed by a read of the "test address". If the data read from the "test address" matches the data written to the "known good address" each time, the address line is determined to be stuck. The "test address" is printed as the error address.

3.2.3 TEST 2 INFORMATIONAL MESSAGES

UNIT x UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
INFORMATION SENT BACK FROM THE DRIVE IS BEING PRESENTED.
TEST NUMBER 0000
DRIVE TYPE 00
ERROR NUMBER 0000
data

There is not error, but it is a message. The disk drive wanted the let the host know what had happened when the drive's internal diagnostic was run. The format follows that of hard error 2021.

UNIT x UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
FOLLOWING REPORT HAS BEEN TRUNCATED DUE TO SIZE

This is a message that may appear if the disk drive gave too much data for the DM program to handle. This message may preceed the previous message and hard error 2021.

3.2.4 TEST 2 ERROR MESSAGES (02000 TO 02999)

02000 CZUDC HRD ERR 02000 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
HOST SPECIFIED UNIT #0 THAT CAN'T BE FOUND.
TEST2 RESTARING

When test 2 starts executing out of the DM, it doesn't know if it had been started to execute drive diagnostics or restarted to down line load a diagnostic into the drive. If it had been restarted for the latter reason, the host must tell Test 2 which drive was to receive the diagnostic. If the drive specified by the host is not attached to the UDA or could not be located by Test 2, this error message will be printed.

02001 CZUDC HRD ERR 02001 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
CANNOT RECEIVE VALID DRIVE STATE FROM DRIVE AFTER DRIVE WAS INITED
CHECK IF DRIVE IS POWERED ON.

This error message is presented if valid drive state was not received from the drive after the drive was inited. There are two types of invalid states: no clocks or 'hard' errors. If after getting state and no clocks occur, error 2001 is reported. There may be a bad transmitter on the drive side or a bad receiver on the UDA side or the SDI cable may have taken a hit.

02002 CZUDC HRD ERR 02002 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
DRIVE STATE RECEIVED HAS BAD PARITY AFTER DRIVE WAS INITED

This error message is presented if bad purity was received from the drive after the drive was inited. There may be a bad transmitter on the drive side or a bad receiver on the UDA side or the SDI cable may have taken a hit.

02003 CZUDC HRD ERR 02003 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
DRIVE IS NOT ASSERTING RECEIVER READY IN DRIVE STATE AFTER DRIVE WAS INITED

This error message is presented if receiver ready was not received from the drive after the drive was inited. There may be a bad transmitter on the drive side or a bad receiver on the UDA side or the SDI cable may have taken a hit.

02004 CZUDC HRD ERR 02004 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
TIME-OUT ON SEND OF ECHO COMMAND TO DRIVE
ECHO DATA FF

This error message is presented if a send of the ECHO command timed out. This may be caused by receiver ready being deasserted. The echo data is presented in hex.

02005 CZUDC HRD ERR 02005 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
ERROR DURING RECEIVE OF ECHO RESPONSE FROM DRIVE
ECHO DATA FF

This error message is presented if a receive of an ECHO command was in error. The echo data is presented in hex. There may be a bad transmitter on the drive side or a bad receiver on the UDA side or the SDI cable may have taken a hit.

02006 CZUDC HRD ERR 02006 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
ECHO COMMAND RESPONDED WITH DIFFERENT DATA
ECHO DATA SENT 00FE
ECHO DATA RECEIVED 00FF

This error message is presented if the data returning from an ECHO command did not match the data it was suppose to. The data presented is in hex.

02007 CZUDC HRD ERR 02007 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
ERROR BIT SET IN GET STATUS RESPONSE AFTER DRIVE CLEAR COMMAND
GET STATUS RESPONSE
REAL TIME STATE state
STATUS (FROM R TO L): word6 word5 word4 word3 word2 word1 word0:

This error message is presented when an error bit is set in the status of a drive after the drive was cleared of all errors. The data displayed is the responce from a GET STATUS command. The error bits in the responce are in bit position 3, 5 and 6 of word2. For further description of the GET STATUS responce, refer to the SDI Functional Spec v3.6 and the drive's functional spec.

REAL TIME STATE state: REAL TIME STATE 0003
The real time state is the real time drive state <<AFTER>> Test 2 detected the error. <<THIS VALUE IS DISPLAYED IN HEX>>. In this example, receiver ready and attention are both asserted.

The bit positions are defined as follows:
0001 - Receiver ready (Test 2 able to transmit to drive)
0002 - Attention (error occurred or online timeout expired)
0040 - Available (drive offline and usuable)
1000 - Read/Write ready

The complete meaning of these bits is beyond the scope of this text, please refer to the operator documentation for the drive you are working on.

STATUS (R TO L): word6 word5 word4 word3 word2 word1 word0:
The status is the response to the SDI GET STATUS command. These words are printed in HEX. <<NOTE THAT THE STATUS IS PRINTED OUT FROM RIGHT TO LEFT!!>>. The status' meaning is beyond the scope of this text, please refer to the operator documentation for the drive you are working on.

02008 CZUDC HRD ERR 02008 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
TIME-OUT ON SEND OF ONLINE COMMAND TO DRIVE

The ONLINE command timed out while it was sent to the drive. The drive did not assert the RECEIVER READY signal over the SDI.

02009 CZUDC HRD ERR 02009 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
ERROR DURING RECEIVE OF ONLINE RESPONSE FROM DRIVE
explanation

This error message is presented if a receive of an ONLINE command was in error. An explanation of what the error was is also presented. These explanations are:

TIMEOUT ERROR OCCURED DURING RECEIVE XFC
- This error is a failure of the drive to respond to an SDI level 2 command (see the SDI specification) before the drive-supplied command timeout expires.

1ST WORD NOT START FRAME DURING RECEIVE XFC
- The first word received by the UDA from the drive was not a valid message start frame.

FRAMING ERROR OCCURED ON SDI LEVEL 0 READ DURING RECEIVE XFC
- This is caused by one of the following conditions: 1) Illegal frame code -- the frame is not a message start, continue, or end frame. 2) Illegal sequence of frames -- such as a message start frame without ever receiving a message end frame. This can be caused by the drive sending a response before the UDA asserts receiver ready, or a random hit on the SDI cable that garbles a frame or a bad drive transmitter or UDA receiver.

CHECKSUM ERROR OCCURED ON SDI LEVEL 0 READ DURING RECEIVE XFC
- The checksum attached to a message end frame did not match the checksum computed over the level 2 command. This could be caused by a bad drive transmitter, bad UDA receiver, incorrectly computed checksum by the drive (unlikely) or a random hit on the SDI cable.

BUFFER SIZE SMALLER THEN RESPONSE DURING RECEIVE XFC
- A buffer size size set aside for the response was not large enough for the response received. This is caused by the drive sending a response that is incorrect for the request sent to the drive, or the drive sending some garbage with the response.

CODE FROM RECEIVE XFC WAS UNINTELLIGIBLE FROM SUBSYSTEM 0000
- The responce from the drive was not anything that was expected. Possible UDA microcode change without test 2 update.

02010 CZUDC HRD ERR 02010 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
ONLINE COMMAND WAS UNSUCCESSFUL
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

The ONLINE command was not successful. The drive's status is displayed. See hard error 2007 for further information on the format of the status. The drive did not assert the RECEIVER READY signal over the SDI.

02011 CZUDC HRD ERR 02011 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
ONLINE COMMAND DID NOT RETURN EXPECTED RESPONSE CODE
EXPECTED RESPONSE 7E
ACTUAL RESPONSE 00

The ONLINE command did not return an expected response code. If there were at least an UNSUCCESSFUL response, test 2 will report the drive state and status. The expected response and actual response are in hex.

02012 CZUDC HRD ERR 02012 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
TIME-OUT ON SEND OF GET UNIT CHARACTERISTICS COMMAND TO DRIVE

The GET UNIT CHARACTERISTICS command timed out while it was sent to the drive. The drive did not assert the RECEIVER READY signal over the SDI.

02013 CZUDC HRD ERR 02013 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
ERROR DURING RECEIVE OF GET UNIT CHARACTERISTICS COMMAND FROM DRIVE
explanation

This error message is presented if a receive of a GET UNIT CHARACTERISTICS command was in error. An explanation of what the error was is also presented. These explanations are described in hard error 2009.

02014 CZUDC HRD ERR 02014 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
GET UNIT CHARACTERISTICS COMMAND WAS UNSUCCESSFUL
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

The GET UNIT CHARACTERISTICS command was not successful. The drive's status is displayed. See hard error 2007 for further information on the format of the status.

02015 CZUDC HRD ERR 02015 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
GET UNIT CHARACTERISTICS COMMAND DID NOT RETURN EXPECTED RESPONSE CODE
EXPECTED RESPONSE 78
ACTUAL RESPONSE 00

The GET UNIT CHARACTERISTICS command did not return an expected response code. The expected response and actual response are in hex.

02016 CZUDC HRD ERR 02016 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
HOST PROGRAM GAVE DM CODE IMPROPER DATA
EXPECTED VALUE SHOULD BE BETWEEN 0 AND 3
ACTUAL VALUE WAS xx

The host tells the DM program what to do after the DM program is done testing the drive's diagnostic. If the value is not within the expected range, this error message is printed. There is no drive problem. The problem is between the host and the UDA.

02017 CZUDC HRD ERR 02017 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
TIME-OUT ON SEND OF DIAGNOSE COMMAND TO DRIVE

The DIAGNOSE command timed out while it was sent to the drive. The drive did not assert the RECEIVER READY signal over the SDI.

02018 CZUDC HRD ERR 02018 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
ERROR DURING RECEIVE OF DIAGNOSE RESPONSE FROM DRIVE
explanation

This error message is presented if a receive of a DIAGNOSE command was in error. An explanation of what the error was is also presented. These explanations are described in hard error 2009.

02019 CZUDC HRD ERR 02019 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
DIAGNOSE COMMAND WAS UNSUCCESSFUL
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

The DIAGNOSE command was not successful. The drive's status is displayed. See hard error 2007 for further information on the format of the status.

02020 CZUDC HRD ERR 02020 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
DIAGNOSE COMMAND DID NOT RETURN EXPECTED RESPONSE CODE
EXPECTED RESPONSE FC
ACTUAL RESPONSE 00

The DIAGNOSE command did not return an expected response code. The expected response and actual response are in hex.

02021 CZUDC HRD ERR 02021 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
DRIVE DIAGNOSTIC REPORTS A HARD ERROR
TEST NUMBER 0000
DRIVE TYPE 00
ERROR NUMBER 0000
data

The drive diagnostic found an error and is reporting the error back to the host. All values are in hex. TEST NUMBER shows what test was run. DRIVE TYPE shows what type of drive was being tested. ERROR NUMBER shows the result of the test. The drive may pass back data to the host. This data will be presented in a 32 bit hex format following the error message. More data may follow the 32 bit hex values. This data is printed in ascii format. For definitions of what these values mean, refer to the drive functional spec.

02022 CZUDC HRD ERR 02022 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
HOST PROGRAM DOWN LINE LOADED A DIAGNOSTIC WITH A ZERO BYTE COUNT

The host program was attempting down line load a diagnostic of zero length. The DM program must have the byte count specified by the host.

02023 CZUDC HRD ERR 02023 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
DIAGNOSTIC filnam REQUESTED BY THE DRIVE COULD NOT BE SUPPLIED BY HOST.

The host program could not supply the diagnostic 'filnam' to down line load to the drive.

02024 CZUDC HRD ERR 02024 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
TIME-OUT ON SEND OF MEMORY READ COMMAND TO DRIVE

The MEMORY READ command timed out while it was sent to the drive. The drive did not assert the RECEIVER READY signal over the SDI.

02025 CZUDC HRD ERR 02025 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
ERROR DURING RECEIVE OF MEMORY READ RESPONSE FROM DRIVE
explanation

This error message is presented if a receive of a MEMORY READ command was in error. An explanation of what the error was is also presented. These explanations are described in hard error 2009.

02026 CZUDC HRD ERR 02026 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
MEMORY READ COMMAND WAS UNSUCCESSFUL
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

The MEMORY READ command was not successful. The drive's status is displayed. See hard error 2007 for further information on the format of the status.

02027 CZUDC HRD ERR 02027 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
MEMORY READ COMMAND DID NOT RETURN EXPECTED RESPONSE CODE
EXPECTED RESPONSE 72
ACTUAL RESPONSE 00

The MEMORY READ command did not return an expected response code. The expected response and actual response are in hex.

02028 CZUDC HRD ERR 02028 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
TIME-OUT ON SEND OF MEMORY WRITE COMMAND TO DRIVE

The MEMORY WRITE command timed out while it was sent to the drive. The drive did not assert the RECEIVER READY signal over the SDI.

02029 CZUDC HRD ERR 02029 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
ERROR DURING RECEIVE OF MEMORY WRITE RESPONSE FROM DRIVE
explanation

This error message is presented if a receive of a MEMORY WRITE command was in error. An explanation of what the error was is also presented. These explanations are described in hard error 2009.

02030 CZUDC HRD ERR 02030 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
MEMORY WRITE COMMAND WAS UNSUCCESSFUL
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

The MEMORY WRITE command was not successful. The drive's status is displayed. See hard error 2007 for further information on the format of the status.

02031 CZUDC HRD ERR 02031 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
MEMORY WRITE COMMAND DID NOT RETURN EXPECTED RESPONSE CODE
EXPECTED RESPONSE 7E
ACTUAL RESPONSE 00

The MEMORY WRITE command did not return an expected response code. The expected response and actual response are in hex.

02032 CZUDC HRD ERR 02032 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
TIME-OUT ON SEND OF RUN COMMAND TO DRIVE

The RUN command timed out while it was sent to the drive. The drive did not assert the RECEIVER READY signal over the SDI.

02033 CZUDC HRD ERR 02033 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
ERROR DURING RECEIVE OF RUN RESPONSE FROM DRIVE
explanation

This error message is presented if a receive of a RUN command was in error. An explanation of what the error was is also presented. These explanations are described in hard error 2009.

02034 CZUDC HRD ERR 02034 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
RUN COMMAND WAS UNSUCCESSFUL
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

The RUN command was not successful. The drive's status is displayed. See hard error 2007 for further information on the format of the status.

02035 CZUDC HRD ERR 02035 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
RUN COMMAND DID NOT RETURN EXPECTED RESPONSE CODE
EXPECTED RESPONSE 7E
ACTUAL RESPONSE 00

The RUN command did not return an expected response code. The expected response and actual response are in hex.

02036 CZUDC HRD ERR 02036 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
TIME-OUT ON SEND OF RECALIBRATE COMMAND TO DRIVE

The RECALIBRATE command timed out while it was sent to the drive. The drive did not assert the RECEIVER READY signal over the SDI.

02037 CZUDC HRD ERR 02037 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
ERROR DURING RECEIVE OF RECALIBRATE RESPONSE FROM DRIVE
explanation

This error message is presented if a receive of a RECALIBRATE command was in error. An explanation of what the error was is also presented. These explanations are described in hard error 2009.

02038 CZUDC HRD ERR 02038 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
RECALIBRATE COMMAND WAS UNSUCCESSFUL
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

The RECALIBRATE command was not successful. The drive's status is displayed. See hard error 2007 for further information on the format of the status.

02039 CZUDC HRD ERR 02039 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
RECALIBRATE COMMAND DID NOT RETURN EXPECTED RESPONSE CODE
EXPECTED RESPONSE 7E
ACTUAL RESPONSE 00

The RECLAIBRATE command did not return an expected response code. The expected response and actual response are in hex.

02040 CZUDC HRD ERR 02040 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
TIME-OUT ON SEND OF GET STATUS COMMAND TO DRIVE

The GET STATUS command timed out while it was sent to the drive. The drive did not assert the RECEIVER READY signal over the SDI.

02041 CZUDC HRD ERR 02041 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
ERROR DURING RECEIVE OF GET STATUS RESPONSE FROM DRIVE
explanation

This error message is presented if a receive of a GET STATUS command was in error. An explanation of what the error was is also presented. These explanations are described in hard error 2009.

02042 CZUDC HRD ERR 02042 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
GET STATUS COMMAND WAS UNSUCCESSFUL
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

The GET STAUTS command was not successful. The drive's status is displayed. See hard error 2007 for further information on the format of the status.

02043 CZUDC HRD ERR 02043 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
GET STATUS COMMAND DID NOT RETURN EXPECTED RESPONSE CODE
EXPECTED RESPONSE F0
ACTUAL RESPONSE 00

The GET STAUTS command did not return an expected response code. The expected response and actual response are in hex.

02044 CZUDC HRD ERR 02044 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
TIME-OUT ON SEND OF DRIVE CLEAR COMMAND TO DRIVE

The DRIVE CLEAR command timed out while it was sent to the drive. The drive did not assert the RECEIVER READY signal over the SDI.

02045 CZUDC HRD ERR 02045 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
ERROR DURING RECEIVE OF DRIVE CLEAR RESPONSE FROM DRIVE
explanation

This error message is presented if a receive of a DRIVE CLEAR command was in error. An explanation of what the error was is also presented. These explanations are described in hard error 2009.

02046 CZUDC HRD ERR 02046 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
DRIVE CLEAR COMMAND WAS UNSUCCESSFUL
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

The DRIVE CLEAR command was not successful. The drive's status is displayed. See hard error 2007 for further information on the format of the status.

02047 CZUDC HRD ERR 02047 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK RESIDENT DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
DRIVE CLEAR COMMAND DID NOT RETURN EXPECTED RESPONSE CODE
EXPECTED RESPONSE 7E
ACTUAL RESPONSE 00

The DRIVE CLEAR command did not return an expected response code. The expected response and actual response are in hex.

3.2.5 TEST 3 INFORMATIONAL MESSAGES

UNIT xx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
LOGGABLE INFORMATION AFTER RECAL
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

After sending a RECALIBRATE command, the ATTENTION bit was set. Test 3 then sent a GET STATUS command and found the LOGGABLE INFORMATION bit was set. This is not an error, it is only some information being sent from the drive. Normal operation continues.

Check 03001 for explanation of 'REAL TIME STATE' and 'STATUS'

3.2.6 TEST 3 ERROR MESSAGES (03000 TO 03999)

03001 CZUDC HRD ERR 03001 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
TIME-OUT ON SEND
COMMAND WAS command
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

If test 3 tries to send a level 2 command to the drive, and receiver ready is deasserted, error 3001 occurs.
Where command is one of the following:

GET COMMON CHARACTERISTICS
ONLINE
DRIVE CLEAR
DISCONNECT
GET SUBUNIT CHARACTERISTICS
GET STATUS
CHANGE MODE
INITIATE RECALIBRATE
SPIN UP

REAL TIME STATE state: REAL TIME STATE 0003
The real time state is the real time drive state <<AFTER>> Test 3 detected the error. <<THIS VALUE IS DISPLAYED IN HEX>>. In this example, receiver ready and attention are both asserted.

The bit positions are defined as follows:
0001 - Receiver ready (Test 3 able to transmit to drive)
0002 - Attention (error occurred or online timeout expired)
0040 - Available (drive offline and unuable)
1000 - Read/Write ready
The complete meaning of these bits is beyond the scope of this text, please refer to the operator documentation for the drive you are working on.

STATUS (R TO L): word6 word5 word4 word3 word2 word1 word0:
The status is the response to the SDI GET STATUS command. These words are printed in HEX. <<NOTE THAT THE STATUS IS PRINTED OUT FROM RIGHT TO LEFT!!>>. The status' meaning is beyond the scope of this text, please refer to the operator documentation for the drive you are working on.

03002 CZUDC HRD ERR 03002 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
TIME-OUT OF RECEIVE
COMMAND WAS GET COMMON CHARACTERISTICS
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

This error is a failure of the drive to respond to an SDI level 2 command (see the SDI specification) befor the drive-supplied command timeout expires.

Check 03001 for explanation of 'REAL TIME STATE' and 'STATUS'

03003 CZUDC HRD ERR 03003 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
FIRST WORD RECEIVED WAS NOT A START FRAME
COMMAND WAS GET COMMON CHARACTERISTICS
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

The first word received by the UDA from the drive was not a valid message start frame.

Check 03001 for explanation of 'REAL TIME STATE' and 'STATUS'

03004 CZUDC HRD ERR 03004 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
FRAMING ERROR ON LEVEL 0 RESPONSE
COMMAND WAS GET COMMON CHARACTERISTICS
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

Error 3004 is caused by one or more of the following conditions: 1) Illegal frame code -- the frame is not a message start, continue, or end frame. 2) Illegal sequence of frames -- such as a message start frame without ever receiving a message end frame. This can be caused by the drive sending a response before the UDA asserts receiver ready, or a random bit on the SDI cable that garbles a frame or a bad drive transmitter or UDA receiver.

Check 03001 for explanation of 'REAL TIME STATE' and 'STATUS'

03005 CZUDC HRD ERR 03005 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
CHECKSUM ERROR ON LEVEL 0 RESPONSE
COMMAND WAS GET COMMON CHARACTERISTICS
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

The checksum attached to a message end frame did not match the checksum computed over the level 2 command. This could be caused by a bad drive transmitter, bad UDA receiver, incorrectly computed checksum by the drive (unlikely) or a random hit on the SDI cable.

Check 03001 for explanation of 'REAL TIME STATE' and 'STATUS'

03006 CZUDC HRD ERR 03006 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
RESPONSE LONGER THAN EXPECTED
COMMAND WAS GET COMMON CHARACTERISTICS
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

The buffer size set aside for the response was not large enough for the response received. This is caused by the drive sending a response that is incorrect for the request sent to the drive, or the drive sending some garbage with

the response.

Check 03001 for explanation of 'REAL TIME STATE' and 'STATUS'

03007 CZUDC HRD ERR 03007 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
CODE FROM RECEIVE WAS UNINTELLIGIBLE FROM SUBSYSTEM = 0000
COMMAND WAS GET COMMON CHARACTERISTICS
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

The unknown error code occurs when the UDA returns an error code from an operation that test 3 does not recognize. Possible UDA microcode change without test 3 update.

Check 03001 for explanation of 'REAL TIME STATE' and 'STATUS'

03008 CZUDC HRD ERR 03008 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
COMMAND DID NOT RETURN EXPECTED RESPONSE CODE
COMMAND WAS GET COMMON CHARACTERISTICS
EXPECED RESPONSE 7E
ACTUAL RESPONSE 7D
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

This is caused by receiving an UNSUCCESSFUL response from the drive, or the drive sending some response other than the correct response for the request sent to the drive. See the contents of status for the unexpected response error (or reason).

Check 03001 for explanation of 'REAL TIME STATE' and 'STATUS'

03009 CZUDC HRD ERR 03009 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
DRIVE NOT ASSERTING RECEIVER READY IN DRIVE STATE
REAL TIME STATE 0002
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

Test 3 inits the drive and checks the drive's real time state. If RECEIVER READY was not asserted after a period of time this error message is printed.

Check 03001 for explanation of 'REAL TIME STATE' and 'STATUS'

03011 CZUDC HRD ERR 03011 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
NO VALID STATE FROM DRIVE
NO DRIVE CLOCKS
CHECK THAT DRIVE IS POWERED ON.

If test 3 attempts to get the drive state, and finds that there are no drive clocks on the port, the above message is occurs. This error usually means that the SDI cable is not connected, the drive is not powered on or the drive's port button that connects it to this UDA is not

depressed.

03012 CZUDC HRD ERR 03012 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
NO VALID STATE FROM DRIVE
HARD PARITY OR PULSE ERROR FOR 1/2 A SECOND

If test 3 attempts to get the drive state, and gets pulse or parity errors for a full 1/2 second, the above message is printed. This error usually indicates a poor connection or grounding of the SDI cables, a bad drive transmitter, a bad UDA receiver or a broken SDI cable.

03014 CZUDC HRD ERR 03014 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
SUBUNIT CHARACTERISICS SAY THERE ARE ZERO READ ONLY GROUPS
IN THE DIAGNOSTIC AREA

After interrogating the subunit characteristics, test 3 finds out that the drive claims there are zero read only groups in the diagnostic area. There must be at least one for the test to run.

03015 CZUDC HRD ERR 03015 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
SUBUNIT CHARACTERISTICS SAY THERE ARE LESS THAN 1 READ/WRITE
GROUPS IN THE DIAGNOSTIC AREA

After interrogating the subunit characteristics, test 3 finds out that the drive claims there are zero read/write groups in the diagnostic area. There must be at least one for the test to run.

03016 CZUDC HRD ERR 03016 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
NEITHER R/W READY NOR ATTENTION SET AFTER RECALIBRATE COMMAND
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

After a RECALIBRATE command, R/W READY or ATTENTION did not set. Check the state for further information. This could be cause by a bad transmitter or receiver or by a hit on the SDI cable.

Check 03001 for explanation of 'REAL TIME STATE' and 'STATUS'

03017 CZUDC HRD ERR 03017 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
SUBUNIT CHARACERISTICS SAY LESS THAN 1 DIAGNOSTIC CYLINDER

After interrogating the subunit characteristics, test 3 finds out that the drive claims there are zero diagnostic cylinders. There must be at least one for the test to run.

03018 CZUDC HRD ERR 03018 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
READ/WRITE READY DROPPED BEFORE FORMAT OPERATION
CYLINDER aaa. GROUP bb. TRACK cc.

```
                REAL TIME STATE 0003
                STATUS (R TO L): 1312  1110  0908  0706  0504  0302  0100

                        The R/W READY signal was deasserted by the drive before
                        a format operation was going to be sent by the UDA.
                        The drive may have gone off line or is not transmitting
                        properly or the UDA may not be receiving properly or
                        the SDI cable took a hit.

                        Where:
                                aaa is the cylinder value in decimal.
                                bb is the group value in decimal.
                                cc is the track value in decimal.

                        Check 03001 for explanation of 'REAL TIME STATE' and 'STATUS'

03019           CZUDC HRD ERR  03019 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
                DISK FUNCTION DM PC:xxxx  UDA AT xxxxxx  DRIVE xxx  RUNTIME hhh:mm:ss
                FORMAT OPERATION REPORTED TIME-OUT FAILURE
                CYLINDER aaa.   GROUP  bb.   TRACK cc.
                REAL TIME STATE 0003
                STATUS (R TO L): 1312  1110  0908  0706  0504  0302  0100

                        The format operation sent by the UDA failed.  The command
                        timed out possibly due to receiver ready being dropped or
                        communication problem (bad transmitter or receiver or hit
                        on the SDI cable)

                        Where:
                                aaa is the cylinder value in decimal.
                                bb is the group value in decimal.

                        Check 03001 for explanation of 'REAL TIME STATE' and 'STATUS'

                                cc is the track value in decimal.
03020           CZUDC HRD ERR  03020 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
                DISK FUNCTION DM PC:xxxx  UDA AT xxxxxx  DRIVE xxx  RUNTIME hhh:mm:ss
                AFTER RECAL, ERROR BITS WERE SET
                REAL TIME STATE 0003
                STATUS (R TO L): 1312  1110  0908  0706  0504  0302  0100

                        After sending a RECALIBRATE command, the ATTENTION
                        bit was set.  Test 3 then sent a GET STATUS command
                        and found the error bits were set.  For further
                        information, check the state and the status.

                        Check 03001 for explanation of 'REAL TIME STATE' and 'STATUS'

03022           CZUDC HRD ERR  03022 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
                DISK FUNCTION DM PC:xxxx  UDA AT xxxxxx  DRIVE xxx  RUNTIME hhh:mm:ss
                READ/WRITE READY DROPPED BEFORE WRITE OPERATION
                CYLINDER aaa.   GROUP  bb.   TRACK cc
                REAL TIME STATE 0003
                STATUS (R TO L): 1312  1110  0908  0706  0504  0302  0100

                        The R/W READY signal was deasserted by the drive before
                        a write operation was going to be sent by the UDA.
```

The drive may have gone off line or is not transmitting properly or the UDA may not be receiving properly or the SDI cable took a hit.

Where:
aaa is the cylinder value in decimal.
bb is the group value in decimal.
cc is the track value in decimal.

Check 03001 for explanation of 'REAL TIME STATE' and 'STATUS'

03023 CZUDC HRD ERR 03023 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME nhh:mm:ss
COULD NOT WRITE AND READ ANY BLOCK ON THIS TRACK. ON LAST BLOCK:
WRITE OPERATION REPORTED FAILURE -- ERROR CODE aaa OCTAL.
DBN bbb. CYLINDER ccc. GROUP dd. TRACK ee.
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

After each track in the diagnostic space is formatted, at least one block must be able to have data written to it and read from it and the data must be correct. Not one block (DBN bbb.) from track (ee) was able to pass. The error code (aaa) gives the reason for the write operation failure.

Where:
aaa is the error code in octal.
It may have one of the following values:
2 = drive failure
3 = requested LBN is a secondary revector.
<<< NOTE >>> We are working with DBN's
4 = header compare failure
(desired header not found)
153 = suspected positioner error
213 = read/write ready failure
253 = drive data or state clock timeout
(indicates cable/transmitter/receiver broken)
313 = receiver ready timeout
413 = drive state receive error during write
bbb is the DBN in decimal.
ccc is the cylinder value in decimal.
dd is the group value in decimal.
ee is the track value in decimal.

Check 03001 for explanation of 'REAL TIME STATE' and 'STATUS'

03024 CZUDC HRD ERR 03024 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
READ/WRITE READY DROPPED BEFORE READ OPERATION
CYLINDER aaa. GROUP bb. TRACK cc.
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

The R/W READY signal was deasserted by the drive before

a read operation was going to be sent by the UDA.
The drive may have gone off line or is not transmitting
properly or the UDA may not be receiving properly or
the SDI cable took a hit.

Where:
aaa is the cylinder value in decimal.
bb is the group value in decimal.
cc is the track value in decimal.

Check 03001 for explanation of 'REAL TIME STATE' and 'STATUS'

03025 CZUDC HRD ERR 03025 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
COULD NOT WRITE AND READ ANY BLOCK ON THIS TRACK. ON LAST BLOCK:
READ OPERATION REPORTED FAILURE -- ERROR CODE aaa OCTAL.
CYLINDER ccc. GROUP dd. TRACK ee.
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

After each track in the diagnostic space is formatted, at
least one block must be able to have data written to it
and read from it and the data must be correct. No block
from track (ee) was able to pass. The error code (aaa)
gives the reason for the read operation failure.

Where:
aaa is the error code in octal.
It may have one of the following values:
2 = drive failure
3 = requested LBN is a secondary
revector.
<<< NOTE >>> We are working with DBN's
4 = header compare failure
(desired header not found)
52 = SERDES overrun error
150 = data sync timeout on read
153 = suspected positioner error
213 = read/write ready failure
253 = drive data or state clock timeout
(indicates cable/transmitter/
receiver broken)
313 = receiver ready timeout
413 = drive state receive error during write
ccc is the cylinder value in decimal.
dd is the group value in decimal.
ee is the track value in decimal.

Check 03001 for explanation of 'REAL TIME STATE' and 'STATUS'

03026 CZUDC HRD ERR 03026 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
COULD NOT WRITE AND READ ANY BLOCK ON THIS TRACK. ON LAST BLOCK:
DATA COMPARE FAILURE ON WORD aa.
EXPECTED DATA bbbb
ACTUAL DATA cccc
CYLINDER ddd. GROUP ee. TRACK ff.

After each track in the diagnostic space is formatted, at least one block must be able to have data written to it and read from it and the data must be correct. Not one block (DBN bbb.) from track (ee) was able to pass. The data read did not match the data written.

Where:
aa is the offset in decimal into the buffer where the error occurred.
bbbb is the expected data in hex.
cccc is the actual data in hex.
ddd is the cylinder value in decimal.
ee is the group value in decimal.
ff is the track value in decimal.

03027 CZUDC HRD ERR 03027 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
SEEK COMPLETE TIME-OUT -- READ/WRITE READY DID NOT SET
SEEK WAS TO CYLINDER aaa. GROUP bb.
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

After a SEEK command has been successfully sent from the UDA to the drive, the signal READ/WRITE READY must be set to indicate that the seek completed. If READ/WRITE READY never is asserted by the drive after the seek, the seek times out and error 3027 is presented.

Where:
aaa is the cylinder in decimal.
bb is the group in decimal.

Check 03001 for explanation of 'REAL TIME STATE' and 'STATUS'

03028 CZUDC HRD ERR 03028 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
NO BLOCK ON THIS TRACK CAN BE READ. LAST BLOCK TRIED:
aBN bbbb. CYLINDER ccc. GROUP dd. TRACK ee.

After a seek to a track, at least one block must be able to be read to assure that test 3 can read the header. If not one block was successful, error message 3028 appears.

Where:
a is 'L' for LBN, 'D' for DBN, or 'X' for XBN.
bbbb is the block number in decimal.
ccc is the cylinder in decimal.
dd is the group number in decimal.
ee is the track number in decimal.

03029 CZUDC HRD ERR 03029 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
AVAILABLE WAS NOT ASSERTED AFTER DISCONNECT
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

After the DISCONNECT command was sent, the AVAILABLE flag should be asserted after a period of time. It it never was, then error 3029 appears. There maybe a problem with a transmitter or a receiver or the SDI cable at this point.

Check 03001 for explanation of 'REAL TIME STATE' and 'STATUS'

03030 CZUDC HRD ERR 03030 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
INVALID LEVEL 2 COMMAND OPCODE aaaa WAS SUCCESSFUL
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

Some invalid level 2 commands are sent over the SDI. The drive should find these illegal commands and flag them as such. If the drive doesn't, then error 3030 will appear.

Where aaaa is the invalid command in hex.

Check 03001 for explanation of 'REAL TIME STATE' and 'STATUS'

03031 CZUDC HRD ERR 03031 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
COMMAND WITH type LENGTH = a WAS SUCCESSFUL
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

SDI level 2 commands with invalid lengths are sent to the drive to check if the drive can find them.

Where:
type could be 'COMMAND' or 'RESPONSE' for which field was affected
a is the invalid length

Check 03001 for explanation of 'REAL TIME STATE' and 'STATUS'

03032 CZUDC HRD ERR 03032 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
UNIT DID NOT REPORT TRANSMITTION ERROR
WHEN reason
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

Invalid level 1 sequences were sent to the drive. Several sequences are tried and the drive should find fault with everyone of them.

Where reason could be one of the following:

AN END FRAME WAS SENT AFTER A START FRAME TIMED OUT
A CONTINUE OR END FRAME DID NOT FOLLOW A START FRAME
AN END FRAME WAS SENT WITH NO START FRAME
AN END FRAME WIH A BAD CHECKSUM WAS SENT
A CONTINUE FRAME WAS SENT WITH NO START FRAME

Check 03001 for explanation of 'REAL TIME STATE' and 'STATUS'

03033 CZUDC HRD ERR 03033 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
UNIT ACCEPTED AN INVALID GROUP NUMBER FROM GROUP SELECT LEVEL 1
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

A level 1 select group command with an illegal group number is sent to the drive. If the drive accepted it, then error 3033 will be displayed.

Check 03001 for explanation of 'REAL TIME STATE' and 'STATUS'

03035 CZUDC DVC FTL ERR 03035 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
SUCCESSFULLY WROTE ON DBN AREA WHEN DRIVE WAS WRITE PROTECTED
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

An attempt was made to write on a write protected drive. It should have resulted in an error response from the disk drive, but it didn't.

Check 03001 for explanation of 'REAL TIME STATE' and 'STATUS'

03036 CZUDC DVC FTL ERR 03036 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
DRIVE IS NOT PROPERLY FORMATTED.
UDA WILL SPIN DOWN THIS DRIVE IF USED IN NORMAL SYSTEM OPERATION
THIS DRIVE NEEDS TO BE FORMATTED.

Test 3 reads a copy of the FCT in the XBN area and determined that the FCT was corrupted. Any normal operating system (which uses the UDA as a controller) will spin down the drive, so the drive will need to be reformatted.

03037 CZUDC DVC FTL ERR 03037 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
DRIVE IS FORMATTED IN 576 BYTE MODE.
TO RUN WITH A UDA, THIS DRIVE NEEDS TO BE FORMATTED IN 512 BYTE MODE.
UDA WILL SPIN DOWN THIS DRIVE IF USED IN NORMAL SYSTEM OPERATION
THIS DRIVE NEEDS TO BE FORMATTED.

Test 3 reads a copy of the FCT from the XBN area and determined that the drive was formatted in 576 byte mode. Any normal operating system (which uses the UDA as a controller) will spin down the drive, so the drive will need to be reformatted.

03038 CZUDC DVC FTL ERR 03038 ON UNIT 00 TST 003 SUB 000 PC: xxxxxx
DISK FUNCTION DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
NO COPY OF THE FCT COULD BE READ.
UDA WILL SPIN DOWN THIS DRIVE IF USED IN NORMAL SYSTEM OPERATION
THIS DRIVE NEEDS TO BE FORMATTED.

Test 3 attempted to read every copy of the FCT without success. Any normal operating system (which uses the UDA as a controller) will spin down the drive, so the drive will need to be reformatted

3.2.7 TEST 4 INFORMATIONAL MESSAGES

```
UNIT u UDA AT cccccc DRIVE n   RUNTIME hh:mm:ss
A CORRECTABLE ECC ERROR EXISTS IN type bn
SECTORS FROM INDEX sector TRK track GRP group CYL cylinder
```

The above message occurs when Test 4 1) detects an ECC error and 2) is able to correct it, and 3) the corrections are less than the drive ECC threshold, (a SDI DRIVE CHARACTERISTIC) and 4) the EDC computed over the corrected sector matched the EDC read.

```
UNIT unit UDA AT udaadr DRIVE plug   RUNTIME hh:mm:ss
INITIAL WRITE COMPLETE
```

Whenever Test 4 is STArted with initial write enabled, <<OR>> whenever it is STArted or REStarted and the diagnostic area is being tested on a drive not in read only mode, the disk will be initially written. The above message occurs when the initial write completes.

```
UNIT unit UDA AT udaadr DRIVE plug   RUNTIME hh:mm:ss
READ ONLY DRIVE, INITIAL WRITE WILL NOT BE PERFORMED
```

If an initial write is to be performed (see above for conditions) and a unit or subunit is in read only mode, (can be set in the manual intervention questions) an initial write will not be performed, and this message will print to inform the operator.

NOTE: DATA COMPARE ERRORS RESULT IF THE DISK IS NOT INITIALLY WRITTEN!!

```
UNIT unit UDA AT udaadr DRIVE plug   RUNTIME hh:mm:ss
THE PREVIOUS DEVICE FATAL WILL CAUSE THE FOLLOWING DRIVES
TO BE DROPPED: plug, plug+1, plug+2, plug+3
```

plug: drive plug number -- each subunit's plug number is displayed. for a single subunit drive (such as and RA80) only one plug number is displayed.

If a device fatal error occurs and dropping is enabled, <<ALL>> subunits on the unit that the device fatal occurred must be dropped. To inform the operator, this message is printed after the device fatal error message.

NOTE: IF MORE THAN ONE UDA IS ON A SYSTEM, THIS MESSAGE MAY NOT IMMEDIATELY FOLLOW THE DEVICE FATAL IF AN ERROR HAPPENS AT THE SAME TIME ON ANOTHER UDA.

3.2.8 TEST 4 ERROR MESSAGES (04000 TO 04999)

04001 CZUDC SFT ERR 04001 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
ATTN ASSERTED DURING SEEK
SEEK FROM GRP group CYL cylinder TO GRP group CYL cylinder
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

This error occurs when the drive asserts the SDI ATTENTION signal without asserting the READ/WRITE READY signal, indicating the unsuccessful completion of a seek.

See retry/recovery section for recovery details.

04002 CZUDC SFT ERR 04002 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
ATTN ASSERTED UNEXPECTEDLY, ASYN DRIVE ERROR OR LOGGABLE
INFORMATION
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

This is an asynchronous drive error. Asynchronous drive errors are those errors reported by the drive which are not related to a level 2 command. These errors are reported by the drive using the SDI ATTENTION signal. The operator must look at the status returned to determine the error that occurred.

See retry/recovery section for recovery details.

04003 CZUDC SFT ERR 04003 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
SEEK DID NOT COMPLETE, NEITHER ATTN OR R/W RDY WAS ASSERTED
BEFORE TIMEOUT
SEEK FROM GRP group CYL cylinder TO GRP group CYL cylinder
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

This error occurs when the drive fails to assert READ/WRITE READY before the seek timeout, which indicates the successful completion of a seek.

See retry/recovery section for recovery details.

04004 CZUDC HRD ERR 04004 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
RCT AREA CORRUPTED, COULD NOT FIND REPLACEMENT FOR
LBN THAT WAS REVECTORED
ATTEMPTING TO READ RCT LBN bn
SEARCHING FOR LBN bn

CZUDC HRD ERR 04004 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx

DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
RCT AREA CORRUPTED, COULD NOT FIND REPLACEMENT FOR
LBN WITH HEADER NOT FOUND
ATTEMPTING TO READ RCT LBN bn
SEARCHING FOR LBN bn

Error 4004 will occurr only when Test 4 is running in the customer data area. It occurs when 1) A sector is either marked revectored or the header can't be found in two revolutions of the disk (both cases should be revectored) and 2) The replacement for that sector isn't found in the RCT and 3) a NULL entry isn't found at the end of the RCT (see DEC STANDARD 166, Replacement and Caching Table Format). In either case, the subunit should be reformatted, and the cause of the RCT corruption determined.

04005 CZUDC HRD ERR 04005 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
HEADER NOT FOUND DURING WRITE
DBN bn
SECTORS FROM INDEX sector TRK track GRP group CYL cylinder
ORIGIN OF SEEK: GRP group CYL cylinder

Error 4005 occurs only when Test 4 is writing a DBN or RBN. This is because bad blocks in the diagnostic area are not revectored, and RBN's are what LBN's are revectord to, so they should never be bad. Test 4 reports this error if the header being searched for couldn't be found in two revolutions of the disk.

04006 CZUDC SFT ERR 04006 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
SELECT TRACK AND WRITE LEVEL 1 CMD NOT SENT
ATTEMPT attempt
type bn
SECTORS FROM INDEX sector TRK track GRP group CYL cylinder
ORIGIN OF SEEK: GRP group CYL cylinder
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

Select track and read or write not executed occurs when the UDA attempts to send the select track and read/write level 1 cmd, but receiver ready is deasserted or the state is invalid so it cannot send the command (the SERDES could also be broken so it's unable to send the command). The same error is generated if the UDA gets a header sync timeout, and when it looks at the drive's state, it is either invalid or reciever ready is deasserted (header sync timeout is <<NOT>> a error -- it's quite normal on a high-density disk).

See retry/recovery section for recovery details.

04007 CZUDC SFT ERR 04007 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss

```
                ECC DETECTED ERROR
                RETRY retry
                ERROR RECOVERY LEVEL level
                type bn
                SECTORS FROM INDEX sector TRK track GRP group CYL cylinder

                        Error 4007 occurs if an ECC error is detected but ECC correction is
                        disabled.

                        See retry/recovery section for recovery details.


04008           CZUDC   SFT ERR  04008 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
                DISK EXERCISER  DM PC:xxxx  UDA AT xxxxxx  DRIVE xxx  RUNTIME hh:mm:ss
                ECC DETECTED ERROR, BUT CORRECTION FAILED
                RETRY retry
                ERROR RECOVERY LEVEL level
                type bn
                SECTORS FROM INDEX sector TRK track GRP group CYL cylinder

                        Error 4008 occurs if an ECC error is detected, but the correction
                        algorithm is unable to correct the errors.

                        NOTE: THIS IS USUALLY (BUT NOT ALWAYS) INDICATIVE OF A BAD SPOT IN THE
                        ECC RESIDUE AREA AFTER THE DATA AREA OF THE SECTOR.

                        See retry/recovery section for recovery details.


04009           CZUDC   SFT ERR  04009 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
                DISK EXERCISER  DM PC:xxxx  UDA AT xxxxxx  DRIVE xxx  RUNTIME hh:mm:ss
                ECC CORRECTIONS EXCEED THRESHOLD
                RETRY retry
                ERROR RECOVERY LEVEL level
                type bn
                SECTORS FROM INDEX sector TRK track GRP group CYL cylinder

                        Error 4009 occurs if an ECC error is detected, the correction
                        algorithm succeeds in correcting the errors, but the number of bits
                        that were corrected exceeds the correction threshold (a SDI DRIVE
                        CHARACTERISTIC).

                        See retry/recovery section for recovery details.


04010           CZUDC   SFT ERR  04010 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
                DISK EXERCISER  DM PC:xxxx  UDA AT xxxxxx  DRIVE xxx  RUNTIME hh:mm:ss
                ECC CORRECTION SUCCEEDED, BUT EDC DETECTS ERROR
                RETRY retry
                ERROR RECOVERY LEVEL level
                type bn
                SECTORS FROM INDEX sector TRK track GRP group CYL cylinder
                EDC COMPUTED edc
                EDC READ     edc
```

edc: The edc computed and read in octal.

Error 4010 could be caused by several problems:

1) A buffer with a few ECC errors that can be corrected, but the EDC was incorrectly computed or written, or 2) The ECC algorithm incorrectly corrected the buffer and/or the EDC value, (but corrections were less than the threshold) or 3) UDA buffer RAM problem.

See retry/recovery section for recovery details.

04011
```
CZUDC   HRD ERR  04011 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER  DM PC:xxxx  UDA AT xxxxxx  DRIVE xxx  RUNTIME hh:mm:ss
ERROR RECOVERY TRIED ALL LEVELS WITHOUT SUCCESS
type bn
GRP group CYL cylinder
```

Error 4011 occurs when retries are enabled, and Test 4 has tried all retries on all levels of error recovery. See ECC and EDC retries in the retry/recovery section.

04012
```
CZUDC   HRD ERR  04012 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER  DM PC:xxxx  UDA AT xxxxxx  DRIVE xxx  RUNTIME hh:mm:ss
DATA COMPARISON FAILED
ECC OR EDC HAD DETECTED ERROR IN BUFFER
type bn
SECTORS FROM INDEX sector TRK track GRP group CYL cylinder
PATTERN NUMBER pattern
OFFSET OF ERROR WITHIN BUFFER: buffer_offset
OFFSET OF ERROR WITHIN DISPLAYED LIST: list_offset (1ST WORD OFFSET 0)
    data0   data1   data2   data3   data4   data5
    data6   data7   data8   data9   data10  data11

CZUDC   HRD ERR  04012 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER  DM PC:xxxx  UDA AT xxxxxx  DRIVE xxx  RUNTIME hh:mm:ss
DATA COMPARISON FAILED
ECC OR EDC HAD <<NOT>> DETECTED ERROR IN BUFFER
type bn
SECTORS FROM INDEX sector TRK track GRP group CYL cylinder
PATTERN NUMBER pattern
OFFSET OF ERROR WITHIN BUFFER: buffer_offset
OFFSET OF ERROR WITHIN DISPLAYED LIST: list_offset (1ST WORD OFFSET 0)
    data0   data1   data2   data3   data4   data5
    data6   data7   data8   data9   data10  data11
```

pattern: The pattern number (decimal) that failed the comparison.

buffer_offset: The offset of the error (decimal) within the sector read, where the first word in the sector is offset 0

list_offset: The offset of the error (decimal) within the displayed list, where the first word in the list is offset 0

dataX: Test 4 displays twelve data words read from the sector. They are displayed left to right, top to bottom.

Error 4012 occurs when a data compare detects a difference between the buffer read and a known data pattern. The operator is informed if the error was detected by the ECC or EDC. The first word of the sector which may or may not be printed, depending on the position of the error, is the pattern number replicated in each nibble of the word. If a disk is not initally written, it is likely that data comparison failures will occur in the fist word of the sector. The following is the first word of the sector for the sixteen different patterns.

pattern	word 0	pattern	word 0
1	010421	9	114631
2	021042	10	125252
3	031463	11	135673
4	042104	12	146314
5	052525	13	156735
6	063146	14	167356
7	073567	15	177777
8	104210	16	000000

Note that pattern 16 is mapped to pattern 0.

04013 CZUDC DEV FTL ERR 04013 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
DRIVE NOT ONLINE TO UDA, AND NOT SPINABLE

If a drive dropps offline while being tested (a normal occurance during Test 4) and some event happens that makes the drive unspinnable (such as the operator popping out the run/stop switch) error 4013 will be printed. If the operator inhibits dropping units, Test 4 will go into error recovery and loop on error 4023, spindle dropped ready.

04014 CZUDC DEV FTL ERR 04014 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
UNABLE TO COMPLETE SEEK -- TRIED 3 TIMES
type bn
GRP group CYL cylinder

Once a seek has been attempted 3 times, and never successfully completed, error 4014 will be printed and the entire unit dropped. If the operator inhibits dropping units, the drive will be recalibrated, and the seek will be attempted again.

04015 CZUDC SFT ERR 04015 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
SEEK REQUIRED retries RETRIES BEFORE COMPLETING
GRP group CYL cylinder

retries: The number of times the seek was re-issued

If a seek required retries, error 4015 would print to notify the operator.

04016 CZUDC DEV FTL ERR 04016 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
ERRORS DURING DRIVE INITIALIZATION AND SETUP
THIS UDA AND ALL DRIVES ATTACHED WILL BE REMOVED FROM TESTING

If any errors occur during drive and test initialization, DRIVES ATTACHED TO THE UDA THAT HAD THE DRIVE INITIALIZATION ERRORS WILL NOT BE TESTED. In this case, error 4016 will be printed to notify the operator. THIS ERROR DOES <<NOT>> REFER TO UDA INITIALIZATION. This error is unaffected by the operator inhibiting the dropping of units.

04017 CZUDC DEV FTL ERR 04017 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
NO VALID STATE FROM DRIVE
NO DRIVE CLOCKS

CZUDC DEV FTL ERR 04017 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
NO VALID STATE FROM DRIVE
HARD PARITY OR PULSE ERROR FOR 1/2 A SECOND

If Test 4 is <<EVER>> unable to get valid drive state, the drive is immediately dropped, and error 4017 is printed. There are two types of invalid state: no clocks or 'hard' errors. If Test 4 <<EVER>> detects no clocks, the driver is dropped IMMEDIATELY. Parity and pulse errors are normal, so Test 4 tolerates them, <<UNLESS THEY HAPPEN CONTINUOUSLY FOR 1/2 A SECOND>>. If they do occur for 1/2 a second, either the transmitter or receiver is bad, and the drive is dropped. If the operator has inhibited the dropping of units, Test 4 will retry the module that the error occurred on.

04018 CZUDC DEV FTL ERR 04018 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
ATTEMPT TO WRITE ON WRITE PROTECTED DRIVE
ERROR CODE RETURNED FROM UDA: code
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

code: The error (in octal) returned to Test 4 from the UDA when Test 4 attempted to write on the write protected drive.

The UDA error codes (in octal) are as follows:

code error

2	SELECT TRACK AND WRITE LEVEL 1 CMD NOT SENT
3	LBN IS REVECTORED
4	HEADER NOT FOUND
153	SEEK OR HEAD SELECT ERROR
213	R/W RDY DROPPED
253	DATA OR STATE CLOCK TIMEOUT
313	RCVR RDY DROPPED
413	REAL TIME STATE RECEIVE ERROR

If Test 4 attempts to write on a write protected drive, error 4018 is printed. Test 4 requires the drive to detect the attempt to write when write protected and return an error for this error to be printed. If the operator has inhibited the dropping of units, a seek will be issued and the write attempted again.

04019 CZUDC HRD ERR 04019 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
HEADER NOT FOUND DURING READ
type bn
SECTORS FROM INDEX sector TRK track GRP group CYL cylinder
ORIGIN OF SEEK: GRP group CYL cylinder

Error 4019 occurs only when Test 4 is reading a DBN or RBN. This is because bad blocks in the diagnostic area are not revectored, and RBN's are what LBN's are revectord to, so they should never be bad. Test 4 reports this error if the header being searched for couldn't be found in two revolutions of the disk.

04020 CZUDC SFT ERR 04020 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
SELECT TRACK AND READ LEVEL 1 CMD NOT SENT
ATTEMPT attempt
type bn
SECTORS FROM INDEX sector TRK track GRP group CYL cylinder
ORIGIN OF SEEK: GRP group CYL cylinder
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

Select track and read or write not executed occurs when the UDA attempts to send the select track and read/write level 1 cmd, but receiver ready is deasserted or the state is invalid so it cannot send the command (the SERDES could also be broken so it's unable to send the command). The same error is generated if the UDA gets a header sync timeout, and when it looks at the drive's state, it is either invalid or reciever ready is deasserted (header sync timeout is <<NOT>> a error -- it's quite normal on a high-density disk).

See retry/recovery section for recovery details.

04021 CZUDC DEV FTL ERR 04021 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss

```
        DRIVE NOT FORMATTED IN 512 BYTE MODE -- UNABLE TO TEST
        FCT BLOCK ZERO MODE WORD: mode

        *** THIS PACK HAS AN INVALID FORMAT AND CANNOT BE USED ***
```

mode: The mode word found on the drive's FCT block zero.

Error 4021 occurs only when Test 4 finds that the mode word found in FCT block zero is not the 512 byte mode word (126736 octal). See DEC STANDARD 166 "FCT Structure". Inhibiting the dropping of units has no effect on this error.

```
04022   CZUDC   DEV FTL ERR  04022 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
        DISK EXERCISER  DM PC:xxxx  UDA AT xxxxxx  DRIVE xxx  RUNTIME hh:mm:ss
        COULD NOT READ FCT BLOCK ZERO

        *** THIS PACK HAS AN INVALID FORMAT AND CANNOT BE USED ***
```

Error 4022 occurs when test 4 is unable to read any copy of FCT block zero. See DEC STANDARD 166 "FCT Structure". Inhibiting the dropping of units has no effect on this error.

```
04023   CZUDC   DEV FTL ERR  04023 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
        DISK EXERCISER  DM PC:xxxx  UDA AT xxxxxx  DRIVE xxx  RUNTIME hh:mm:ss
        UNABLE TO CONTINUE TESTING
        PORT SWITCH OUT
        REAL TIME STATE 0003
        STATUS (R TO L): 1312  1110  0908  0706  0504  0302  0100
```

If, during testing, the operator disables the port that Test 4 is using by popping out the port switch, Test 4 prints error 4023. CHANGING THE STATE OF THE PORT SWITCH FOR THE PORT THAT Test 4 IS <<NOT>> USING HAS NO EFFECT ON THE TEST. If dropping of units is inhibited, Test 4 will loop in error recovery, printing this error, until the error state is corrected (by some external action).

```
        CZUDC   DEV FTL ERR  04023 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
        DISK EXERCISER  DM PC:xxxx  UDA AT xxxxxx  DRIVE xxx  RUNTIME hh:mm:ss
        UNABLE TO CONTINUE TESTING
        RUN/STOP SWITCH OUT
        REAL TIME STATE 0003
        STATUS (R TO L): 1312  1110  0908  0706  0504  0302  0100
```

If, during testing, the operator pops out the run/stop switch, Test 4 prints error 4023. If dropping of units is inhibited, Test 4 will loop in error recovery, printing this error, until the error state is corrected (by some external action).

```
        CZUDC   DEV FTL ERR  04023 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
```

```
DISK EXERCISER  DM PC:xxxx  UDA AT xxxxxx  DRIVE xxx  RUNTIME hh:mm:ss
UNABLE TO CONTINUE TESTING
SPINDLE DROPPED READY
REAL TIME STATE 0003
STATUS (R TO L): 1312  1110  0908  0706  0504  0302  0100
```

If, during testing, the spindle drops from its ready state, error 4023 is printed. If dropping of units is inhibited, Test 4 will loop in error recovery, printing this error, until the error state is corrected (by some external action).

04024

```
CZUDC   SFT ERR  04024 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER  DM PC:xxxx  UDA AT xxxxxx  DRIVE xxx  RUNTIME hh:mm:ss
EDC DETECTED ERROR BUT ECC DID NOT
RETRY retry
ERROR RECOVERY LEVEL level
type bn
SECTORS FROM INDEX sector TRK track GRP group CYL cylinder
EDC COMPUTED edc
EDC READ     edc
```

edc: The edc computed and read in octal.

Error 4024 could be caused by several problems. 1) A buffer with no ECC errors, but the EDC was incorrectly computed or written, or 2) UDA buffer RAM problem, or 3) The error is such that the ECC really doesn't detect an error... This is unlikely.

See retry/recovery section for recovery details.

04025

```
CZUDC   HRD ERR  04025 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER  DM PC:xxxx  UDA AT xxxxxx  DRIVE xxx  RUNTIME hh:mm:ss
WRITE ATTEMPTED MAXIMUM TIMES
type bn
```

If three I/O errors occur when attempting to write to the drive (one I/O error if retries are disabled) error 4025 is printed to inform the operator.

04026

```
CZUDC   HRD ERR  04026 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER  DM PC:xxxx  UDA AT xxxxxx  DRIVE xxx  RUNTIME hh:mm:ss
READ ATTEMPTED MAXIMUM TIMES
type bn
```

If three I/O errors occur when attempting to read from the drive (one I/O error if retries are disabled) error 4026 is printed to inform the operator.

04028

```
CZUDC   DEV FTL ERR  04028 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
```

DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
BOTH READ ONLY <AND> WRITE ONLY BITS SET -- HOST ERROR

Error 4028 prints ONLY IF THERE IS A HOST CODE ERROR -- THIS IS NOT AN ERROR FROM A DRIVE. Inhibiting the dropping of units has no effect on this error.

04034 CZUDC SFT ERR 04034 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
SERDES OVERRUN ERROR DURING READ
ATTEMPT attempt
type bn
SECTORS FROM INDEX sector TRK track GRP group CYL cylinder
ORIGIN OF SEEK: GRP group CYL cylinder
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

The SERDES overrun error is detected on a read operation and is indicative of a drive whose transfer rate is greater than 23 MHZ or a broken SERDES.

See retry/recovery section for recovery details.

04035 CZUDC SFT ERR 04035 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
DATA OR STATE CLOCK TIMEOUT DURING READ
ATTEMPT attempt
type bn
SECTORS FROM INDEX sector TRK track GRP group CYL cylinder
ORIGIN OF SEEK: GRP group CYL cylinder
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

The loss of drive clock occurs when the UDA is clocking data to or from the drive through the SERDES. Failure of a word to be clocked in during a 125 millisecond time period triggers a loss of drive clock error.

See retry/recovery section for recovery details.

04036 CZUDC SFT ERR 04036 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
DATA SYNC TIMEOUT DURING READ
ATTEMPT attempt
type bn
SECTORS FROM INDEX sector TRK track GRP group CYL cylinder
ORIGIN OF SEEK: GRP group CYL cylinder
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

This error occurs on a read operation after the correct header has

been found and the UDA times out waiting for the data sync word.

See retry/recovery section for recovery details.

04037 CZUDC SFT ERR 04037 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
R/W RDY DROPPED BEFORE/DURING READ
ATTEMPT attempt
type bn
SECTORS FROM INDEX sector TRK track GRP group CYL cylinder
ORIGIN OF SEEK: GRP group CYL cylinder
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

The loss of read/write ready error is detected either before an I/O has begun when trying to send out the real time command or at the end of an I/O operation when checking for errors.

See retry/recovery section for recovery details.

04038 CZUDC SFT ERR 04038 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
RCVR RDY DROPPED BEFORE/DURING READ
ATTEMPT attempt
type bn
SECTORS FROM INDEX sector TRK track GRP group CYL cylinder
ORIGIN OF SEEK: GRP group CYL cylinder
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

The loss of drive receiver ready is detected when the UDA is trying to send out a real-time read or write command.

See retry/recovery section for recovery details.

04040 CZUDC HRD ERR 04040 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
ALL COPIES OF RCT READ WITH ERROR, SEARCHING FOR
LBN THAT WAS REVECTORED
LAST RCT LBN SEARCHED bn
SEARCHING FOR LBN bn

CZUDC HRD ERR 04040 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
ALL COPIES OF RCT READ WITH ERROR, SEARCHING FOR
LBN WITH HEADER NOT FOUND
LAST RCT LBN SEARCHED bn
SEARCHING FOR LBN bn

Error 4040 occurs when Test 4 is trying to find the RBN that replaces a LBN that was revectored or whose header could not be found (both should

be revectored). Test 4 was unable to get a valid copy out of the M copies of the RCT due to I/O errors or ECC/EDC errors. M is a SDI DRIVE CHARACTERISTIC and is defined by the drive. This is indicitave of either a bad pack (HDA) or that something wrote over the RCT incorrectly. Try to reformat the subunit.

04041 CZUDC HRD ERR 04041 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
COULD NOT FIND REPLACEMENT FOR
LBN THAT WAS REVECTORED
LBN TO REPLACE bn

CZUDC HRD ERR 04041 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
COULD NOT FIND REPLACEMENT FOR
LBN WITH HEADER NOT FOUND
LBN TO REPLACE bn

Error 4041 only occure when Test 4 is running in the customer data area, and is trying to find the RBN that replaces a LBN that was revectored (must be in the RCT) or whose header could not be found (should be in the RCT, unless the media under the header has 'grown a bad spot recently). In either case, Test 4 was unable to find an entry in the RCT for the the sector and the subunit should be reformatted. In the case of the revectored LBN, the cause of the RCT's corruption should be determined (even with the header not found, the RCT may have been corrupted because a header going bad without warning [eg. the formatter not being able to see it as a weak spot] is a very low probibility occurance).

04042 CZUDC DEV FTL ERR 04042 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
TIMEOUT WAITING FOR SECTOR OR INDEX PULSE
GRP group CYL cylinder
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

Error 4042 occure when the UDA microcode never detects a sector or index pulse from the drive before a read or write operation. If dropping of units is inhibited, a seek will be issued, and the write attempted again.

04044 CZUDC SFT ERR 04044 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
SEEK OR HEAD SELECT ERROR DETECTED DURING WRITE
ATTEMPT attempt
LBN bn
SECTORS FROM INDEX sector TRK track GRP group CYL cylinder
ORIGIN OF SEEK: GRP group CYL cylinder
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

See error 4045 for description.

See retry/recovery section for recovery details.

04045 CZUDC SFT ERR 04045 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
SEEK OR HEAD SELECT ERROR DETECTED DURING READ
ATTEMPT attempt
LBN bn
SECTORS FROM INDEX sector TRK track GRP group CYL cylinder
ORIGIN OF SEEK: GRP group CYL cylinder
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

Errors 4044 and 4045 occur when the header comparison routine determines that the drive is positioned at the wrong physical cylinder, or that the wrong head (which can be cylinders, groups or tracks, or any combination depending on the drive) had been selected. This error only occurs when the drive itself had not detected the misseek or incorrect head selected.

NOTE: These errors will only be detected when the operator is running Test 4 in the customer data area. This error will <<never>> appear when running in the diagnostic area.

See retry/recovery section for recovery details.

04047 CZUDC SFT ERR 04047 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
DATA OR STATE CLOCK TIMEOUT DURING WRITE
ATTEMPT attempt
type bn
SECTORS FROM INDEX sector TRK track GRP group CYL cylinder
ORIGIN OF SEEK: GRP group CYL cylinder
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

The loss of drive clock occurs when the UDA is clocking data to or from the drive through the SERDES. Failure of a word to be clocked in during a 125 millisecond time period triggers a loss of drive clock error.

See retry/recovery section for recovery details.

04048 CZUDC SFT ERR 04048 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
R/W RDY DROPPED BEFORE/DURING WRITE
ATTEMPT attempt
type bn
SECTORS FROM INDEX sector TRK track GRP group CYL cylinder
ORIGIN OF SEEK: GRP group CYL cylinder
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

The loss of read/write ready error is detected either before an I/O has begun when trying to send out the real time command or at

the end of an I/O operation when checking for errors.

See retry/recovery section for recovery details.

04049 CZUDC SFT ERR 04049 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
RCVR RDY DROPPED BEFORE/DURING WRITE
ATTEMPT attempt
type bn
SECTORS FROM INDEX sector TRK track GRP group CYL cylinder
ORIGIN OF SEEK: GRP group CYL cylinder
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

The loss of drive receiver ready is detected when the UDA is trying to send out a real-time read or write command.

See retry/recovery section for recovery details.

04050 CZUDC DEV FTL ERR 04050 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
OPERATOR ERROR IN ANSWERING MANUAL INTERVENTION QUESTIONS FOR THIS UNIT
BEGIN/END SET STARTING BLOCK NUMBER GREATER THAN ENDING BLOCK NUMBER

This is a Test 4 initialization error due to an operator error. Go back to the manual intervention questions and check the answers to the BEGIN/END set questions. Inhibiting the dropping of units has no effect on this error.

04051 CZUDC DEV FTL ERR 04051 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
OPERATOR ERROR IN ANSWERING MANUAL INTERVENTION QUESTIONS FOR THIS UNIT
THE BEGIN/END SETS OVERLAP

This is a Test 4 initialization error due to an operator error. Go back to the manual intervention questions and check the answers to the BEGIN/END set questions. Inhibiting the dropping of units has no effect on this error.

04052 CZUDC DEV FTL ERR 04052 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
OPERATOR ERROR IN ANSWERING MANUAL INTERVENTION QUESTIONS FOR THIS UNIT
BEGIN/END SET ENDING BLOCK NUMBER EXCEEDS MAXIMUM
MAXIMUM BLOCK NUMBER ON DEVICE IS maximum_block_number

maximum_block_number: This is the highest block number the operator can specify.

This is a Test 4 initialization error due to an operator error. Go back to the manual intervention questions and check the answers to the BEGIN/END set questions. Inhibiting the dropping of units has no effect on this error.

04053 CZUDC DEV FTL ERR 04053 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
OPERATOR ERROR IN ANSWERING MANUAL INTERVENTION QUESTIONS FOR THIS UNIT
DUPLICATE BAD BLOCKS

This is a Test 4 initialization error due to an operator error. Go back to the manual intervention questions and check the answers to the BAD BLOCK questions. Inhibiting the dropping of units has no effect on this error.

04054 CZUDC DEV FTL ERR 04054 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
OPERATOR ERROR IN ANSWERING MANUAL INTERVENTION QUESTIONS FOR THIS UNIT
BAD BLOCK NUMBER EXCEEDS MAXIMUM. MAXIMUM BLOCK NUMBER
ON DEVICE IS maximum_block_number

maximum_block_number: This is the highest block number the operator can specify.

This is a Test 4 initialization error due to an operator error. Go back to the manual intervention questions and check the answers to the BAD BLOCK questions. Inhibiting the dropping of units has no effect on this error.

04055 CZUDC DEV FTL ERR 04055 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
OPERATOR ERROR IN ANSWERING MANUAL INTERVENTION QUESTIONS FOR THIS UNIT
STARTING CYLINDER GREATER THAN ENDING CYLINDER

This is a Test 4 initialization error due to an operator error. Go back to the manual intervention questions and check the answers to the STARTING AND ENDING CYLINDER questions. Inhibiting the dropping of units has no effect on this error.

04056 CZUDC DEV FTL ERR 04056 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
OPERATOR ERROR IN ANSWERING MANUAL INTERVENTION QUESTIONS FOR THIS UNIT
RANDOM AND SEQUENTIAL SEEKS CANNOT BE MIXED WITHIN A UNIT

Error 4056 is an operator error. The error occurs on a multiple subunit drive when one subunit is selected to run in random mode, and another is selected to run in sequential mode. This mix is not supported, so the above message is issued. Inhibiting the dropping of units has no effect on this error.

04057 CZUDC DEV FTL ERR 04057 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
OPERATOR ERROR IN ANSWERING MANUAL INTERVENTION QUESTIONS FOR THIS UNIT
OVERFLOW WHEN CALCULATING THE L/DBN FROM THE GIVEN CYLINDER
CYLINDER TOO LARGE

This is a Test 4 initialization error due to an operator error. The operator entered a cylinder number, that when converted to a block number, the block number exceeded (2**28) - 1. Go back to the manual intervention questions and check the answers to the STARTING AND ENDING CYLINDER questions. Inhibiting the dropping of units has no effect on this error.

04058 CZUDC DEV FTL ERR 04058 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
OPERATOR ERROR IN ANSWERING MANUAL INTERVENTION QUESTIONS FOR THIS UNIT
TRACK EXCEEDS MAXIMUM FOR DEVICE, MAXIMUM IS maximum_track

maximum_track: This is the highest track number the operator can specify.

This is a Test 4 initialization error due to an operator error. Go back to the manual intervention questions and check the answers to the TRACK questions. Inhibiting the dropping of units has no effect on this error.

CZUDC DEV FTL ERR 04058 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
OPERATOR ERROR IN ANSWERING MANUAL INTERVENTION QUESTIONS FOR THIS UNIT
GROUP EXCEEDS MAXIMUM FOR DEVICE, MAXIMUM IS maximum_group

maximum_group: This is the highest group number the operator can specify.

This is a Test 4 initialization error due to an operator error. Go back to the manual intervention questions and check the answers to the GROUP questions. Inhibiting the dropping of units has no effect on this error.

04059 CZUDC DEV FTL ERR 04059 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
OPERATOR ERROR IN ANSWERING MANUAL INTERVENTION QUESTIONS FOR THIS UNIT
TWO IDENTICAL TRACKS

This is a Test 4 initialization error due to an operator error. Go back to the manual intervention questions and check the answers to the TRACK questions. Inhibiting the dropping of units has no effect on this error.

CZUDC DEV FTL ERR 04059 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss

OPERATOR ERROR IN ANSWERING MANUAL INTERVENTION QUESTIONS FOR THIS UNIT
TWO IDENTICAL GROUPS

This is a Test 4 initialization error due to an operator error. Go back to the manual intervention questions and check the answers to the GROUP questions. Inhibiting the dropping of units has no effect on this error.

04062 CZUDC DEV FTL ERR 04062 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
OPERATOR ERROR IN ANSWERING MANUAL INTERVENTION QUESTIONS FOR THIS UNIT
DBN COMPUTED FROM END CYLINDER GIVEN EXCEEDS MAXIMUM DBN NUMBER ON
DEVICE - CYLINDER TOO LARGE

This is a Test 4 initialization error.
Note that though there may be writeable DBN's on the 'last' cylinder, the read only diagnostic area may start on that same cylinder, and Test 4 tries to write to the end of the cylinder that the operator specified. Therefore, specify the previous cylinder if cylinders must be specified. Inhibiting the dropping of units has no effect on this error.

CZUDC DEV FTL ERR 04062 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
OPERATOR ERROR IN ANSWERING MANUAL INTERVENTION QUESTIONS FOR THIS UNIT
LBN COMPUTED FROM END CYLINDER GIVEN EXCEEDS MAXIMUM LBN NUMBER ON
DEVICE - CYLINDER TOO LARGE

This is a Test 4 initialization error.
Note that though there may be writeable LBN's on the 'last' cylinder, the RCT area may start on that same cylinder, and Test 4 tries to write to the end of the cylinder that the operator specified. Therefore, specify the previous cylinder if cylinders must be specified. Inhibiting the dropping of units has no effect on this error.

04063 CZUDC SFT ERR 04063 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
REAL TIME STATE RECEIVE ERROR DURING WRITE
ATTEMPT attempt
type bn
SECTORS FROM INDEX sector TRK track GRP group CYL cylinder
ORIGIN OF SEEK: GRP group CYL cylinder
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

The real time drive state receive error is detected at the end of an I/O operation and indicates that there was a pulse or parity error in the receipt of the drive's state during the I/O operation.

See retry/recovery section for recovery details.

04064 CZUDC SFT ERR 04064 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
REAL TIME STATE RECEIVE ERROR DURING READ
ATTEMPT attempt
type bn
SECTORS FROM INDEX sector TRK track GRP group CYL cylinder
ORIGIN OF SEEK: GRP group CYL cylinder
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

The real time drive state receive error is detected at the end of an I/O operation and indicates that there was a pulse or parity error in the receipt of the drive's state during the I/O operation.

See retry/recovery section for recovery details.

04068 CZUDC HRD ERR 04068 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
UNKNOWN ERROR CODE DURING WRITE
ERROR CODE RETURNED error_code
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

error_code: This is the error code returned to Test 4 by the UDA that Test 4 does not recognize.

The unknown error code occurs when the UDA returns an error code from an operation that Test 4 does not recognize. Possible UDA microcode change without Test 4 update.

See retry/recovery section for recovery details.

04069 CZUDC HRD ERR 04069 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
UNKNOWN ERROR CODE DURING READ
ERROR CODE RETURNED error_code
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

error_code: This is the error code returned to Test 4 by the UDA that Test 4 does not recognize.

The unknown error code occurs when the UDA returns an error code from an operation that Test 4 does not recognize. Possible UDA microcode change without Test 4 update.

See retry/recovery section for recovery details.

04070 CZUDC SFT ERR 04070 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss

```
                TIMEOUT OF SEND
                command_type
                REAL TIME STATE 0003
                STATUS (R TO L): 1312  1110  0908  0706  0504  0302  0100
```

command_type: See section following error 4078 for a description

If Test 4 tries to send a level 2 command to the drive, and receiver ready is deasserted, error 4070 occurs.

See retry/recovery section for recovery details.

```
04071   CZUDC   SFT ERR  04071 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
                DISK EXERCISER  DM PC:xxxx  UDA AT xxxxxx  DRIVE xxx  RUNTIME hh:mm:ss
                TIMEOUT OF RECEIVE
                command_type
                REAL TIME STATE 0003
                STATUS (R TO L): 1312  1110  0908  0706  0504  0302  0100
```

command_type: See section following error 4078 for a description

This error is a failure of the drive to respond to an SDI level 2 command (see the SDI specification) before the drive-supplied command timeout expires.

See retry/recovery section for recovery details.

```
04072   CZUDC   SFT ERR  04072 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
                DISK EXERCISER  DM PC:xxxx  UDA AT xxxxxx  DRIVE xxx  RUNTIME hh:mm:ss
                FIRST WORD RECEIVED WAS NOT START FRAME
                command_type
                REAL TIME STATE 0003
                STATUS (R TO L): 1312  1110  0908  0706  0504  0302  0100
```

command_type: See section following error 4071 for a description

The first word received by the UDA from the drive was not a valid message start frame.

See retry/recovery section for recovery details.

```
04073   CZUDC   SFT ERR  04073 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
                DISK EXERCISER  DM PC:xxxx  UDA AT xxxxxx  DRIVE xxx  RUNTIME hh:mm:ss
                FRAMING ERROR ON LEVEL 0 RECEIVE
                command_type
                REAL TIME STATE 0003
                STATUS (R TO L): 1312  1110  0908  0706  0504  0302  0100
```

command_type: See section following error 4078 for a description

Error 4073 is caused by one or more of the following conditions:

1) Illegal frame code -- the frame is not a message start, continue, or end frame. 2) Illegal sequence of frames -- such as a message start frame without ever receiving a message end frame. This can be caused by the drive sending a response before the UDA asserts receiver ready, or a random hit on the SDI cable that garbles a frame or a bad drive transmitter or UDA receiver.

See retry/recovery section for recovery details.

04074 CZUDC SFT ERR 04074 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
CHECKSUM ERROR ON LEVEL 0 RECEIVE
command_type
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

command_type: See section following error 4078 for a description

The checksum attached to a message end frame did not match the checksum computed over the level 2 command. This could be caused by a bad drive transmitter, bad UDA receiver, incorrectly computed checksum by the drive (unlikely) or a random hit on the SDI cable.

See retry/recovery section for recovery details.

04075 CZUDC SFT ERR 04075 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
BUFFER SIZE SMALLER THAN LEVEL 2 RESPONSE
command_type
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

command_type: See section following error 4078 for a description

The buffer size set aside for the response was not large enough for the response received. This is caused by the drive sending a response that is incorrect for the request sent to the drive, or the drive sending some garbage with the response.

See retry/recovery section for recovery details.

04076 CZUDC SFT ERR 04076 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
RESPONSE OF LEVEL 2 CMD NOT AS EXPECTED
command_type
EXPECTED RESPONSE expected_response
RESPONSE RECEIVED response_received
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

command_type: See section following error 4078 for a description

expected_response: This is the correct response (HEX) for the command.

response_received: This is the response received from the drive, (HEX) where a 7D is an unsuccessful response. Any other than a 7D for this value indicates a <<VERY>> sick drive.

This is caused by receiving an UNSUCCESSFUL response from the drive, or the drive sending some response other than the correct response for the request sent to the drive. See the contents of status for the unexpected response error (or reason).

See retry/recovery section for recovery details.

04077 CZUDC HRD ERR 04077 ON UNIT 00 TST 04 SUB 000 PC: xx:xxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
DRIVE NEVER DEASSERTED RECEIVER READY AFTER LEVEL 2 SEND
command_type
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

command_type: See section following error 4078 for a description

This is caused by the drive not seeing a command sent by the UDA. The drive must deassert receiver ready to acknowledge that it did see a command via the SDI. If the drive saw only part of the command, it would have marked the command as unsuccessful. But in this case, the drive did not see any of the command and is now waiting for a command to be sent from the UDA.

04078 CZUDC HRD ERR 04078 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hh:mm:ss
UNKNOWN ERROR CODE RETURNED FROM LEVEL 2 RECEIVE
command_type
ERROR CODE RETURNED error_code
REAL TIME STATE 0003
STATUS (R TO L): 1312 1110 0908 0706 0504 0302 0100

command_type: See section following error 4078 for a description

error_code: This is the error code returned to Test 4 by the UDA that Test 4 does not recognize.

The unknown error code occurs when the UDA returns an error code from an operation that Test 4 does not recognize. Possible UDA microcode change without Test 4 update.

See retry/recovery section for recovery details.

NOTE: Errors 4070 - 4078 will become device fatals if attempted 3 times. If dropping of units are inhibited, error recovery is the same as

if the error was a soft error.

command_type: in errors 4070-4078 command_type is one of the following level 2 commands:

ATTEMPTING TO BRING DRIVE ONLINE
ATTEMPTING TO ISSUE SEEK
ATTEMPTING TO GET STATUS
ATTEMPTING DRIVE CLEAR CMD
ATTEMPTING TO BRING DRIVE ONLINE
ATTEMPTING TO CHANGE MODE
ATTEMPTING ERROR RECOVERY CMD
ATTEMPTING TO ISSUE SEEK
ATTEMPTING TO RECALIBRATE

The following commands_types occur only during initialization, and will cause a device fatal if they occur. Inhibiting the dropping of units has no effect on these errors.

ATTEMPTING TO SPIN UP DRIVE
ATTEMPTING TO GET COMMON CHAR
ATTEMPTING TO GET SUBUNIT CHAR

If <<ANY>> error occurs during initialization, <<NO>> testing is done on <<ANY>> drive attached to the UDA that the initialization erorr occured on. See error number 4016.

3.2.9 SPECIAL DEVICE FATAL (05000)

05000 CZUDC DVC FTL 05000 ON UNIT 00 TST 002 SUB 000 PC: xxxxxx
DISK zzzzzzzz DM PC:xxxx UDA AT xxxxxx DRIVE xxx RUNTIME hhh:mm:ss
UNABLE TO FIND REQUESTED DRIVE FOR TESTING
THE FOLLOWING IS VISIBLE ON THE PORTS
UDA PORT 0 -- description
UDA PORT 1 -- description
UDA PORT 2 -- description
UDA PORT 3 -- description

Where zzzzzzzz is either 'RESIDENT', 'FUNCION' or 'EXERCISER'.
This message is presented when the specified drive
was not found by test 2, test 3 or test 4 on any of
the ports. A description of what was each port follows.

NO DRIVE ATTACHED
- There is nothing or the port. If there is suppose to be a drive on this port, make sure there is an odd number of cables between the UDA and the drive and make sure the cables are properly attached.

RCVR RDY NEVER ASSERTED
- The device on the port did not assert RCVR RDY while trying to get state.

TIMEOUT OF SEND
- Sending an SDI command timed out. RCVR RDY is not asserted.

TIMEOUT OF RECEIVE
- Receiving an SDI command timed out. The drive failed to respond to an SDI level 2 command before a timeout expired.

FIRST WORD RECEIVED WAS NOT START FRAME
- The first word received by the UDA from the drive was not a valid message start frame.

FRAMING ERROR ON LEVEL 0 RECEIVE
- The device and the UDA are out of sync or an illegal frame code (the frame is not a message start, continue, or end frame) or illegal sequence of frames. This can be caused by the drive sending a response before the UDA asserts receiver ready, or a random hit on the SDI cable that garbles a frame or a bad drive transmitter or UDA receiver.

CHECKSUM ERROR ON LEVEL 0 RECEIVE
- The checksum attached to a message end frame did not match the checksum computed over the level 2 command. This could be caused by a bad drive transmitter, bad UDA receiver, incorrectly computed checksum by the drive (unlikely) or a random hit on the SDI cable.

RESPONSE LONGER THAN EXPECTED FOR CMD
- The buffer size set aside for the response was not large enough for the response received. This is caused by the drive sending a response that is incorrect for the request sent to the drive, or the drive sending some garbage with the response.

DRIVE n[, consecutive drive numbers if subunited drive] [further explanation]
A drive was found at the end of the cable. It may be a subunited drive, so all the subunit numbers are printed. A further explanation may be presented. These further explanations are:

DRIVE NOT AVAILABLE TO THIS UDA
- The drive was found but is not available to this UDA. It may be dual ported and the drive is online to another controller.

UNSPINABLE DRIVE
- The drive is unspinable. The drive may be powered up but the RUN/STOP switch may be popped out.

3.3 TEST 4 RETRY/RECOVERY METHODS

ECC Error on Disk Read

ECC DETECTED ERROR, BUT CORRECTION FAILED
ECC CORRECTIONS EXCEED THRESHOLD
ECC DETECTED ERROR (If ECC correction disabled)

Retry/Recovery - The UDA or Test 4 will first re-read the sector with the erroneous ECC N times, then N times for each level of error recovery the drive supports. The value of N is an SDI drive characteristic. This retry mechanism will persist until either the recovery level reaches zero or the operation succeeds. It should be noted that the manual intervention questions can disable retries (in this case the recovery fails the first time) and disable error correction (i.e., no ECC correction will be performed). ECC correction and retries are <<ALWAYS>> enabled when the Test 4 is reading the RCT.

Recovery success - One soft error is counted for the entire operation including retries.

Recovery Failure - Test 4 will issue a hard error for the sector. No soft errors will be counted.

Error Detecting Code (EDC) Error

EDC DETECTED ERROR BUT ECC DID NOT
ECC CORRECTION SUCCEEDED, BUT EDC DETECTS ERROR

This error is indicative of a UDA hardware error, either a SERDES failure or an undetected RAM failure, or a sector that was written with an incorrectly computed EDC.

Retry/Recovery - The UDA or Test 4 will re-read the sector with the erroneous EDC N times, then N times for each level of error recovery the drive supports. The value of N is an SDI drive characteristic. This retry mechanism will persist until either the recovery level reaches zero or the operation succeeds. It should be noted that the manual intervention questions can disable retries (in this case the recovery fails the first time). Retries are <<ALWAYS>> enabled when the Test 4 is reading the RCT.

Recovery success - One soft error is counted for the entire operation including retries.

Recovery Failure - Test 4 will issue a hard error for the sector. No soft errors will be counted.

SDI Level 2 and Asynchronous Errors

The SDI level 2 errors are as follows:

- Packet acknowledge failure
- Level 2 command error response, "DE" bit set
- Level 2 command error response, "PE" or "RE" bit set
- Receipt of erroneous drive response
- Seek complete timeout
- Asynchronous drive errors

Level 2 errors are always retried, even if retries are disabled in the manual intervention questions.

In the following retry/recovery algorithms, the Test 4 'Generic error recovery' is the following steps:

1. Issue online command

2. Get status

   2a. If the port, run or spindle ready (PS, RU or SR) bit is deasserted, an Immediate device fatal error is reported and the unit and all its subunits are dropped from testing.

   2b. If the recalibrate requested (RR) bit is set, Test 4 will issue a RECALIBRATE, then SEEK <<AFTER>> generic error recovery is complete.

   2c. If the drive error (DE) bit is set, Test 4 will issue a SEEK <<AFTER>> generic error recovery is complete.

3. If no drive errors, go to 5

4. Send DRIVE CLEAR command

5. Change mode

NOTE: If the drive's timeout expires once, so the drive asserts attention just to get Test 4 to issue a level 2, Test 4 will go through the above error recovery. However, since the timeout expiring is not an error, no error message is issued.

Packet Acknowledge Failure

TIMEOUT OF SEND
TIMEOUT OF RECEIVE

The timeout of send occurs when the UDA attempts to send a level 2 command to the drive, but the drive's receiver ready is not asserted. Timeout of receive is a failure of the drive to respond to an SDI level 2 command (see the SDI specification) before the drive-supplied command timeout expires. These errors are grouped together because their recoveries are the same.

Retry/Recovery - UDA - The steps listed below are performed.

1. The drive is initialized.

2. An SDI GET STATUS command is issued.

3. If the status obtained in the previous step indicated error conditions, these error conditions are resolved and then cleared by an SDI DRIVE CLEAR command.

4. An SDI SEEK command is issued.

5. The command is retried.

Retry/Recovery - Test 4 - The steps listed below are performed.

1. The drive is initialized

2. Test 4 Generic error recovery is performed

3. An SDI SEEK command is issued.

4. The command is retried.

Recovery success - One soft error is counted for the entire operation including retries.

Recovery Failure - The above sequence will be repeated two times and, if the failure persists, the Test 4 will issue a device fatal error and the drive and all its subunits will be dropped. It should be noted that the retry strategy for SDI level 2 errors involves issuing additional level 2 commands. The retry count is the sum of all retries on all SDI level 2 commands, including those commands issued in recovery attempts.

Level 2 Command Error Response - "DE" Bit Set

RESPONSE OF LEVEL 2 CMD NOT AS EXPECTED
SEEK RECEIVED UNSUCCESSFUL RESPONSE

An UNSUCCESSFUL response to a level 2 command, with the "DE" bit set in the status response, notifies the Test 4 that a drive error was detected (or occurred) in connection with the execution of the SDI command.

Retry/Recovery - UDA - The steps listed below are performed.

1. An SDI GET STATUS command is issued.

2. The drive error is cleared by an SDI DRIVE CLEAR command and a SEEK command is issued for the cylinder where the drive was positioned when the error was reported.

3. The command is retried.

Retry/Recovery - Test 4 - The steps listed below are performed.

1. Test 4 Generic error recovery is performed
Note that because the "DE" bit is set, Test 4 generic error recovery will issue a SEEK (see generic error recovery)

2. The command is retried

Recovery success - One soft error is counted for the entire operation including retries.

Recovery Failure - The above sequence is repeated two times and, if the failure persists, the Test 4 will issue a device fatal error and the drive and all its subunits will be dropped. Note that the
retry strategy for SDI level 2 errors involves issuing additional level 2 commands. The retry count is the sum of all retries on all SDI level 2 commands, including those commands issued in recovery attempts.

Level 2 Command Error Response - "PE" or "RE" Bit Set

RESPONSE OF LEVEL 2 CMD NOT AS EXPECTED
SEEK RECEIVED UNSUCCESSFUL RESPONSE

An UNSUCCESSFUL response to a level 2 command with the "PE" or "RE" bit set in the status response notifies the Test 4 that the command either was not appropriate for the state of the drive, or that the command contained invalid arguments.

Retry/Recovery - UDA - The steps listed below are performed.

1. An SDI GET STATUS command is issued

2. The drive error is cleared by an SDI DRIVE CLEAR command.

3. The controller verifies the state of the drive and, if possible, retries the level 2 command. Otherwise, the UDA notifies the host and bypasses subsequent retries.

Retry/Recovery - Test 4 - The steps listed below are performed.

1. Test 4 Generic error recovery is performed

2. The command is retried

Recovery success - One soft error is counted for the entire operation including retries.

Recovery Failure - The above sequence is repeated two times and, if the failure persists, the Test 4 will issue a device fatal error and the drive and all its subunits will be dropped. Note that the retry strategy for SDI level 2 errors involves issuing additional level 2 commands. The retry count is the sum of all retries on all SDI level 2 commands, including those commands issued in recovery attempts.

Receipt of an Erroneous Drive Response

FIRST WORD RECEIVED WAS NOT START FRAME
FRAMING ERROR ON LEVEL 0 RECEIVE
CHECKSUM ERROR ON LEVEL 0 RECEIVE
BUFFER SIZE SMALLER THAN RESPONSE
UNKNOWN ERROR CODE RETURNED FROM LEVEL 2 RECEIVE (hard error)

The first word not start frame error is caused when the UDA does not see a valid message start frame as the first frame received from the drive. The framing error is caused by the UDA receiving an illegal frame code -- the frame is not a message start, continue, or end frame or Illegal sequence of frames -- such as a message start frame without ever receiving a message end frame. The checksum error occurs when a message end frame checksum did not match the checksum computed over the level 2 command. The buffer size smaller than response error occurs when the buffer set aside for the response was not large enough for the response received. The unknown error code is returned when the UDA returns an error code that the Test 4 does not recognize. These errors are grouped together because their recoveries are the same.

Retry/Recovery - UDA - The steps listed below are performed.

1. An SDI GET STATUS command is issued.

2. If the status obtained in the previous step indicated error conditions, these error conditions are resolved and then cleared by an SDI DRIVE CLEAR command.

3. The command is retried.

Retry/Recovery - Test 4 - The steps listed below are performed.

1. Test 4 Generic error recovery is performed

2. The command is retried

Recovery success - One soft error is counted for the entire operation including retries.

Recovery Failure - The above sequence is repeated two times and, if the failure persists, the Test 4 will issue a device fatal error and the drive and all its subunits will be dropped. Note that the retry strategy for SDI level 2 errors involves issuing additional level 2 commands. The retry count is the sum of all retries on all SDI level 2 commands, including those commands issued in recovery attempts.

Seek Complete Timeout

ATTN ASSERTED DURING SEEK
SEEK DID NOT COMPLETE, NEITHER ATTN OR R/W RDY WAS ASSERTED

This error occurs when the drive fails to assert READ/WRITE READY, indicating the successful completion of a seek, or asserts the SDI ATTENTION signal without asserting the READ/WRITE READY signal, indicating the unsuccessful completion of a seek.

Retry/Recovery - UDA - The steps listed below are performed.

1. An SDI GET STATUS command is issued.

2. If the status obtained in the previous step indicated error conditions, these error conditions are resolved and then cleared by an SDI DRIVE CLEAR command.

3. The SEEK is retried.

Retry/Recovery - Test 4 - The steps listed below are performed.

1. Test 4 Generic error recovery is performed

2. The SEEK is retried

Recovery success - One soft error is counted for the entire operation including retries.

Recovery Failure - The above sequence is repeated two times and, if the failure persists, the Test 4 will issue a device fatal error and the drive and all its subunits will be dropped. Note that the retry strategy for SDI level 2 errors involves issuing additional level 2 commands. The retry count is the sum of all retries on all SDI level 2 commands, including those commands issued in recovery attempts.

Asynchronous Drive Errors

ATTN ASSERTED UNEXPECTEDLY, ASYN DRIVE ERROR OR LOGGABLE INFORMATION

Asynchronous drive errors are those errors reported by the drive which are not related to a level 2 or command. These errors are reported by the drive using the SDI ATTENTION signal. Examples are OFF CYLINDER and HDA OVERTEMPERATURE errors. Drive errors are reported to the controller by the "DE" or "WE" bit being set in the error byte in the status response.

Retry/Recovery - UDA - The steps listed below are performed.

1. An SDI GET STATUS command is issued.

2. The drive error is cleared by an SDI DRIVE CLEAR command and, if the error is not "WE", a SEEK command is issued for the cylinder where the drive was last positioned.

Retry/Recovery - Test 4 - The steps listed below are performed.

1. Test 4 Generic error recovery is performed

2. A SEEK is issued

NOTE: A "WE" is a write on a write protected drive; Test 4 detects this in a different manner, so "WE" will never be set.

Recovery Failure -

NOTE: There is a difference between the UDA in controller mode and the Test 4 for this type of error.

The UDA in controller mode will repeat the above sequence two times and, if the drive error persists, the drive would be marked as offline.

Test 4 will <<NOT>> drop the drive after two retries. Instead, the drive will be dropped due to a side affect of such an error: A seek never completing, (causing a device fatal error) or Spindle ready dropping (causing a device fatal error).

Drive I/O Errors

The drive I/O errors occur either during the header compare process (i.e., before I/O actually begins) or during the I/O operation itself. They are as follows:

- Header not found
- Seek or head select error
- Data sync timeout
- Data or state clock timeout during operation (read/write)
- Receiver ready dropped during operation (read/write)
- Read/write ready dropped during operation (read/write)
- SERDES overrun error
- Drive failed to execute select track and (read/write)
- Real time state receive error

Header not found (header compare error)

HEADER NOT FOUND DURING (read/write)

This error occurs when the header compare routine fails to find the desired header (or a revectored version of the desired header) in two disk revolutions.

Retry/Recovery - UDA and Test 4 - Failure to find the desired header in two rotations of the disk will cause the Test 4 to search the Replacement and Caching Table (RCT) to check if the logical block number has been replaced. If a match is found, the Test 4 will perform the desired operation on the revectored block. Enabling/disabling retries has no affect on this operation.

Recovery success - No error is reported or counted.

Recovery Failure - A hard error (header not found) is reported.

Seek or head select error (Positioner Error)

SEEK OR HEAD SELECT ERROR DETECTED DURING (read/write)

This error occurs when the header comparison routine determines that the drive is positioned at the wrong cylinder and that the drive has not detected a seek error.

NOTE: The header comparison routine is active <<ONLY>> in the customer data area. This error will never be detected in the diagnostic area.

Retry/Recovery - UDA - The steps listed below are performed.

1. An SDI GET STATUS command is issued.

2. If the status obtained in the previous step indicated error conditions, these error conditions are resolved and then cleared by an SDI DRIVE CLEAR command.

3. An SDI RECALIBRATE command is issued.

4. An SDI SEEK command is issued.

5. The I/O operation is retried.

Retry/Recovery - Test 4 - The steps listed below are performed.

1. Test 4 Generic error recovery is performed

2. An SDI RECALIBRATE command is issued.

3. An SDI SEEK command is issued.

4. If retries are disabled, Immediate recovery failure. Retries are <<ALWAYS>> enabled when the Test 4 is reading the RCT.

5. The I/O operation is retried.

Recovery success - One soft error is counted for the entire operation including retries.

Recovery Failure - The above sequence is repeated two times and, if a drive I/O error persists, a hard error is reported for the sector. No soft errors are counted.

Data Sync Timeout Error

DATA SYNC TIMEOUT DURING READ

This error occurs on a read operation after the correct header has been found and the UDA times out waiting for the data sync word.

Retry/Recovery - UDA - The steps listed below are performed.

1. An SDI GET STATUS command is issued.

2. If the status obtained in the previous step indicated error conditions, these error conditions are resolved and then cleared by an SDI DRIVE CLEAR COMMAND.

3. An SDI SEEK command is issued.

4. The read operation is retried.

Retry/Recovery - Test 4 - The steps listed below are performed.

1. Test 4 Generic error recovery is performed

2. An SDI SEEK command is issued.

3. If retries are disabled, Immediate recovery failure. Retries are <<ALWAYS>> enabled when the Test 4 is reading the RCT.

4. The read operation is retried.

Recovery success - One soft error is counted for the entire operation including retries.

Recovery Failure - The above sequence is repeated two times and, if a drive I/O error persists, a hard error is reported for the sector. No soft errors are counted.

Data or state clock timeout (Loss of Drive Clock)
Receiver ready failure (Loss of Drive Receiver Ready)

DATA OR STATE CLOCK TIMEOUT DURING (read/write)
RCVR RDY DROPPED DURING (read/write)
COULD NOT SEND SELECT TRACK AND (read/write) CMD OR
HEADER SYNC TIMEOUT WITH INVALID STATE

The loss of drive clock occurs when the UDA is clocking data to or from the drive through the SERDES. Failure of a word to be clocked in during a 125 millisecond time period triggers a loss of drive clock error. The loss of drive receiver ready is detected when the UDA is trying to send out a real-time read or write command. Unable to select track and read or write occurs when the UDA attempts to send the select track and read/write level 1 cmd, but receiver ready is deasserted or the state is invalid so it cannot send the command (the SERDES could also be broken so it's unable to send the command). The same error is generated if the UDA gets a header sync timeout, and when it looks at the drive's state, it is either invalid or reciever ready is deasserted (header sync timeout is <<NOT>> a error -- it's quite normal on a high-density disk). These errors are grouped together because their recoveries are the same.

Retry/Recovery - UDA - The steps listed below are performed.

1. The drive is initialized.

2. An SDI GET STATUS command is issued.

3. If the status obtained in the previous step indicated error conditions, these error conditions are resolved and then cleared by an SDI DRIVE CLEAR command.

4. An SDI SEEK command is issued.

5. The I/O operation is retried.

Retry/Recovery - Test 4 - The steps listed below are performed.

1. The drive is initialized

2. Test 4 Generic error recovery is performed

3. An SDI SEEK command is issued.

4. If retries are disabled, Immediate recovery failure. Retries are <<ALWAYS>> enabled when the Test 4 is reading the RCT.

5. The I/O operation is retried.

Recovery success - One soft error is counted for the entire operation including retries.

Recovery Failure - The above sequence is repeated two times and, if a drive I/O error persists, a hard error is reported for the sector. No soft errors are counted.

Read/Write ready dropped (Loss of Drive Read/Write Ready)
SERDES Overrun Error
Real Time State Receive Error (Real Time Drive State Receive Error)

R/W RDY DROPPED DURING (read/write)
SERDES OVERRUN ERROR DURING READ
REAL TIME STATE RECEIVE ERROR DURING (read/write)
UNKNOWN ERROR CODE DURING (read/write)

The loss of read/write ready error is detected either before an I/O has begun when trying to send out the real time command or at the end of an I/O operation when checking for errors. The SERDES overrun error is detected on a read operation and is indicative of a drive whose transfer rate is greater than 23 MHZ or a broken SERDES. The real time drive state receive error is detected at the end of an I/O operation and indicates that there was a pulse or parity error in the receipt of the drive's state during the I/O operation. The unknown error code is returned when the UDA returns an error code that the Test 4 does not recognize. They are grouped together because their recoveries are the same.

Retry/Recovery - UDA - The steps listed below are performed.

1. An SDI GET STATUS command is issued.

2. If the status obtained in the previous step indicated error conditions, these error conditions are resolved and then cleared by an SDI DRIVE CLEAR command.

3. An SDI SEEK command is issued.

4. The I/O operation is retried.

Retry/Recovery - Test 4 - The steps listed below are performed.

1. Test 4 Generic error recovery is performed

2. An SDI SEEK command is issued.

3. If retries are disabled, Immediate recovery failure. Retries are <<ALWAYS>> enabled when the test 4 is reading the RCT.

4. The read operation is retried.

Recovery success - One soft error is counted for the entire operation including retries.

Recovery Failure - The above sequence is repeated two times and, if a drive I/O error persists, a hard error is reported for the sector. No soft errors are counted.

3.4 DEC STANDARD 166 EXCERPTS

3.4.1 THE REPLACEMENT AND CACHING TABLES

The Replacement and Caching Tables record the locations of all revectored LBN sectors and the status of each RBN on the unit. Each copy of the table is organized in ascending RBN order, with an entry for each RBN sector on the unit. There are "n" copies of the table on the unit, where "n" is a device characteristic. The tables are stored at the high address end of the LBN area of the unit. Table entries (and RBNs) are allocated via a hash algorithm described later.

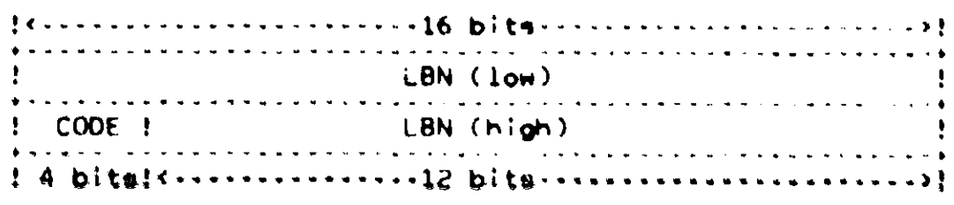
Replacement And Caching Table Format -

Each entry in the Replacement and Caching Table represents an RBN on the unit. The table is ordered in ascending RBN order. Thus the first entry corresponds to the first RBN on the unit, etc. The size of each copy of the table may exceed that required to contain an entry for each RBN on the unit since additional entries may be required to align the table so that adjacent copies can begin on a track boundary. Entries that do not correspond to RBNs on the unit are called "null entries"; there is always at least one null entry at the end of the RCT. All other entries past this last null entry are undefined.

NOTE

The RCT pad area is controller specific and should never be accessed by the host.

The format of a replacement block descriptor in the Replacement and Caching Tables is:



Where:

LBN is the Logical Block Number of a revectored LBN sector.

CODE is one of the following octal values:

00 - Unallocated (empty) replacement block.

02 - Allocated replacement block - primary RBN.

03 - Allocated replacement block - non-primary RBN.

04 - Unusable replacement block.

♦ 05 - Alternate unusable replacement block

10 - Null entry - no corresponding RBN sector.

For codes 00, 04, and 10 the LBN field is always zero.

NOTE

♦ This code is reserved. Programs should treat this code as if it were code 04.

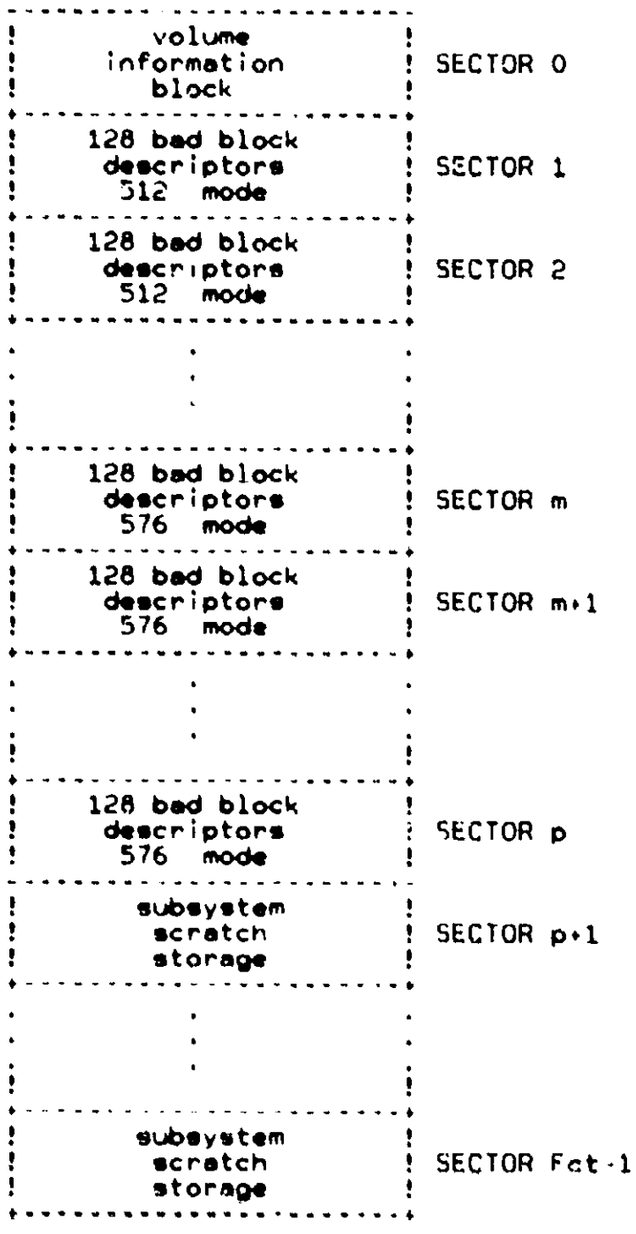
Embedded-controllers with no distinction between primary and secondary RBN's must use:

1. Code 02 if the replacement block can be retrieved with little degradation of performance for all blocks.

2. Code 03 if accessing the replacement block has a large impact on performance for all blocks.

3.4.2 FCT Structure

Each copy of the FCT is composed of one volume information block, one 512 byte format table, one 576 byte format table, and one subsystem temporary storage area (distributed amongst the alignment pads). An FCT copy has the following format:



The XBN area itself is always formatted to contain 512 byte sectors. The calculations for m and p are:

m := ((((Lc*g*t*r)+1)/2)+127)/128

p := 2*m

Sector 0 contains various volume identification information. The format is:

media mode	WORD 0
formatting instance number	WORD 1
volume serial number least significant word	WORD 2
volume serial number	WORD 3
volume serial number	WORD 4
volume serial number most significant word	WORD 5
date that volume was first formatted (low)	WORD 6
date that volume was first formatted	WORD 7
date that volume was first formatted	WORD 8
date that volume was first formatted (high)	WORD 9
date of most recent volume formatting (low)	WORD 10
date of most recent volume formatting	WORD 11
date of most recent volume formatting	WORD 12
date of most recent volum formatting (high)	WORD 13
number of used entries in 512 table (low)	WORD 14

number of used entries in 512 table (high)	WORD 15
number of used entries in 576 table (low)	WORD 16
number of used entries in 576 table (high)	WORD 17
XBN of scratch area in this copy (low)	WORD 18
XBN of scratch area in this copy (high)	WORD 19
size of scratch area in this copy	WORD 20
zeros	
zeros	WORD 255

Where:

WORD 0: "Media Mode" - is "126736" for a 512 byte format and "074161" for a 576 byte format. During formatting the media mode word is set to zero.

4.0 PERFORMANCE AND PROGRESS REPORTS

At the end of each pass, the pass count is given along with the total number of errors reported since the diagnostic was started. The "EOP" switch can be used to control how often the end of pass message is printed. Section 2.2 describes switches.

A statistical report will automatically be printed periodically (approximately every fifteen minutes) and at the end of test #4. It can be suppressed by setting the Inhibit Statistical Report flag (e.g. START/FLAGS:ISR). This is the same report that can be printed on demand with the PRINT command.

During tests 1, 2, and 3, the report will look like the following example:

```
TEST 1 IN PROGRESS    RUN TIME 2:24:10
```

During test #4, the report will contain statistics on each drive for the current pass of the test; for example:

```
TEST 4 IN PROGRESS    RUN TIME 2:24:10

UNIT DRIVE     SERIAL-NUMBER SEEKS MBYTES  MBYTES  HARD   SOFT     ECC
                             X1000 READ  WRITTEN ERRORS ERRORS
  0     0              1002    12     36      22      0      0       1
  1     4        7342102112    14     42      29      0      2       0
```

Explanation of each column:

UNIT	The unit number (number of HW P-table).
DRIVE	The drive number (the number which appears on the "unit plug" on the front of the disk drive).
SERIAL-NUMBER	The decimal serial number of the disk drive.
SEEKS X1000	The decimal number of seeks performed by this drive during this pass of test 4. Multiply value by 1000.
MBYTES READ	The number of mega-bytes (million bytes) read by this drive during this pass of test 4. It is this value that is used to optionally drop a drive by the READ TRANSFER LIMIT software question.
MBYTES WRITTEN	The number of mega-bytes written by this drive during this pass of test 4.
HARD ERRORS	The number of hard error reports printed for this drive during this pass of test 4. It is this value that is used to optionally drop a drive by the ERROR LIMIT software question.

SOFT ERRORS	The number of soft errors reported for the drive during this pass of test 4. A soft error is any error condition that resulted in a retry operation that eventually succeeded in recovering from the error condition. One soft error is counted even though several retry attempts may be made and does not correspond to the number of soft error reports printed. To see the soft error reports, you must change the default answer to the SUPPRESS PRINTING SOFT ERRORS software question.
ECC	The number of times data read from the drive was modified using the error correction code (ECC) and resulted in a matching error detection code (EDC).

5.0 TEST SUMMARIES

The UDA Host Resident Diagnostic consists of one PDP-11 diagnostic supervisor program that runs in the PDP-11 processor and four programs that run in the UDA's buffer memory through an interpreter called the "diagnostic machine" which resides in the UDA. The PDP-11 program mainly is responsible for downline loading the "diagnostic machine" programs into the UDA and starting their execution. The "diagnostic machine" program controls the testing from that point by requesting the PDP-11 processor to supply information, print error messages and update statistics. The "diagnostic machine" program informs the PDP-11 processor when a test is complete.

Four "diagnostic machine" programs are in the ZUDDE0.PAK data file which is read from the XXDP+ system device by the PDP-11 program. The data file comes with listings of each program.

5.1 TEST # 1 - UNIBUS ADDRESSING TEST

The purpose of test #1 is to complete the testing of the Unibus interface in the UDA. The UDA resident diagnostic is not able to completely test the Unibus interface because communication with the PDP-11 processor is necessary. Specifically, this test will:

1. Check that every address line on the Unibus can be driven to both one and zero states.

2. Check that the UDA can interrupt the PDP-11 processor at the proper priority level and vector.

3. Exercise the Unibus interface by transferring blocks of data to and from Unibus memory.

This test assumes that the following are being tested by the UDA Resident Diagnostic:

1. All data bits can be written and read correctly.

2. NPR cycles can be executed correctly.

Test 1 is divided into six subtests. One at a time, each UDA selected for testing will run each subtest.

Subtest 1 makes sure that the UDAIP and UDASA registers are existant and runs the first part of the UDA's resident diagnostics.

Subtest 2 initializies the UDA into diagnostic loop mode. In this mode any value written into the UDASA is echoed in the UDASA.

In subtest 3, the UDA is initialized with interrupts enabled. The vector address and priority level will be determined solely from the answers to the hardware questions. If the hardware vectors to the wrong address, it is impossible to determine the result. A descriptive error message of the problem will not occur (the program or processor may hang or an unrelated message may occur). Therefore, the message "TESTING INTERRUPT ABILITY OF UDA AT ADR xxxxxx VEC xxx..." isprinted just before the UDA is requested to cause an interrupt and the word "COMPLETED" is printed (on the same line) when the interrupt test is completed. If the word "COMPLETED" does not follow the first message, it should be apparent that the interrupt caused the diagnostic or processor to go astray. The priority level of the interrupt request is also verified.

Subtest 4 and 5 initialize the UDA using different sizes of the host communications area. The different sizes of the host communications area are supplied to allow the UDA Resident Diagnostic to do the most Unibus address testing possible. Interrupts are disabled. Any UDA Resident Diagnostic errors will be reported. Subtest 4 initializes the UDA with the smallest ring buffer size possible. Subtest 5 initializes the UDA with a large ring buffer area.

Subtest 6 downline loads a "diagnostic machine" program into the UDA. The "diagnostic machine" program is downline loaded from the memory space included in the host communications area when the UDA was first initialized. The UDA Resident Diagnostic has already verified that it can access these memory addresses, so the downline load command should perform properly. The "diagnostic machine" program is then started.

The "diagnostic machine" program asks the PDP-11 program to fill free memory (that memory available to the PDP-11 program that is not being used by the program or the Runtime Services) with an addressing pattern and report the location and size of the free memory. Every location of free memory is read and the data checked. Then, one by one, each address line is tested as follows:

1. Determine a test address by taking the first address of free memory and complimenting the address bit to be tested.

2. Read from the test address.

3. If a non-existant memory error occurs, the test is complete.

4. Write all ones to the first address of free memory then read from the test address. If data read is not all ones, then test is complete.

5. Write zeros to the first address of free memory then read from the test address. If data read is not zeros, then test is complete.

6. Report Unibus addressing error.

When all address bits have been tested, then block transfers to and from memory are tested with different data patterns. This data is transferred at the rate disk data is transferred to and from memory during normal UDA operation.

The next UDA selected for testing is then be tested in the same manner. When all UDAs have been tested, test #1 ends.

5.2 TEST # 2 - DISK RESIDENT DIAGNOSTIC TEST

The purpose of test #2 is to execute the diagnostics that run in each disk drive. These diagnostic programs may be resident in the disk drive or require downline loading from the ZUDDE0.PAK data file. (There currently are no disk drives that require downline loading and no such files exist in the ZUDDE0.PAK file. This program is designed such that they can be easily added in a future release.) This UDA diagnostic program only knows the procedure to execute the disk resident diagnostics and how to determine whether a test passed or failed.

One at a time, each UDA selected for testing is initialized and a "diagnostic machine" program downline loaded. The "diagnostic machine" program asks what drives are to be tested, then issues several commands to the disk drive and check for the correct response from the drive. This should serve as a good indicator that the UDA and disk drive can communicate.

A DIAGNOSE command is then issued to the drive to request the drive run all of its diagnostics. If the disk drive requests a downline load of a drive diagnostic, the diagnostic program is read from the XXDP+ load device, downline loaded into the disk drive and started. There is no limit to the number of downline loads that can be requested by a drive.

If the "Manual Intervention Mode" software question was answered "N" (default) testing proceeds to the next drive. When all drives on the UDA have been tested, the next UDA selected for testing is tested in the same manner. When all UDA's have been tested, test #2 ends.

If the "Manual Intervention Mode" software question was answered "Y", an interactive mode is entered to allow the operator to perform diagnostic activities on the disk drive as desired. The Service Manual for the disk drive must be used to determine what diagnostic capabilities are available.

First, a brief description of available commands is printed as follows:

```
TEST #2 MANUAL INTERVENTION ON UNIT xx UDA AT xxxxxx DRIVE xxx
TO WRITE AND READ MEMORY:
  W DATA REGION OFFSET
  R REGION OFFSET
TO RUN A DIAGNOSTIC:
  D REGION
TO EXIT QUESTIONING:
  E
DATA, REGION AND OFFSET ARE HEX VALUES.
 ?
```

Commands may be typed after the question mark prompt. Each command is processed as entered and results displayed immediately. The exit command will allow the diagnostic to proceed.

Read and write commands remember the region and offset values. Successive read and successive write commands automatically increment to the next offset if the region and offset values are not typed. If a region is typed but not an offset, offset zero is used.

Examples:

```
1.      W FF FFFC 4
2.      W 02
3.      R FFFC 4
          FFFC 0004/ FF
4.      R
          FFFC 0005/ 02
5.      W 21 FFFC
6.      R
          FFFC 0000/ 21
```

Command 1 writes one byte (FF) into region FFFC, offset 4. Command 2 writes one byte (02) into the next byte - region FFFC, offset 0005. Commands 3 and 4 read the bytes back. Command 5 writes one byte (21) into the first byte of region FFFC. Command 6 reads back that byte.

The diagnose command remembers the region from previous diagnose commands only, because the region containing the diagnostic is generally not the same region used to write parameters or read results. If the diagnostic returns any data, the data is printed immediately.

5.3 TEST # 3 - DISK FUNCTION TEST

The purpose of test #3 is to functionally test the disk drive. On a drive that is well diagnosed by its disk resident diagnostics (executed by test #2) these functional tests will have little value. On a drive that has no or minimal resident diagnostics, these functional tests will have more value.

Test #3 starts by initializing each UDA selected for testing and then downline loading a "diagnostic machine" program into each UDA. Once all UDAs have been started, the PDP-11 program responds to requests from all UDAs. When all the UDAs have indicated the end of testing, test #3 ends.

The "diagnostic machine" program performs the following functions on each drive:

1. Issue a DRIVE CLEAR command.
2. Issue RECALIBRATE command.
3. Issue a CHANGE MODE command to enable diagnostic cylinder access, set the drive to 512 byte sector size, and write protect.
4. Issue INITIATE SEEK command to last diagnostic cylinder.
5. Read all factory formatted sector headers. If no headers on a track can be read, report the error, otherwise continue.
6. Starting with cylinder 0, group 0 and incrementing through every cylinder on the disk, seek to a group, read a header on track 0 and then seek to the factory formatted diagnostic cylinder. Read from the diagnostic cylinder to verify disk positioned correctly.
7. Attempt to write on the first diagnostic cylinder while write protected.
8. Issue a CHANGE MODE command to enable formatting operations and disable write protect.
9. Format all writable DBNs in 512 byte format.
10. Write and read several data patterns to each writable DBN. Report an error if all DBNs on one track have an error.
11. Send invalid SDI level 2 and level 1 commands and check the results.
12. Go to the XBN area and read a copy of the FCT. Check to see if the drive has been properly formatted in 512 byte mode.
13. Issue a DISCONNECT command.

5.4 TEST # 4 - DISK EXERCISER

The purpose of test #4 is to exercise the disk drives in a manner similar to normal usage under standard operating systems. Execution of this test should give an indication of the performance of the disk drive. This test may be run for long or short periods of time, depending on how the software questions are answered.

These are two modes of operation for test #4:

1. Default operation on the entire area selected (customer or diagnostic) with all parameters selected for random operation as shown by default answers below.

2. Manual intervention mode where a number of questions are asked and operation is controlled by their answers.

Which mode is entirely determined by the answer to the first software question asking, "Enter manual intervention mode for special diagnosis?" This question would normally have been answered "N" (default) and testing will begin immediately. If answered "Y", the following series of questions will be asked for each unit selected for testing:

THE FOLLOWING QUESTIONS REFER TO UNIT xx UDA AT xxxxxx DRIVE xxx

This message will identify to which drive the questions are being asked. The entire series of questions will be asked for each drive, there is no short way to answer like in the hardware questions.

NUMBER OF BAD BLOCKS (D) 0 ?

An answer in the range of 1 to 16 will allow that many bad block numbers to be entered. The program will allow writes and reads to these blocks but no error messages will be printed for these blocks. Errors encountered on these blocks will not appear in the statistics. Answer zero to bypass entering bad blocks.

BAD BLOCK (A) ?

This question will be asked the number of times requested by the previous answer. Any decimal number that can be converted into a 28-bit binary value will be accepted. No other error checking will be made at this time to determine if the block number actually exists on the disk.

DO YOU WANT TO CHANGE TESTING PARAMETERS FOR THIS DRIVE (L) N ?

Answer "N" to bypass all further questioning on this drive.
Answer "Y" to be asked the following questions.

READ ONLY (L) N ?

Answer "Y" to dictate read only and prevent test 04 from performing any writes to the disk.

WRITE ONLY (L) N ?

This question will only be asked if the previous question was answered "N". Answer "Y" to dictate write only.

CHECK ALL WRITES BY READING (L) N ?

Answer "Y" to cause all writes to be checked by reading the data immediately after the write operation.

RANDOMLY CHECK WRITES BY READING (L) Y ?

This question will only be asked if the previous question was answered "N". Answer "Y" for the write check to be performed randomly. Answer "N" if write checks are not desired. This question is asked no matter how previous questions were asked.

DATA PATTERN - 0 FOR RANDOM SELECTION (D) 0 ?

There are 16 data patterns available, selected as 1 to 16. Pattern number 0 will cause patterns 1 to 15 to be randomly selected for each write. If pattern number 16 is selected, the following set of questions will be asked for a pattern to be input.

ENABLE ECC DATA CORRECTION (L) Y ?

A "Y" answer will enable the use of ECC to correct data errors. If the number of corrections is within the drive's threshold, an informational message will be printed identifying the block number. These ECC corrections will also appear in the statistical report for the drive.

An "N" answer will prevent the use of ECC. All ECC errors will cause an error message to be printed and retries to be attempted.

COMPARE ALL DATA READ (L) N ?

Answer "Y" to cause a data compare after every read.

RANDOMLY COMPARE DATA READ (L) Y ?

This question will only be asked if the previous question was answered "N". Answer "Y" for the data compare to be performed on random records. Answer "N" if data compares are not desired.

```
ENABLE RETRIES (L) Y
```

A "Y" answer will enable retries to be performed on disk errors.

```
RANDOM ACCESS MODE (L) Y ?
```

Answer "Y" to cause block numbers to be chosen randomly. Answer "N" to cause block numbers to be selected sequentially up and down the disk surface.

```
DO YOU WISH TO:
   0 - TEST ENTIRE AREA SELECTED
   1 - SPECIFY BEGIN/END SETS TO TEST
   2 - SPECIFY TRACKS AND CYLINDERS TO TEST
   3 - SPECIFY GROUPS AND CYLINDERS TO TEST
   4 - SPECIFY CYLINDERS TO TEST
(D) 0 ?
```

This question specifies the options available to limit testing to a portion of the selected area (customer or diagnostic) of the disk. A zero answer is the default which specifies to use the entire area for the test. Other answers will cause additional questions to be asked.

```
NUMBER OF BEGIN/END SETS (D) 1 ?
BEGIN BLOCK (A) 0 ?
END BLOCK (A) 0 ?
```

These questions are asked if begin/end sets were selected to limit the testing area (Answer 1). One to four sets may be specified. The BEGIN BLOCK and END BLOCK questions are asked as many times as needed.

```
NUMBER OF TRACKS TO TEST (D) 1 ?
TRACK (D) 0 ?

NUMBER OF GROUPS TO TEST (D) 1 ?
GROUP (D) 0 ?
```

One of these sets of questions is asked if either tracks and cylinders or groups and cylinders was specified to limit the testing area (Answers 2 or 3). Up to seven tracks or groups may be specified on which testing will be limited.

```
DO YOU WISH TO LIMIT THE CYLINDERS TESTED (L) N ?
```

This question is asked only after the tracks or groups have been specified above. If testing is to be further limited to a set of cylinders, answer "Y" and the following two questions will be asked:

```
STARTING CYLINDER (A) 0 ?
ENDING CYLINDER (A) 0 ?
```

These questions are asked if the question immediately above was answered "Y" or if cylinders were selected to limit the testing area (Answer 4). One set of cylinder numbers may be specified to limit the testing area.

After the above questions have been asked for all drives selected for testing, the following questions will be asked if data pattern 16 was selected for any drive:

```
NUMBER OF WORDS IN DATA PATTERN 16 (D) 1 ?
DATA WORD (O) 0 ?
```

Data pattern 16 can be input by these questions. A data pattern consists of a buffer of one to 16 words which is repeated throughout the data portion of the disk block. Enter the contents of the data pattern buffer. The DATA WORD question will be repeated as needed.

Test #4 will then initialize each UDA selected for testing and downline load a "diagnostic machine" program into each UDA. Because the "diagnostic machine" programs are too large to fit both copies in memory at the same time (as done in Tests 1 through 3), the program checks which type of UDA-50s are being tested. If all are of the same type, that program is read. If both types are selected for testing, the program for the UDA-50 with the M7485 and M7486 boards is read.
The "diagnostic machine" program asks what drives are to be tested and then for the parameters for each drive (the answers to the manual intervention questions or their defaults). Once all UDAs have been started, the PDP-11 program responds to requests from all UDAs.

The disks are then be exercised according to the parameters. The exercise consists of selecting a disk sector, seeking to the proper cylinder, then reading or writing the sector. The parameters control how the disk sector is selected, whether the sector is written or read and whether a write is followed by a read (write check).

The "diagnostic machine" program periodically sends statistics to the PDP-11 program. These statistics include counts of reads, writes, seeks and errors on a per drive basis. The PDP-11 program accumulates the statistics from all the UDAs and watches for the transfer limit to be exceeded. As long as the error log is not enabled, the exceeding of the transfer limit will cause the end of test #4.

Each time an error occurs, the "diagnostic machine" tells the PDP-11 program. A message is printed (or stored in the log buffer) and then the error limit for the drive is checked. If the error limit has been reached, the drive is dropped from testing. If no more drives remain to be tested, test #4 will end (unless the error log is enabled).

When the end of test #4 occurs, the accumulated statistics for each drive is printed. This statistical report can be printed at any time during test #4 by typing control-C then the PRINT command.

The data patterns used by test #4 are indicated below. Each pattern is generated by writing the pattern number in each 4-bit nibble of the first word, then repeating the data pattern (sequence of one to 16 words) throughout the rest of the data buffer. Pattern number 16 writes nibbles of zeros. When pattern number zero is used, the actual pattern number written (1 to 15) is placed in the nibbles.

PATTERN 0 This pattern number is used to indicate any pattern number 1 to 15 chosen at random.

PATTERN 1 Words in pattern sequence - 1

Sequence (Octal) 105613
Sequence (Hex) 8888

PATTERN 2 Words in pattern sequence - 1

Sequence (Octal) 031463
Sequence (Hex) 3333

PATTERN 3 Words in pattern sequence - 1

Sequence (Octal) 030221
Sequence (Hex) 3091

PATTERN 4 Words in pattern sequence - 16 (Shifting ones)

Sequence (Octal) 000001, 000003, 000007, 000017, 000037, 000077, 000177, 000377, 000777, 001777, 003777, 007777, 017777, 037777, 077777, 177777

Sequence (Hex) 0001, 0003, 0007, 000F, 001F, 003F, 007F, 00FF, 01FF, 03FF, 07FF, 0FFF, 1FFF, 3FFF, 7FFF, FFFF

PATTERN 5 Words in pattern sequence - 16 (Shifting zeros)

Sequence (Octal) 177776, 177774, 177770, 177760, 177740,
177700, 177600, 177400, 177000, 176000,
174000, 170000, 160000, 140000, 100000,
000000

Sequence (Hex) FFFE, FFFC, FFF8, FFF0, FFE0, FFC0,
FF80, FF00, FE00, FC00, F800, F000,
E000, C000, 8000, 0000

PATTERN 6 Words in pattern sequence - 16

Sequence (Octal) 000000, 000000, 000000, 177777, 177777,
177777, 000000, 000000, 177777, 177777,
000000, 177777, 000000, 177777, 000000,
177777

Sequence (Hex) 0000, 0000, 0000, FFFF, FFFF, FFFF,
0000, 0000, FFFF, FFFF, 0000, FFFF,
0000, FFFF, 0000, FFFF

PATTERN 7 Words in pattern sequence - (BINARY 1011011011011001)

Sequence (Octal) 133331
Sequence (Hex) B6D9

PATTERN 8 Words in pattern sequence - 16

Sequence (Octal) 052525, 052525, 052525, 125252, 125252,
125252, 052525, 052525, 125252, 125252,
052525, 125252, 052525, 125252, 052525,
125252

Sequence (Hex) 5555, 5555, 5555, AAAA, AAAA, AAAA,
5555, 5555, AAAA, AAAA, 5555, AAAA,
5555, AAAA, 5555, AAAA

PATTERN 9 Words in pattern sequence - 1 (BINARY 1101101101101100)

Sequence (Octal) 155554
Sequence (Hex) DB6C

PATTERN 10 Words in pattern sequence - 16

Sequence (Octal) 026455, 026455, 026455, 151322, 151322,
151322, 026455, 026455, 151322, 151322,
026455, 151322, 026455, 151322, 026455,
151322

Sequence (Hex) 2D2D, 2D2D, 2D2D, D2D2, D2D2, D2D2,
2D2D, 2D2D, D2D2, D2D2, 2D2D, D2D2,
2D2D, D2D2, 2D2D, D2D2

PATTERN 11 Words in pattern sequence - 1 (BINARY 01101101101101l0)

Sequence (Octal) 066666
Sequence (Hex) 6DD6

PATTERN 12 Words in pattern sequence - 16 (Ripple one)

Sequence (Octal) 000001, 000002, 000004, 000010, 000020, 000040, 000100, 000200, 000400, 001000, 002000, 004000, 010000, 020000, 040000, 100000

Sequence (Hex) 0001, 0002, 0004, 0008, 0010, 0020, 0040, 0080, 0100, 0200, 0400, 0800, 1000, 2000, 4000, 8000

PATTERN 13 Words in pattern sequence - 16 (Ripple zero)

Sequence (Octal) 177776, 177775, 177773, 177767, 177757, 177737, 177677, 177577, 177377, 176777, 175777, 173777, 167777, 157777, 137777, 077777

Sequence (Hex) FFFE, FFFD, FFF8, FFF7, FFEF, FFDF, FFBF, FF7F, FEFF, FDFF, FBFF, F7FF, EFFF, DFFF, BFFF, 7FFF

PATTERN 14 Words in pattern sequence - 3

Sequence (Octal) 155555, 133333, 155555
Sequence (Hex) DB6D, B6DB, DB6D

PATTERN 15 Words in pattern sequence - 16

Sequence (Octal) 133331, 133331, 133331, 155554, 155554, 155554, 133331, 133331, 155554, 155554, 133331, 155554, 133331, 155554, 133331, 155554

Sequence (Hex) B6D9, B6D9, B6D9, DB6C, DB6C, DB6C, B6D9, B6D9, DB6C, DB6C, B6D9, DB6C, B6D9, DB6C, B6D9, DB6C

PATTERN 16 This is the operator selectable pattern in manual intervention mode. Questions are asked when test #4 is started for the operator to input the number of words in the sequence and the contents of the words.

Sample of terminal dialogue going through manual intervention questions:

```
DR>STA/TEST:4

CHANGE HW (L)  ? N

CHANGE SW (L)  ? Y

ENTER MANUAL INTERVENTION MODE FOR SPECIAL DIAGNOSIS (L) N ? Y

REMAINING SOFTWARE QUESTIONS APPLY TO TEST 4 ONLY

ERROR LIMIT (D)  32 ?
READ TRANSFER LIMIT IN MEGABYTES - 0 FOR NO LIMIT (D)  0 ?
SUPPRESS PRINTING SOFT ERRORS (L) Y ? N
DO INITIAL WRITE ON START (L) Y ?
ENABLE ERROR LOG (L) N ?

THE FOLLOWING QUESTIONS REFER TO UNIT 0 UDA AT 172150 DRIVE 0

NUMBER OF BAD BLOCKS (D) 0 ? 2

BAD BLOCK (A) ? 234

BAD BLOCK (A) ? 8900

DO YOU WANT TO CHANGE TESTING PARAMETERS FOR THIS DRIVE (L) N ? Y

READ ONLY (L) N ?

WRITE ONLY (L) N ?

CHECK ALL WRITES BY READING (L) N ? Y

DATA PATTERN - 0 FOR RANDOM SELECTION (D) 0 ? 1

ENABLE ECC DATA CORRECTION (L) Y ?

COMPARE ALL DATA READ (L) N ? Y

ENABLE RETRIES (L) Y ?

RANDOM ACCESS MODE (L) Y ? N

DO YOU WISH TO:
   0 - TEST ENTIRE AREA SELECTED
   1 - SPECIFY BEGIN/END SETS TO TEST
   2 - SPECIFY TRACKS AND CYLINDERS TO TEST
   3 - SPECIFY GROUPS AND CYLINDERS TO TEST
   4 - SPECIFY CYLINDERS TO TEST
 (D) 0 ? 1

NUMBER OF BEGIN/END SETS (D) 1 ?

BEGIN BLOCK (A) 0 ?
```

```
END BLOCK (A) 0 ? 200

NUMBER OF WORDS IN DATA PATTERN 16 (D) 1 ?

DATA WORD (O) 0 ?
@
```

```
      1                                 ;*LAST REVISION 04-OCT-83
      2
    358                               .TITLE  CZUDCE0 UDA & DISK DRV DIAG
    367
    368                               .SBTTL  PROGRAM HEADER
    394
    396 000000                                .ASECT
    397                                       .ENABL  AMA
    398         002000                        .       =       2000
    400
    402                               ;++
    403                               ; THE PROGRAM HEADER IS THE INTERFACE BETWEEN
    404                               ; THE DIAGNOSTIC PROGRAM AND THE SUPERVISOR.
    405                               ;--
    406
    408
    425
    427 002000                        L$NAME::                  ;DIAGNOSTIC NAME
        002000      103                           .ASCII /C/
        002001      132                           .ASCII /Z/
        002002      125                           .ASCII /U/
        002003      104                           .ASCII /D/
        002004      103                           .ASCII /C/
        002005      000                           .BYTE   0
        002006      000                           .BYTE   0
        002007      000                           .BYTE   0
    002010                            L$REV::                   ;REVISION LEVEL
    002010      105                           .ASCII  /E/
    002011                            L$DEPO::                  ;0
    002011      060                           .ASCII  /0/
    002012                            L$UNIT::                  ;NUMBER OF UNITS
    002012  000001                            .WORD   T$PTHV
    002014                            L$TIML::                  ;LONGEST TEST TIME
    002014  000000                            .WORD   0
    002016                            L$HPCP::                  ;POINTER TO H.W. QUES.
    002016  113266                            .WORD   L$HARD
    002020                            L$SPCP::                  ;POINTER TO S.W. QUES.
    002020  113526                            .WORD   L$SOFT
    002022                            L$HPTP::                  ;PTR. TO DEF. H.W. PTABLE
    002022  064356                            .WORD   L$HW
    002024                            L$SPTP::                  ;PTR. TO S.W. PTABLE
    002024  064374                            .WORD   L$SW
    002026                            L$LADP::                  ;DIAG. END ADDRESS
    002026  114312                            .WORD   L$LAST
    002030                            L$STA::                   ;RESERVED FOR APT STATS
    002030  000000                            .WORD   0
    002032                            L$CO::
    002032  000000                            .WORD   0
    002034                            L$DTYP::                  ;DIAGNOSTIC TYPE
    002034  000001                            .WORD   1
    002036                            L$APT::                   ;APT EXPANSION
    002036  000000                            .WORD   0
    002040                            L$DTP::                   ;PTR. TO DISPATCH TABLE
    002040  064340                            .WORD   L$DISPATCH
    002042                            L$PRIO::                  ;DIAGNOSTIC RUN PRIORITY
    002042  000340                            .WORD   PRIO7
    002044                            L$ENVI::                  ;FLAGS DESCRIBE HOW IT WAS SETUP
```

```
002044  000000                          .WORD   0
002046                          L$EXP1::                ;EXPANSION WORD
002046  000000                          .WORD   0
002050                          L$MREV::                ;SVC REV AND EDIT #
002050      003                 .BYTE   C$REVISION
002051      003                 .BYTE   C$EDIT
002052                          L$EF::                  ;DIAG. EVENT FLAGS
002052  000000                          .WORD   0
002054  000000                          .WORD   0
002056                          L$SPC::
002056  000000                          .WORD   0
002060                          L$DEVP::                ; POINTER TO DEVICE TYPE LIST
002060  064700                          .WORD   L$DVTYP
002062                          L$REPP::                ;PTR. TO REPORT CODE
002062  106654                          .WORD   L$RPT
002064                          L$EXP4::
002064  000000                          .WORD   0
002066                          L$EXP5::
002066  000000                          .WORD   0
002070                          L$AUT::                 ;PTR. TO ADD UNIT CODE
002070  000000                          .WORD   0
002072                          L$DUT::                 ;PTR. TO DROP UNIT CODE
002072  000000                          .WORD   0
002074                          L$LUN::                 ;LUN FOR EXERCISERS TO FILL
002074  000000                          .WORD   0
002076                          L$DESP::                ;POINTER TO DIAG. DESCRIPTION
002076  064724                          .WORD   L$DESC
002100                          L$LOAD::                ;GENERATE SPECIAL AUTOLOAD EMT
002100  104035                      EMT     E$LOAD
002102                          L$ETP::                 ;POINTER TO ERRTBL
002102  064402                          .WORD   L$ERRTBL
002104                          L$ICP::                 ;PTR. TO INIT CODE
002104  107636                          .WORD   L$INIT
002106                          L$CCP::                 ;PTR. TO CLEAN-UP CODE
002106  111302                          .WORD   L$CLEAN
002110                          L$ACP::                 ;PTR. TO AUTO CODE
002110  111300                          .WORD   L$AUTO
002112                          L$PRT::                 ;PTR. TO PROTECT TABLE
002112  107630                          .WORD   L$PROT
002114                          L$TEST::                ;TEST NUMBER
002114  000000                          .WORD   0
002116                          L$DLY::                 ;DELAY COUNT
002116  000000                          .WORD   0
002120                          L$HIME::                ;PTR. TO HIGH MEM
002120  000000                          .WORD   0
436
```

```
                                ;THIS LOCATION MUST BE AT THIS POSITION. SEPERATE CODE, STORED IN
                                ;THE PAK FILE, WAS ASSEMBLED WITH THIS ADDRESS

        062220                  STOSIZ  = 25000. - 256.                 ;STORAGE SIZE

002122                          STORAG: .BLKB   STOSIZ
```

```
                                .SBTTL  DISPATCH TABLE

                                ;++
                                ; THE DISPATCH TABLE CONTAINS THE STARTING ADDRESS OF EACH TEST.
                                ; IT IS USED BY THE SUPERVISOR TO DISPATCH TO EACH TEST.
                                ;--

064342  000004                          .WORD   4
064344                          L$DISPATCH::
064344  111344                          .WORD   T1
064346  112420                          .WORD   T2
064350  112516                          .WORD   T3
064352  112554                          .WORD   T4

```

```
                                .SBTTL  DEFAULT HARDWARE P-TABLE

                                ;++
                                ; THE DEFAULT HARDWARE P-TABLE CONTAINS DEFAULT VALUES OF
                                ; THE TEST-DEVICE PARAMETERS   THE STRUCTURE OF THIS TABLE
                                ; IS IDENTICAL TO THE STRUCTURE OF THE HARDWARE P-TABLES,
                                ; AND IS USED AS A "TEMPLATE" FOR BUILDING THE P-TABLES.
                                ;--

 064354  000006                         .WORD   L10000-L$HW/2
 064356                         L$HW::
 064356                         DFPTBL::
 064356  172150                         .WORD   172150                  ; UNIBUS ADDRESS
 064360  000154                         .WORD   154                     ; VECTOR ADDRESS
 064362  000005                         .WORD   5.                      ; BR LEVEL
 064364  000077                         .WORD   63.                     ; UNIBUS BURST RATE
 064366  000000                         .WORD   0.                      ; LOGICAL DRIVE NUMBER
 064370  000000                         .WORD   0.                      ; CUSTOMER DATA AREA

 064372                         L10000:
```

```
                                .SBTTL  SOFTWARE P-TABLE

                                ;++
                                ; THE SOFTWARE TABLE CONTAINS VARIOUS DATA USED BY THE
                                ; PROGRAM AS OPERATIONAL PARAMETERS.  THESE PARAMETERS ARE
                                ; SET UP AT ASSEMBLY TIME AND MAY BE VARIED BY THE OPERATOR
                                ; AT RUN TIME.
                                ;--

064372  000003                          .WORD   L10001-L$SW/2
064374                          L$SW::
064374                          SFPTBL::
064374  000040                          .WORD   32.                     ;ERROR LIMIT
064376  000000                          .WORD   0.                      ;DATA TRANSFER LIMIT (MEGABITS)
064400  040400                          .WORD   ^B0100000100000000      ;SINGLE BIT QUESTIONS

064402                          L10001:
```

```
                                .SBTTL  GLOBAL EQUATES SECTION

                                ;++
                                ; THE GLOBAL EQUATES SECTION CONTAINS PROGRAM EQUATES THAT
                                ; ARE USED IN MORE THAN ONE TEST.
                                ;--

                                ;
                                ; BIT DIFINITIONS
                                ;
100000                          BIT15== 100000
040000                          BIT14== 40000
020000                          BIT13== 20000
010000                          BIT12== 10000
004000                          BIT11== 4000
002000                          BIT10== 2000
001000                          BIT09== 1000
000400                          BIT08== 400
000200                          BIT07== 200
000100                          BIT06== 100
000040                          BIT05== 40
000020                          BIT04== 20
000010                          BIT03== 10
000004                          BIT02== 4
000002                          BIT01== 2
000001                          BIT00== 1
                                ;
000400                          BIT9==  BIT09
000400                          BIT8==  BIT08
000200                          BIT7==  BIT07
000100                          BIT6==  BIT06
000040                          BIT5==  BIT05
000020                          BIT4==  BIT04
000010                          BIT3==  BIT03
000004                          BIT2==  BIT02
000002                          BIT1==  BIT01
000001                          BIT0==  BIT00
                                ;
                                ; EVENT FLAG DEFINITIONS
                                ;   EF32:EF17 RESERVED FOR SUPERVISOR TO PROGRAM COMMUNICATION
                                ;
000040                          EF.START==      32.                     ; START COMMAND WAS ISSUED
000037                          EF.RESTART==    31.                     ; RESTART COMMAND WAS ISSUED
000036                          EF.CONTINUE==   30.                     ; CONTINUE COMMAND WAS ISSUED
000035                          EF.NEW==        29.                     ; A NEW PASS HAS BEEN STARTED
000034                          EF.PWR==        28.                     ; A POWER-FAIL/POWER-UP OCCURRED
                                ;
                                ;
                                ; PRIORITY LEVEL DEFINITIONS
                                ;
000340                          PRI07== 340
000300                          PRI06== 300
000240                          PRI05== 240
000200                          PRI04== 200
000140                          PRI03== 140
000100                          PRI02== 100
```

GLOBAL EQUATES SECTION

```
000040                  PRIO1== 40
000000                  PRIO0== 0
                        ;
                        ;OPERATOR FLAG BITS
                        ;
000004                  EVL==       4
000010                  LOT==      10
000020                  ADR==      20
000040                  IDU==      40
000100                  ISR==     100
000200                  UAM==     200
000400                  BOE==     400
001000                  PNT==    1000
002000                  PRI==    2000
004000                  IXE==    4000
010000                  IBE==   10000
020000                  IER==   20000
040000                  LOE==   40000
100000                  HOE==  100000
```

```
                        .SBTTL  UDA BIT DEFINITIONS


                        ;UDASA REGISTER UNIVERSAL READ BITS

100000                  SA.ERR  = 100000                ;ERROR INDICATOR
040000                  SA.S4   = 040000                ;STEP 4 STATUS BIT
020000                  SA.S3   = 020000                ;STEP 3 STATUS BIT
010000                  SA.S2   = 010000                ;STEP 2 STATUS BIT
004000                  SA.S1   = 004000                ;STEP 1 STATUS BIT


                        ;UDASA REGISTER ERROR STATUS BITS

003777                  SA.ERC  = 003777                ;ERROR CODE


                        ;UDASA REGISTER STEP 1 SEND BITS

000177                  SA.VEC  = 000177                ;INTERRUPT VECTOR (DIVIDED BY 4)
000200                  SA.INT  = 000200                ;INTERRUPT ENABLE DURING INITIALIZATION
003400                  SA.MSG  = 003400                ;MESSAGE RING LENGTH
034000                  SA.CMD  = 034000                ;COMMAND RING LENGTH
040000                  SA.WRP  = 040000                ;WRAP BIT
100000                  SA.STP  = 100000                ;STEP - MUST ALWAYS BE WRITTEN A ONE

000400                  SA.MS1  = 000400                ;LSB OF MESSAGE RING LENGTH
004000                  SA.CM1  = 004000                ;LSB OF COMMAND RING LENGTH


                        ;UDASA REGISTER STEP 1 RESPONSE BITS

002000                  SA.NV   = 002000                ;NON SETTABLE INTERRUPT VECTOR
001000                  SA.A2   = 001000                ;22 BIT ADDRESS BUS
000400                  SA.DI   = 000400                ;ENHANCED DIAGNOSTICS
                        ;         000377                ;ALL BITS RESERVED


                        ;UDASA REGISTER STEP 2 SEND BITS

000001                  SA.PRG  = 000001                ;ENABLE VAX UNIBUS ADAPTER PURGE INTERRUPT
                        ;         177776                ;LOW ORDER MESSAGE RING BYTE ADDRESS


                        ;UDASA REGISTER STEP 2 RESPONSE BITS

000007                  SA.MSE  = 000007                ;MESSAGE RING LENGTH ECHO
000070                  SA.CME  = 000070                ;COMMAND RING LENGTH ECHO
                        ;         000100                ;RESERVED
000200                  SA.STE  = 000200                ;STEP ECHO
003400                  SA.CTP  = 003400                ;CONTROLLER TYPE


                        ;UDASA REGISTER STEP 3 SEND BITS

                        ;         077777                ;HIGH ORDER MESSAGE RING BYTE ADDRESS
100000                  SA.TST  = 100000                ;PURGE POLE TEST ENABLE
```

F10


```
                                ;UDASA REGISTER STEP 3 RESPONSE BITS
                                
000177                          SA.VCE  = 000177                ;INTERRUPT VECTOR ECHO
000200                          SA.INE  = 000200                ;INTERRUPT ENABLE ECHO
000400                          SA.NVE  = 000400                ;VECTOR NOT PROGRAMMABLE
                                ;       003000                  ;RESERVED

                                ;UDASA REGISTER STEP 4 SEND BITS

000001                          SA.GO   = 000001                ;GO BIT TO START UDA FIRMWARE
000002                          SA.LFC  = 000002                ;LAST FAILURE CODE REQUEST
000374                          SA.BST  = 000374                ;BURST LEVEL

                                ;UDASA REGISTER STEP 4 RESPONSE BITS

000017                          SA.MCV  = 000017                ;UDA MICROCODE VERSION
000360                          SA.CNT  = 000360                ;CONTROLLER TYPE
                                ;       003400                  ;RESERVED
```

```
                        .SBTTL  HOST COMMUNICATION AREA DEFINIIONS

                        .COMMAND/MESSAGE RING BIT DEFINITIONS

100000                  RG.OWN  = 100000                ;SET WHEN UDA OWNS RING
040000                  RG.FLG  = 040000                ;FLAG BIT


                        ;VIRTUAL CIRCUIT IDENTIFIERS

000000                  MSCP    = 0                     ;MSCP CIRCUIT
000001                  LOG     = 1                     ;LOG CIRCUIT
177777                  DIAG    = -1                    ;DIAGNOSTIC CIRCUIT
001000                  DUP     = 1000                  ;DIAGNOSTIC AND UTILITIES PROTOCOL


                        ;OFFSETS INTO HOST COMMUNICATIONS AREA WITH ONE DESCRIPTOR TO EACH RINC
                        ;AND TWO PACKET

000004                  HC.ISZ  = 4.                    ;SIZE OF INTERRUPT INDICATOR WORDS
000004                  HC.RSZ  = 4.                    ;SIZE OF RING IN BYTES
000004                  HC.ESZ  = 4.                    ;SIZE OF ENVELOPE WORDS BEFORE PACKET
000060                  HC.PSZ  = 48.                   ;SIZE OF COMMAND AND MESSAGE PACKETS
000106                  HC.BSZ  = 70.                   ;SIZE OF BUFFER

000000                  HC.INT  = 0.                    ;INTERRUPT INDICATOR WORDS START

000004                  HC.MSG  = HC.INT+HC.ISZ         ;MESSAGE RING START
000006                  HC.MCT  = HC.MSG+2.             ;MESSAGE RING CONTROL WORD

000010                  HC.CMD  = HC.MSG+HC.RSZ         ;COMMAND RING START
000012                  HC.CCT  = HC.CMD+2.             ;COMMAND RING CONTROL WORDS

000014                  HC.MEV  = HC.CMD+HC.RSZ         ;MESSAGE ENVELOPE START
000020                  HC.MPK  = HC.MEV+HC.ESZ         ;MESSAGE PACKET START

000014                  HC.CEV  = HC.MEV                ;COMMAND ENVELOPE START
000020                  HC.CPK  = HC.MPK                ;COMMAND PACKET START

000100                  HC.BF1  = HC.CPK+HC.PSZ         ;FIRST BUFFER
000206                  HC.BF2  = HC.BF1+HC.BSZ         ;SECOND BUFFER

000314                  HC.SIZ  = HC.BF2+HC.BSZ         ;TOTAL SIZE OF HOST COMMUNICATION AREA
```

```
                        .SBTTL  HOST COMMUNICATION AREA LAYOUT

                        ;
                        ;       HC.INT  )       INTERRUPT INDICATORS                    )   4 BYTES
                        ;               )                                               )
                        ;       HC.MSG  )       MESSAGE (RESPONSE) RING                 )   4 BYTES
                        ;       HC.MCT  )                                               )
                        ;       HC.CMD  )       COMMAND RING                            )   4 BYTES
                        ;       HC.CCT  )                                               )
                        ;HC.MEV & HC.CEV)       MESSAGE & COMMAND ENVELOPE              )   4 BYTES
                        ;               )                                               )
                        ;HC.MPK & HC.CPK)       MESSAGE & COMMAND PACKET                )  48 BYTES
                        ;               )                                               )
                        ;               )                                               )
                        ;               )                                               )
                        ;               )                                               )
                        ;       HC.BF1  !       BUFFER # 1 (RESPONSE TO DM PROGRAM)     !  70 BYTES
                        ;               !                                               !
                        ;               !                                               !
                        ;               !                                               !
                        ;       HC.BF2  !       BUFFER # 2 (REQUEST FROM DM PROGRAM)    !  70 BYTES
                        ;               !                                               !
                        ;               !                                               !
                        ;               !                                               !
                        ;
                        ;               NOTE: BYTES ARE GIVEN IN DECIMAL
```

COMMAND PACKET OPCODES DEFINITIONS

```
                        .SBTTL  COMMAND PACKET OPCODES DEFINITIONS

000001          OP.ABO  = 1             ;ABORT COMMAND
000020          OP.ACC  = 20            ;ACCESS COMMAND
000010          OP.AVL  = 10            ;AVAILABLE COMMAND
000021          OP.CCD  = 21            ;COMPARE CONTROLLER DATA COMMAND
000040          OP.CMP  = 40            ;COMPARE HOST DATA COMMAND
000022          OP.ERS  = 22            ;ERASE COMMAND
000023          OP.FLU  = 23            ;FLUSH COMMAND
000002          OP.GCS  = 2             ;GET COMMAND STATUS COMMAND
000003          OP.GUS  = 3             ;GET UNIT STATUS COMMAND
000011          OP.ONL  = 11            ;ONLINE COMMAND
000041          OP.RD   = 41            ;READ COMMAND
000024          OP.RPL  = 24            ;REPLACE COMMAND
000004          OP.SCC  = 4             ;SET CONTROLLER CHARACTERISTICS COMMAND
000012          OP.SUC  = 12            ;SET UNIT CHARACTERISTICS COMMAND
000042          OP.WR   = 42            ;WRITE COMMAND
000030          OP.MRD  = 30            ;MAINTENANCE READ COMMAND
000031          OP.MWR  = 31            ;MAINTENANCE WRITE COMMAND
000200          OP.END  = 200           ;END PACKET FLAG
000007          OP.SEX  = 7             ;SERIOUS EXCEPTION END PACKET
000100          OP.AVA  = 100           ;AVAILABLE ATTENTION MESSAGE
000101          OP.DUP  = 101           ;DUPLICATE UNIT NUMBER ATTENTION MESSAGE
000102          OP.SHC  = 102           ;SHADOW COPY COMPLETE ATTENION MESSAGE
000103          OP.RLC  = 103           ;RESET COMMAND LIMIT ATTENTION MESSAGE

000001          OP.GSS  = 1             ;DUP GET DUST STATUS
000002          OP.ESP  = 2             ;DUP EXECUTE SUPPLIED PROGRAM
000003          OP.ELP  = 3             ;DUP EXECUTE LOCAL PROGRAM
000004          OP.SSD  = 4             ;DUP SEND DUST DATA
000005          OP.RSD  = 5             ;DUP RECEIVE DUST DATA

                ;NOTE: END PACKET OPCODES (ALSO CALLED ENDCODES) ARE FORMED BY ADDING THE END
                ;PACKET FLAG TO THE COMMAND OPCODE. FOE EXAMPLE, A READ COMMAND'S END PACKET
                ;CONTAINS THE VALUE OP.RD+OP.END IN ITS OPCODE FIELD. THE INVALID COMMAND END
                ;PACKET CONTAINS JUST THE END PACKET FLAG (I.E., OP.END) IN ITS OPCODE FIELD.
                ;THE SERIOUS EXCEPTION END PACKET CONTAINS THE SUM OF THE END PACKET FLAG
                ;PLUS THE SERIOUS EXCEPTION OPCODE SHOWN ABOVE (I.E., OP.SEX+OP.END) IN ITS
                ;OPCODE FIELD.
                ;
                ;COMMAND OPCODE BITS 3 THROUGH 5 INDICATE THE COMMAND CLASS, WHICH IS ENCODED
                ;AS FOLLOWS:
                ;    000   IMMEDIATE COMMANDS
                ;    001   SEQUENTIAL COMMANDS
                ;    010   NON-SEQUENTIAL COMMANDS THAT DO NOT INCLUDE A BUFFER DESCRIPTOR
                ;    100   NON-SEQUENTIAL COMMANDS THAT DO INCLUDE A BUFFER DESCRIPTOR
```

```
        DRIVE NOT FORMATTED IN 512 BYTE MODE -- UNABLE TO TEST
        FCT BLOCK ZERO MODE WORD: mode

        *** THIS PACK HAS AN INVALID FORMAT AND CANNOT BE USED ***
```

mode: The mode word found on the drive's FCT block zero.

Error 4021 occurs only when Test 4 finds that the mode word found in FCT block zero is not the 512 byte mode word (126736 octal). See DEC STANDARD 166 "FCT Structure". Inhibiting the dropping of units has no effect on this error.

```
04022   CZUDC   DEV FTL ERR  04022 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
        DISK EXERCISER  DM PC:xxxx  UDA AT xxxxxx  DRIVE xxx  RUNTIME hh:mm:ss
        COULD NOT READ FCT BLOCK ZERO

        *** THIS PACK HAS AN INVALID FORMAT AND CANNOT BE USED ***
```

Error 4022 occurs when test 4 is unable to read any copy of FCT block zero. See DEC STANDARD 166 "FCT Structure". Inhibiting the dropping of units has no effect on this error.

```
04023   CZUDC   DEV FTL ERR  04023 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
        DISK EXERCISER  DM PC:xxxx  UDA AT xxxxxx  DRIVE xxx  RUNTIME hh:mm:ss
        UNABLE TO CONTINUE TESTING
        PORT SWITCH OUT
        REAL TIME STATE 0003
        STATUS (R TO L): 1312  1110  0908  0706  0504  0302  0100
```

If, during testing, the operator disables the port that Test 4 is using by popping out the port switch, Test 4 prints error 4023. CHANGING THE STATE OF THE PORT SWITCH FOR THE PORT THAT Test 4 IS <<NOT>> USING HAS NO EFFECT ON THE TEST. If dropping of units is inhibited, Test 4 will loop in error recovery, printing this error, until the error state is corrected (by some external action).

```
CZUDC   DEV FTL ERR  04023 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
DISK EXERCISER  DM PC:xxxx  UDA AT xxxxxx  DRIVE xxx  RUNTIME hh:mm:ss
UNABLE TO CONTINUE TESTING
RUN/STOP SWITCH OUT
REAL TIME STATE 0003
STATUS (R TO L): 1312  1110  0908  0706  0504  0302  0100
```

If, during testing, the operator pops out the run/stop switch, Test 4 prints error 4023. If dropping of units is inhibited, Test 4 will loop in error recovery, printing this error, until the error state is corrected (by some external action).

```
CZUDC   DEV FTL ERR  04023 ON UNIT 00 TST 04 SUB 000 PC: xxxxxx
```

```
                        .SBTTL  COMMAND PACKET OFFSETS


                        ;GENERIC COMMAND PACKET OFFSETS

000000                  P.CRF   = 0.                      ;COMMAND REFERENCE NUMBER
000004                  P.UNIT  = 4.                      ;UNIT NUMBER
000010                  P.OPCD  = 8.                      ;OPCODE
000012                  P.MOD   = 10.                     ;MODIFIERS
000014                  P.BCNT  = 12.                     ;BYTE COUNT
000020                  P.BUFF  = 16.                     ;BUFFER DESCRIPTOR
000020                  P.UADR  = 16.                     ;UNIBUS ADDRESS OF BUFFER DESCRIPTOR
000034                  P.LBN   = 28.                     ;LOGICAL BLOCK NUMBER


                        ;ABORT AND GET COMMAND STATUS COMMAND PACKET OFFSETS

000014                  P.OTRF  = 12.                     ;OUTSTANDING REFERENCE NUMBER


                        ;ONLINE AND SET UNIT CHARACTERISTICS COMMAND PACKET OFFSETS

000016                  P.UNFL  = 14.                     ;UNIT FLAGS
000020                  P.HSTI  = 16.                     ;HOST IDENTIFIER / RESERVED
000034                  P.ELGF  = 28.                     ;ERROR LOG FLAGS
000040                  P.SHUN  = 32.                     ;SHADOW UNIT
000042                  P.CPSP  = 34.                     ;COPY SPEED


                        ;REPLACE COMMAND PACKET OFFSETS

000014                  P.RBN   = 12.                     ;REPLACEMENT BLOCK NUMBER


                        ;SET CONTROLLER CHARACTERISTICS COMMAND PACKET OFFSETS

000014                  P.VRSN  = 12.                     ;MSCP VERSION
000016                  P.CNTF  = 14.                     ;CONTROLLER FLAGS
000020                  P.HTMO  = 16.                     ;HOST TIMEOUT
000022                  P.USEF  = 18.                     ;USE FRACTION
000024                  P.TIME  = 20.                     ;QUAD-WORD TIME AND DATE


                        ;MAINTENANCE READ AND MAINTENANCE WRITE COMMAND PACKET OFFSETS

000034                  P.RGID  = 28.                     ;REGION ID
000040                  P.RGOF  = 32.                     ;REGION OFFSET


                        ;EXECUTE SUPPLIED PROGRAM COMMAND PACKET OFFSETS

000024                  P.DMDT  = 20.                     ;DMDT TERMINAL ADDRESS (MAINT WRITE ONLY)
000034                  P.OVRL  = 28.                     ;BUFFER DESCRIPTOR FOR OPERLAYS
```

```
                        .SBTTL  END PACKET OFFSETS


                        ;GENERIC END PACKET OFFSETS

000000                  P.CRF   = 0.                   ;COMMAND REFERENCE NUMBER
000004                  P.UNIT  = 4.                   ;UNIT NUMBER
000010                  P.OPCD  = 8.                   ;OPCODE (ALSO CALLED ENDCODE)
000011                  P.FLGS  = 9.                   ;END PACKET FLAGS
000012                  P.STS   = 10.                  ;STATUS
000014                  P.BCNT  = 12.                  ;BYTE COUNT
000034                  P.FBBK  = 28.                  ;FIRST BAD BLOCK


                        ;GET COMMAND STATUS END PACKET OFFSETS

000014                  P.OTRF  = 12.                  ;OUTSTANDING REFERENCE NUMBER
000020                  P.CMST  = 16.                  ;COMMAND STATUS


                        ;GET UNIT STATUS END PACKET OFFSETS

000014                  P.MLUN  = 12.                  ;MULTI-UNIT CODE
000016                  P.UNFL  = 14.                  ;UNIT FLAGS
000020                  P.HSTI  = 16.                  ;HOST IDENTIFIER
000024                  P.UNTI  = 20.                  ;UNIT IDENTIFIER
000034                  P.MEDI  = 28.                  ;MEDIA TYPE IDENTIFIER
000040                  P.SHUN  = 32.                  ;SHADOW UNIT
000042                  P.SHST  = 34.                  ;SHADOW STATUS
000044                  P.TRKS  = 36.                  ;TRACK SIZE
000046                  P.GRPS  = 38.                  ;GROUP SIZE
000050                  P.CYLS  = 40.                  ;CYLINDER SIZE
000054                  P.RCTS  = 44.                  ;RCT TABLE SIZE
000056                  P.RBNS  = 46.                  ;RBNS / TRACK
000057                  P.RCTC  = 47.                  ;RCT COPIES


                        ;ONLINE AND SET UNIT CHARACTERISTICS END PACKET AND AVAILABLE
                        ;ATTENTION MESSAGE OFFSETS

000014                  P.MLUN  = 12.                  ;MULTI-UNIT CODE
000016                  P.UNFL  = 14.                  ;UNIT FLAGS
000020                  P.HSTI  = 16.                  ;HOST IDENTIFIER
000024                  P.UNTI  = 20.                  ;UNIT IDENTIFIER
000034                  P.MEDI  = 28.                  ;MEDIA TYPE IDENTIFIER
000040                  P.SHUN  = 32.                  ;SHADOW UNIT
000042                  P.SHST  = 34.                  ;SHADOW STATUS
000044                  P.UNSZ  = 36.                  ;UNIT SIZE
000050                  P.VSER  = 40.                  ;VOLUME SERIAL NUMBER


                        ;SET CONTROLLER CHARACTERISTICS END PACKET OFFSETS

000014                  P.VRSN  = 12.                  ;MSCP VERSION
000016                  P.CNTF  = 14.                  ;CONTROLLER FLAGS
000020                  P.CTMO  = 16.                  ;CONTROLLER TIMEOUT
000022                  P.CNCL  = 18.                  ;CONTROLLER COMMAND LIMIT
```

```
                                ;GET DUST STATUS END PACKET OFFSETS
                                
000014          P.DEXT  = 12.           ;EXTENSION FOR DOWNLINE LOADABLE PROGRAM
000017          P.DFLG  = 15.           ;FLAGS
000020          P.DPRG  = 16.           ;PROGRESS INDICATOR FOR REMOTE PROGRAM
000024          P.DTMO  = 20.           ;TIMEOUT
```

```
                        .SBTTL  STATUS AND EVENT CODE DEFINITIONS

000037          ST.MSK  = 37                  ;STATUS / EVENT CODE MASK
000040          ST.SUB  = 40                  ;SUB-CODE MULTIPLIER
000000          ST.SUC  = 0                   ;SUCCESS
000001          ST.CMD  = 1                   ;INVALID COMMAND
000002          ST.ABO  = 2                   ;COMMAND ABORTED
000003          ST.OFL  = 3                   ;UNIT-OFFLINE
000004          ST.AVL  = 4                   ;UNIT-AVAILABLE
000005          ST.MFE  = 5                   ;MEDIA FORMAT ERROR
000006          ST.WPR  = 6                   ;WRITE PROTECTED
000007          ST.CMP  = 7                   ;COMPARE ERROR
000010          ST.DAT  = 10                  ;DATA ERROR
000011          ST.HST  = 11                  ;HOST BUFFER ACCESS ERROR
000012          ST.CNT  = 12                  ;CONTROLLER ERROR
000013          ST.DRV  = 13                  ;DRIVE ERROR
000037          ST.DIA  = 37                  ;MESSAGE FROM AN INTERNAL DIAGNOSTIC
000400          ST.AOL  = 400                 ;ALREADY ON-LINE

                ;DUP MESSAGE TYPES

010000          DU.QUE  = 10000               ;QUESTION
020000          DU.DFL  = 20000               ;DEFAULT QUESTION
030000          DU.INF  = 30000               ;INFORMATION
040000          DU.TER  = 40000               ;TERMINATOR
050000          DU.FTL  = 50000               ;FATAL ERROR
060000          DU.SPC  = 60000               ;SPECIAL
```

```
                        .SBTTL  CONTROLLER TABLE DEFINITIONS

                        ;ONE TABLE WILL BE SET UP BY INITIALIZE SECTION FOR EACH UDA SELECTED
                        ;FOR TESTING.  TABLES ARE CONTIGUOUS.  THE END OF THE TABLES IS
                        ;MARKED BY A WORD OF ZEROS.
                        ;
                        ;THE FIRST TABLE IS POINTED TO BY THE CONTENTS OF CTABS.
                        ;THE NUMBER OF TABLES IS CONTAINED IN CTRLRS.

000077                  CT.UNT  = 000077        ;LOGICAL UNIT NUMBER MASK
000777                  CT.VEC  = 000777        ;VECTOR ADDRESS MASK
007000                  CT.BRL  = 007000        ;BR LEVEL MASK

100000                  CT.AVL  = BIT15         ;SET WHEN NOT AVAILABLE FOR TESTING
000040                  CT.U50  = BIT5          ;CONTROLLER IS UDA50 IF SET/UDA52 IF CLEARED
000020                  CT.REQ  = BIT4          ;BUFFER HAS BEEN GIVEN TO UDA FOR REQUEST
                                                ;SET WHENEVER READ STUD DATA COMMAND GIVEN TO UDA
000010                  CT.MSG  = BIT3          ;MESSAGE RESPONSE RECEIVED
                                                ;WHENEVER THIS BIT IS SET, CT.CMD IS CLEARED
000002                  CT.RN   = BIT1          ;DM PROGRAM RUNNING
000004                  CT.CMD  = BIT2          ;COMMAND ISSUED, WAITING FOR RESPONSE

000000                  C.UADR  = 0             ;UNIBUS ADDRESS OF UDAIP REGISTER
000002                  C.UNIT  = 2             ;UNIT NUMBER TO TEST
000004                  C.VEC   = 4             ;VECTOR ADDRESS/BR LEVEL
000006                  C.BST   = 6             ;BURST LEVEL
000010                  C.JSR   = 10            ;INTERRUPT SERVICE ROUTINE FOR CONTROLLER
000012                  C.JAD   = 12            ;THESE TWO WORDS LOADED WITH [JSR R0    UDASRV]
000014                  C.FLG   = 14            ;FLAGS
000016                  C.HCOM  = 16            ;BEGINNING ADRS OF HOST COMM AREA IN MEMORY
000020                  C.DR0   = 20            ;POINTER TO DRIVE TABLES
000022                  C.DR1   = 22            ;IF ZERO, NO DRIVE TABLE EXISTS
000024                  C.DR2   = 24            ;
000026                  C.DR3   = 26            ;
000030                  C.DR4   = 30            ;
000032                  C.DR5   = 32            ;
000034                  C.DR6   = 34            ;
000036                  C.DR7   = 36            ;
000040                  C.TO    = 40            ;TIMEOUT COUNTER
000042                  C.TOH   = 42            ;  (TWO WORDS)
000044                  C.REF   = 44            ;COMMAND REFERENCE NUMBER

000046                  C.SIZE  = 46            ;SIZE OF CONTROLLER TABLE IN BYTES
```

```
                                ;DRIVE TABLE DEFINITIONS
                                ;
                                ;ONE DRIVE TABLE WILL BE SET UP BY THE INITIALIZE SECTION FOR EACH
                                ;DRIVE SELECTED FOR TESTING.  EACH TABLE IS POINTED TO BY A
                                ;WORD IN THE CONTROLLER TABLE ON WHICH THE DRIVE EXISTS.
                                ;
                                ;THE FIRST TABLE IS POINTED TO BY THE CONTENTS OF DTABS.

000077                          DT.UNT  = 000077                ; LOGICAL UNIT NUMBER OF DRIVE

100000                          DT.AVL  = BIT15                 ; SET WHEN NOT AVAILABLE FOR TESTING
040000                          D.IW    = BIT14                 ;INITIAL WRITE
020000                          D.DCY   = BIT13                 ;DIAGNOSTIC CYLINDERS
010000                          D.ECC   = BIT12                 ;ECC CORRECTION ENABLED
004000                          D.RO    = BIT11                 ;READ ONLY
002000                          D.WO    = BIT10                 ;WRITE ONLY
001000                          D.RET   = BIT9                  ;RETRIES ENABLED
000400                          D.CYL   = BIT8                  ;START/END CYLINDERS SPECIFIED
000100                          D.SEQ   = BIT6                  ;SEQUENTIAL ACCESS
000040                          D.BE    = BIT5                  ;BEGIN/END BLOCKS USED
000020                          D.TR    = BIT4                  ;WHEN D.BE=0: 1 - TRACKS, 0 - GROUPS
000010                          D.WC    = BIT3                  ;WRITE CHECKS ENABLED
000004                          D.WCA   = BIT2                  ;ALWAYS WRITE CHECK
000002                          D.DC    = BIT1                  ;DATA COMPARES ENABLED
000001                          D.DCA   = BIT0                  ;ALWAYS DATA COMPARE
011012                          DDEF    = D.ECC+D.WC+D.DC+D.RET ;DEFAULT D.PRM
140200                          D.ZERO  = BIT15+BIT7+D.IW       ;BITS TO BE CLEARED

000000                          D.DRV   = 0                     ;DRIVE NUMBER
000002                          D.UNIT  = 2                     ;
000004                          D.PRM   = 4                     ;HARDWARE QUESTION FLAGS
000006                          D.PAT   = 6                     ;DATA PATTERN NUMBER
000010                          D.BB    = 10                    ;BAD BLOCK COUNT
000012                          D.BB01  = 12                    ;BAD BLOCK 1
000016                          D.BB02  = 16                    ;          2
000022                          D.BB03  = 22                    ;          3
000026                          D.BB04  = 26                    ;          4
000032                          D.BB05  = 32                    ;          5
000036                          D.BB06  = 36                    ;          6
000042                          D.BB07  = 42                    ;          7
000046                          D.BB08  = 46                    ;          8
000052                          D.BB09  = 52                    ;          9
000056                          D.BB10  = 56                    ;         10
000062                          D.BB11  = 62                    ;         11
000066                          D.BB12  = 66                    ;         12
000072                          D.BB13  = 72                    ;         13
000076                          D.BB14  = 76                    ;         14
000102                          D.BB15  = 102                   ;         15
000106                          D.BB16  = 106                   ;         16
```

```
                                
000112          D.BEC   = 112           ;BEGIN/END SET COUNT
000114          D.BGN1  = 114           ;BEGIN BLOCK 1
000120          D.END1  = 120           ;END
000124          D.BGN2  = 124           ;BEGIN BLOCK 2
000130          D.END2  = 130           ;END
000134          D.BGN3  = 134           ;BEGIN BLOCK 3
000140          D.END3  = 140           ;END
000144          D.BGN4  = 144           ;BEGIN BLOCK 4
000150          D.END4  = 150           ;END
000154          D.BCYL  = 154           ;BEGIN CYLINDER
000160          D.ECYL  = 160           ;END CYLINDER
000164          D.XFRW  = 164           ;MEGABITS WRITTEN COUNT
000166          D.XFRR  = 166           ;MEGABITS READ COUNT
000170          D.HERR  = 170           ;HARD ERROR COUNTER
000172          D.SERR  = 172           ;SOFT ERROR COUNTER
000174          D.SEEK  = 174           ;NUMBER OF SEEKS X1000
000176          D.ECCC  = 176           ;ECC COUNTER
000200          D.SERN  = 200           ;DRIVE SERIAL NUMBER

000206          D.SIZE  = 206           ;SIZE OF DRIVE TABLE IN BYTES

                ;DM PROGRAM HEADER DEFINITIONS

000000          DMTRLN  = 0             ;OFFSET TO SIZE OF PROGRAM NEEDING DOWNLINE LOAD
000004          DMOVRL  = 4             ;OFFSET TO SIZE OF OVERLAY
000040          DMMAIN  = 40            ;OFFSET TO FIRST WORD OF MAIN PROGRAM
001000          DMFRST  = 1000          ;ADDRESS IN DM FILE CONTAINING FIRST BYTE OF HEADER
```

```
                                .SBTTL  GLOBAL DATA SECTION

                                ;++
                                ; THE GLOBAL DATA SECTION CONTAINS DATA THAT ARE USED
                                ; IN MORE THAN ONE TEST.
                                ;--

064402                          L$ERRTBL::
064402  000000                  ERRTYP::        .WORD   0
064404  000000                  ERRNBR::        .WORD   0
064406  000000                  ERRMSG::        .WORD   0
064410  000000                  ERRBLK::        .WORD   0

064412                          FFREE:: .BLKW 1                 ;FIRST FREE WORD IN MEMORY
064414                          FSIZE:: .BLKW 1                 ;SIZE OF FREE MEMORY IN WORDS
064416                          FMEM:   .BLKW 1                 ;COPY OF FFREE AT END OF INIT SECTION
064420                          FMEMS:  .BLKW 1                 ;COPY OF FSIZE AT END OF INIT SECTION
064422                          DTABS:: .BLKW 1                 ;START OF DRIVE TABLE STORAGE
064424                          CTABS:: .BLKW 1                 ;START OF CONTROLLER TABLE STORAGE
064426                          CTRLRS: .BLKW 1                 ;COUNT OF UDA CONTROLLERS IN PTABLES
064430                          TSTTAB: .BLKW 1                 ;POINTER TO 1ST CONTROLLER TABLE UNDER TEST
064432                          DMPROG: .BLKW 1                 ;START ADDRESS OF UDA52 DM PROGRAM

064434                          KTBASA: .BLKW 1                 ;HIGH TWO BYTES OF BASE ADDRESS FOR KT ACCESS
064436                          KTBASO: .BLKW 1                 ;LOW BYTE OF ADDRESS FOR KT ACCESS

064440                          IFLAGS::.BLKW 1                 ;FLAGS FROM INIT CODE FOR TEST 4

        000002                  ICONT   == BIT1                 ; CONTINUE EVENT FLAG
        000004                  IREST   == BIT2                 ; RESTART FLAG
        000010                  ISTRT   == BIT3                 ; START FLAG
        000020                  ISTRTH  == BIT4                 ; START FLAG HOLD FOR T4UPRM ROUTINE

064442  000000                  FNUM:   .WORD 0                 ;FILE # IN PAK FILE THAT IS CURRENTLY LOADED
064444  000000                  TNUM:   .WORD 0                 ;NUMBER OF TEST EXECUTING
064446                          URUN:   .BLKW 1                 ;NUMBER OF UNITS TO RUN AT ONE TIME
064450                          URNING: .BLKW 1                 ;NUMBER OF UNITS STILL RUNNING
064452                          UCNT:   .BLKW 1                 ;COUNTER OF UNITS UNDER TEST
064454                          INTRCV: .BLKW 1                 ;INTERRUPT RECEIVED FLAG FOR INT TESTING
```

F11


```
                                
                                
064456     132     125     104  FNAME:  .ASCIZ  \ZUDDEO.PAK\          ;NAME OF DATA FILE
                                        .EVEN
                                
064472  000000                  FDATA:  .WORD 0
064474  000000                  FILOPN: .WORD 0                        ;FILE OPEN WHEN NON-ZERO
064476                          TEMP:   .BLKW 12.                      ;TEMPORY STORAGE FOR GMANI RESPONSES
                                
064526     125     065     062  U52EXT: .ASCII  "U52"
                                        .EVEN
                                
064532  000000                  TYPCNT: .WORD   0                      ; TYPE OF CONTROLLER WORD
                                
        000002                  TY.U50  = BIT1
        000001                  TY.U52  = BIT0
                                
064534  000000                  IPADRS: .WORD   0                      ; EIGHT ENTRIES
064536  000000                          .WORD   0
064540  000000                          .WORD   0
064542  000000                          .WORD   0
064544  000000                          .WORD   0
064546  000000                          .WORD   0
064550  000000                          .WORD   0
064552  000000                          .WORD   0
                                
064554  000001                  PAT16C: .WORD 1                        ;COUNT OF WORDS IN DATA PATTERN 16
064556  000000                  PAT16W: .WORD 0                        ;WORD SEQUENCE FOR DATA PATTERN 16
064560  000000                          .WORD 0
064562  000000                          .WORD 0
064564  000000                          .WORD 0
064566  000000                          .WORD 0
064570  000000                          .WORD 0
064572  000000                          .WORD 0
064574  000000                          .WORD 0
064576  000000                          .WORD 0
064600  000000                          .WORD 0
064602  000000                          .WORD 0
064604  000000                          .WORD 0
064606  000000                          .WORD 0
064610  000000                          .WORD 0
064612  000000                          .WORD 0
064614  000000                          .WORD 0
```

```
 1
 2                                      ;KW11 CLOCK CONTROL
 3
 4 064616  000000                       KW.CSR: .WORD 0                 ;CSR OF CLOCK
 5 064620                               KW.BRL: .BLKW 1                 ;BR LEVEL
 6 064622                               KW.VEC: .BLKW 1                 ;VECTOR
 7 064624                               KW.HZ:  .BLKW 1                 ;HERTZ (50. OR 60.)
 8 064626                               KW.EL:  .BLKW 2                 ;ELAPSED TIME
 9 064632                               STIME:  .BLKW 2                 ;STATISTICAL REPORT TIMER
10
11 064636                               NXMAD:  .BLKW 1                 ;SET TO ALL ONES BY NON-EXISTANT ADDRESS
12 064640  177777                       KTMEM:  .WORD -1                ;SET TO ALL ONES IF NO KT EXISTS
13
14 064642                               T2WRR:  .BLKW 1                 ;WRITE/READ REGION
15 064644                               T2WRO:  .BLKW 1                 ;WRITE/READ OFFSET
16 064646                               T2DR:   .BLKW 1                 ;DIAGNOSE REGION
17
18
19                                      ;ERROR LOG CONTROL WORDS
20
21 064650                               LBUFS:  .BLKW 1                 ;START ADDRESS OF LOG/ZERO IF NONE
22 064652                               LBUFN:  .BLKW 1                 ;ADDRESS FOR MORE DATA FOR LOG
23 064654                               LBUFE:  .BLKW 1                 ;LAST ADDRESS AVAILABLE FOR LOG DATA
24
25                                      ;DISK DIAGNOSTIC DLL CONTROL WORDS
26
27 064656                               DLL:    .BLKW 1                 ;DOWNLINE LOAD RESPONSE CODE = 0 - NO DATA,
28                                                                      ;1 - PROGRAM PROVIDED, 2- PROGRAM NOT FOUND
29 064660                               DLLDR:  .BLKW 1                 ;DRIVE NUMBER REQUESTING PROGRAM
30 064662                               DLLV:   .BLKW 1                 ;A VALUE FROM DM PROGRAM TO BE RETURNED
31 064664                               DLLR:   .BLKW 1                 ;REGION
32 064666                               DLLADR: .BLKW 2                 ;ADDRESS WHERE PROGRAM STORED
33 064672                               DLLSIZ: .BLKW 1                 ;SIZE OF PROGRAM IN BYTES
34 064674                               DLLNAM: .BLKW 2                 ;NAME OF PROGRAM IN RAD50
```

```
                                        .SBTTL  GLOBAL TEXT SECTION

                                        ;++
                                        ; THE GLOBAL TEXT SECTION CONTAINS FORMAT STATEMENTS,
                                        ; MESSAGES, AND ASCII INFORMATION THAT ARE USED IN
                                        ; MORE THAN ONE TEST.
                                        ;--

                                        ;NAMES OF DEVICES SUPPORTED BY PROGRAM
                                        ;
064700                                  L$DVTYP::
064700  114     117     107                     .ASCIZ  /LOGICAL DISK DRIVE/
                                                .EVEN

                                        ; TEST DESCRIPTION
                                        ;
064724                                  L$DESC::
064724  103     132     125                     .ASCIZ  /CZUDCEO UDA & DISK DRV DIAG/
                                                .EVEN


                                        ; UNFORMATTED MESSAGES
                                        ;

064760  040     040     000     T4OPT7: .ASCIZ  \  \
064763  101     122     105     INITWC: .ASCIZ  \ARE YOU SURE CUSTOMER DATA CAN BE DESTROYED\

                                        ; FORMAT STATEMENTS USED IN PRINT CALLS
                                        ;

065037  045     124     000     FRMTT:  .ASCIZ  \#T\
065042  045     116     000     CRLF:   .ASCIZ  \#N\
065047  042     040     040     RNTIM:  .ASCIZ  \"  RUNTIME "D16":"\
065070  104     071     042     RNTIM1: .ASCIZ  \D9":"\
065076  104     071     000     RNTIM2: .ASCIZ  \D9\
065101  042     040     040     ERRME1: .ASCIZ  \"  *  *  *  ERROR PROCESSING MESSAGE STRING  *  *  *"N\
065170  116     042     122     MXFERP: .ASCIZ  \N"REACHED TRANSFER LIMIT - TESTING STOPPED"N\
065245  116     042     125     ERRLIM: .ASCIZ  \N"UNIT "D6" REACHED ERROR LIMIT - WILL NO LONGER BE TESTED"N\
065342  116     042     124     INTSTO: .ASCIZ  \N"TESTING INTERRUPT ABILITY OF UDA AT ADR "016" VEC "09"..."\
065437  042     103     117     INTST1: .ASCIZ  \"COMPLETED"N\
065454  116     042     103     INITWA: .ASCIZ  \N"CUSTOMER DATA WILL BE DESTROYED ON:"NS5"UNIT"S5"UDA AT"S3"DRIVE"N\
065560  045     123     066     INITWB: .ASCIZ  \#S6#D2#S6#O6#S4#D3#N\
065605  116     042     115     T4WARN: .ASCIZ  \N"MANUAL INTERVENTION NOT ALLOWED.  TEST 4 USING DEFAULT PARAMETERS"N\
065713  116     042     125     MESSG:  .ASCIZ  \N"UNIT "D6" UDA AT "016" DRIVE "D9S\
065757  116     042     115     T2WARN: .ASCIZ  \N"MANUAL INTERVENTION NOT ALLOWED, TEST 2 RUNNING UNATTENDED"N\
066056  116     042     124     T2CMS1: .ASCII  \N"TEST #2 MANUAL INTERVENTION ON UNIT "D8" UDA AT "016" DRIVE "D9N\
066160  042     124     117             .ASCII  \"TO WRITE AND READ MEMORY:"N\
066214  042     040     040             .ASCII  \"  W DATA REGION OFFSET"N\
066245  042     040     040             .ASCII  \"  R REGION OFFSET"N\
066271  042     124     117             .ASCII  \"TO RUN A DIAGNOSTIC:"N\
066320  042     040     040             .ASCII  \"  D REGION"N\
066335  042     124     117             .ASCII  \"TO EXIT QUESTIONING:"N\
066364  042     040     040             .ASCII  \"  E"N\
066372  042     104     101             .ASCIZ  \"DATA, REGION AND OFFSET ARE HEX VALUES."N\
066445  042     077     040     T2CMS5: .ASCIZ  \"? INPUT ERROR"N\
```

```
 79 066466      042     116     117  NOCLOCK:.ASCIZ  \"NO LINE CLOCK AVAILABLE FOR TIMING EVENTS"N\
 80 066543      116     042     103  LOGM1:  .ASCIZ  \N"CONTENTS OF ERROR LOG:"\
 81 066575      116     042     105  LOGM2:  .ASCIZ  \N"END OF ERROR LOG"N\
 82 066622      116     042     105  LOGM3:  .ASCIZ  \N"ERROR LOG IS EMPTY"N\
 83
 84 066651      042     110     117  BASNO:  .ASCIZ  \"HOST PROGRAM"\
 86 066670      042     125     116  BASN1:  .ASCIZ  \"UNIBUS ADDRESSING"\
 87 066714      042     104     111  BASN2:  .ASCIZ  \"DISK RESIDENT"\
 88 066734      042     104     111  BASN3:  .ASCIZ  \"DISK FUNCTION"\
 91 066754      042     104     111  BASN4:  .ASCIZ  \"DISK EXERCISER"\
 93 066775      042     040     040  BASL1:  .ASCIZ  \"  DM PC:"012\
 94 067013      042     040     040  BASL2:  .ASCIZ  \"  UDA AT "016\
 95 067032      042     040     040  BASL3:  .ASCIZ  \"  DRIVE "D9\
 96 067047      000                  BAS:    .BYTE 0                         ;NULL TO PRINT NOTHING
 97
 98 067050      122     066     122  BASLN:  .ASCIZ  \R6R6R6R6\              ;USED TO PRINT BASIC LINE OF ERROR MESSAGE
```

```
    1 067061                          X1A:
    2 067061                          X2A:
    3 067061                          X3A:
    4 067061  042  111  040  X8A:     .ASCIZ  \"I DON'T LIKE THE ANSWERS YOU GAVE TO THE HARDWARE QUESTIONS"N\
    5 067160  122  065  122  X1:      .ASCIZ  \R5R6"UDA HAS MORE THAN ONE VECTOR, BR LEVEL OR BURST RATE"N\
    6 067254  122  065  122  X2:      .ASCIZ  \R5R6"TWO UNITS SELECT THE SAME DRIVE"N\
    7 067323  122  065  122  X3:      .ASCIZ  \R5R6"MORE THAN EIGHT DRIVES SELECTED ON THIS UDA"N\
    8 067406  122  064  042  X4:      .ASCII  \R4"NOT ENOUGH ROOM IN MEMORY TO TEST THE UNITS SELECTED"N\
    9 067477  042  120  114           .ASCIZ  \"PLEASE START PROGRAM OVER AND TEST FEWER UNITS AT A TIME"N\
   10 067573  122  064  042  X6:      .ASCIZ  \R4"TABLE CONSISTANCY ERROR. PLEASE RE-LOAD PROGRAM"N\
   11 067660  122  065  122  X8:      .ASCIZ  \R5R6"TWO UDA'S USE THE SAME VECTOR"N\
   13 067725  122  064  042  X5:      .ASCIZ  \R4"CHECKSUM ERROR IN DM PROGRAM FILE "N\
   14 067775  122  064  042  X7:      .ASCIZ  \R4"ERROR IN DM PROGRAM FILE. DM PROGRAM NOT FOUND"N\
   16 070061  122  064  042  X14:     .ASCII  \R4"UDA50 CONTROLLER IS AT A REVISION LEVEL NO LONGER SUPPORTED"N\
   17 070161  042  102  131           .ASCII  \"BY THIS DIAGNOSTIC PROGRAM.  THIS PROGRAM REQUIRES A UDA50-A"N\
   18 070260  042  103  117           .ASCII  \"CONTROLLER (MODEL 6) WITH MICROCODE REVISION AT 3 OR GREATER."N\
   19 070360  116  042  103           .ASCIZ  \N"CONTROLLER REPORTED MODE CODE "D4" AND MICROCODE VERSION "D4N\
   35 070460  122  065  042  X38:     .ASCII  \R5"MEMORY ERROR TRYING TO READ UDA REGISTERS"N\
   36 07053.  042  103  110           .ASCII  \"CHECK UNIBUS SELECTION SWITCHES ON UDA MODULE M7485"N\
   37 070624  042  117  122           .ASCII  \"OR UNIBUS"N\
   38 070640  042  117  122           .ASCIZ  \"OR 'R7\
   39 070650  122  065  042  X21:     .ASCII  \R5"UDA RESIDENT DIAGNOSTICS DETECTED FAILURE"NR8\
   40 070730  042  122  105           .ASCIZ  \"REPLACE UDA MOUULE M748"03N\
   41 070765  122  065  042  X22:     .ASCII  \R5"STEP BIT DID NOT SET IN UDASA REGISTER DURING INITIALIZATION"N\
   42 071066  042  123  124           .ASCIZ  \"STEP BIT EXPECTED "016NR8R7\
   43 071123  122  065  042  X23A:    .ASCII  \R5"UDA DID NOT CLEAR RING STRUCTURE IN HOST MEMORY DURING INITIALIZATION"N\
   44 071235  104  071  042           .ASCII  \D9" WORDS WERE TO BE CLEARED STARTING AT ADDRESS "016N\
   45 071323  042  106  111           .ASCII  \"FIRST SEVERAL WORDS NOT CLEARED (UP TO 6):"N\
   46 071400  123  066  042           .ASCIZ  \S6"ADDRESS"S4"CONTENTS"N\
   47 071431  123  067  117  X23B:    .ASCIZ  \S7016S5016N\
   48 071445  122  065  042  X24:     .ASCII  \R5"UDASA REGISTER DID NOT GO TO ZERO AFTER STEP 3 WRITE OF INITIALIZATION"N
\
   49 071560  042  120  125           .ASCIZ  \"PURGE/POLE DIAGNOSTICS WERE REQUESTED"NR8R7\
   50 071635  122  065  042  X25:     .ASCII  \R5"UDA DID NOT RETURN CORRECT DATA IN UDASA REGISTER DURING INITIALIZATION"
N\
   51 071751  042  040  040           .ASCIZ  \"  UDASA EXPECTED  "016NR8R7\
   53 072006  122  065  042  X26:     .ASCII  \R5"DATA COMPARISON ERROR DURING DIAGNOSTIC PORT LOOP TEST"N\
   54 072101  042  040  040           .ASCII  \"  DATA SENT TO UDASA  "016N\
   55 072135  042  040  040           .ASCIZ  \"  RECEIVED FROM UDASA "016NR7\
   56 072174  122  065  042  X27:     .ASCII  \R5"UDASA REGISTER DID NOT CHANGE AFTER WRITING TO IT"N\
   57 072262  042  111  116           .ASCIZ  \"IN PORT LOOP DIAGNOSTIC"NR8R7\
   58 072321  122  065  042  X28:     .ASCIZ  \R5"UDA DID NOT INTERRUPT THE PDP-11"NR7\
   59 072371  122  065  042  X29:     .ASCII  \R5"UDA INTERRUPTED AT DIFFERENT BR LEVEL THAN SPECIFIED IN HARDWARE"N\
   60 072476  042  121  125           .ASCII  \"QUESTIONS. INTERRUPT WAS AT BR LEVEL "03N\
   61 072550  042  103  110           .ASCII  \"CHECK PRIORITY PLUG ON UDA MODULE M7485"N\
   62 072622  042  117  122           .ASCIZ  \"OR CHANGE HARDWARE QUESTIONS"N\
   64 072662  122  065  042  X30:     .ASCIZ  \R5"UDA REPORTED FATAL ERROR IN UDASA REGISTER WHILE RUNNING DM PROGRAM"NR8\
   65 072775  122  065  042  X31:     .ASCII  \R5"NO INTERRUPT RECEIVED FROM DM PROGRAM FOR 3 MINUTES"N\
   66 073065  042  101  123           .ASCIZ  \"ASSUME PROGRAM IS HUNG"N\
   67 073117  122  065  042  X32:     .ASCIZ  \R5"MESSAGE BUFFER RECEIVED FROM DM PROGRAM WITH UNKNOWN REQUEST NUMBER"N\
   68 073230  122  065  042  X35:     .ASCIZ  \R5"DM PROGRAM ASKED FOR DATA ON UNKNOWN DRIVE"N\
   69 073310  122  065  042  X36:     .ASCII  \R5"NO INTERRUPT RECEIVED FROM UDA FOR 30 SECONDS"N\
   70 073372  042  127  110           .ASCIZ  \"WHILE LOADING DM PROGRAM"N\
   71 073426  122  065  042  X37:     .ASCIZ  \R5"UDA REPORTED FATAL ERROR IN UDASA REGISTER WHILE LOADING DM PROGRAM"NR8R
7\
```

GLOBAL TEXT SECTION

```
      1 073543     042     115     105  XMSG1:   .ASCIZ  \"MESSAGE BUFFER CONTAINS:"N\
      2 073577     123     063     117  XMSG2:   .ASCIZ  \S3016S1016S1016S1016S1016S1016S1016N\
      3 073644     122     065     042  XPKT1:   .ASCII  \R5"RESPONSE PACKET FROM UDA DOES NOT CONTAIN EXPECTED DATA"N\
      4 073740     042     105     111          .ASCII  \"EITHER UDA RETURNED ERROR STATUS OR PACKET WAS NOT RECEIVED CORRECTLY"N\
      5 074050     123     063     042          .ASCIZ  \S3"COMMAND PACKET SENT"S6"RESPONSE PACKET RECEIVED"N\
      6 074135     123     066     117  XPKT2:   .ASCIZ  \S6016S1016S14016S1016N\
      7 074164     042     040     040  XSA:     .ASCIZ  \"  UDASA CONTAINS  "016N\
      8 074215     042     122     105  XFRU:    .ASCIZ  \"REPLACE UDA MODULE M7485"N\
     12                                        .EVEN
```

```
                                .SBTTL  GLOBAL ERROR REPORT SECTION

                                ;**
                                ; THE GLOBAL ERROR REPORT SECTION CONTAINS MESSAGE PRINTING AREAS
                                ; USED BY MORE THAN TEST TO OUTPUT ADDITIONAL ERROR INFORMATION.  PRINTB
                                ; (BASIC) AND PRINTX (EXTENDED) CALLS ARE USED TO CALL PRINT SERVICES.
                                ;--

074252                          ERR001::
074252  012746  067061                  MOV     #X1A,-(SP)              ;PUSH #X1A ON STACK
074256  004137  075674                  JSR     R1,LPNTB                ;CALL   LPNTB PRINT ROUTINE
074262  067160                          .WORD   X1                      ;ADDRESS OF ASCIZ STRING
074264  000002                          .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
074266                          L10002:
074266  104423                          TRAP    C$MSG

074270                          ERR002::
074270  012746  067061                  MOV     #X2A,-(SP)              ;PUSH #X2A ON STACK
074274  004137  075674                  JSR     R1,LPNTB                ;CALL   LPNTB PRINT ROUTINE
074300  067254                          .WORD   X2                      ;ADDRESS OF ASCIZ STRING
074302  000002                          .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
074304                          L10003:
074304  104423                          TRAP    C$MSG

074306                          ERR003::
074306  012746  067061                  MOV     #X3A,-(SP)              ;PUSH #X3A ON STACK
074312  004137  075674                  JSR     R1,LPNTB                ;CALL   LPNTB PRINT ROUTINE
074316  067323                          .WORD   X3                      ;ADDRESS OF ASCIZ STRING
074320  000002                          .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
074322                          L10004:
074322  104423                          TRAP    C$MSG

074324                          ERR004::
074324  004137  075674                  JSR     R1,LPNTB                ;CALL   LPNTB PRINT ROUTINE
074330  067406                          .WORD   X4                      ;ADDRESS OF ASCIZ STRING
074332  000000                          .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
074334                          L10005:
074334  104423                          TRAP    C$MSG

074336                          ERR005::
074336  004137  075674                  JSR     R1,LPNTB                ;CALL   LPNTB PRINT ROUTINE
074342  067725                          .WORD   X5                      ;ADDRESS OF ASCIZ STRING
074344  000000                          .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
074346                          L10006:
074346  104423                          TRAP    C$MSG

074350                          ERR007::
074350  004137  075674                  JSR     R1,LPNTB                ;CALL   LPNTB PRINT ROUTINE
074354  067775                          .WORD   X7                      ;ADDRESS OF ASCIZ STRING
074356  000000                          .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
074360                          L10007:
074360  104423                          TRAP    C$MSG

074362                          ERR014::
074362  010146                          MOV     R1,-(SP)                ;PUSH R1 ON STACK
074364  010346                          MOV     R3,-(SP)                ;PUSH R3 ON STACK
074366  004137  075674                  JSR     R1,LPNTB                ;CALL   LPNTB PRINT ROUTINE
```

```
    074372  070061                          .WORD   X14                     ;ADDRESS OF ASCIZ STRING
    074374  000004                          .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
 54 074376                          L10010:
    074376  104423                          TRAP    C$MSG
 55
 56 074400                          ERR006::
 57 074400  004137  075674                    JSR     R1,LPNTB                ;CALL   LPNTB PRINT ROUTINE
    074404  067573                          .WORD   X6                      ;ADDRESS OF ASCIZ STRING
    074406  000000                          .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
 58 074410                          L10011:
    074410  104423                          TRAP    C$MSG
 59
 60 074412                          ERR008::
 61 074412  012746  067061                    MOV     #X8A,-(SP)              ;PUSH #X8A ON STACK
    074416  004137  075674                    JSR     R1,LPNTB                ;CALL   LPNTB PRINT ROUTINE
    074422  067660                          .WORD   X8                      ;ADDRESS OF ASCIZ STRING
    074424  000002                          .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
 62 074426                          L10012:
    074426  104423                          TRAP    C$MSG
 63
 74
 75 074430                          ERR021::
 76 074430  010201                          MOV     R2,R1
 77 074432  000301                          SWAB R1
 78 074434  042701  177775                    BIC     #^C<2>,R1
 79 074440  006201                          ASR     R1
 80 074442  005201                          INC     R1
 81 074444  010103                          MOV     R1,R3
 82 074446  062703  000004                    ADD     #4,R3
 83 074452  010346                          MOV     R3,-(SP)                ;PUSH R3 ON STACK
    074454  010246                          MOV     R2,-(SP)                ;PUSH R2 ON STACK
    074456  004137  075674                    JSR     R1,LPNTB                ;CALL   LPNTB PRINT ROUTINE
    074462  070650                          .WORD   X21                     ;ADDRESS OF ASCIZ STRING
    074464  000004                          .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
 84 074466                          L10013:
    074466  104423                          TRAP    C$MSG
 85
 86 074470                          ERR022::
 87 074470  042737  100000  105546            BIC     #SA.ERR,UDARSD
 88 074476  010246                          MOV     R2,-(SP)                ;PUSH R2 ON STACK
    074500  013746  105546                    MOV     UDARSD,-(SP)            ;PUSH UDARSD ON STACK
    074504  004137  075674                    JSR     R1,LPNTB                ;CALL   LPNTB PRINT ROUTINE
    074510  070765                          .WORD   X22                     ;ADDRESS OF ASCIZ STRING
    074512  000004                          .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
 89 074514                          L10014:
    074514  104423                          TRAP    C$MSG
 90
 91 074516                          ERR023::
 92 074516  013746  064412                    MOV     FFREE,-(SP)             ;PUSH FFREE ON STACK
    074522  010146                          MOV     R1,-(SP)                ;PUSH R1 ON STACK
    074524  004137  075674                    JSR     R1,LPNTB                ;CALL   LPNTB PRINT ROUTINE
    074530  071123                          .WORD   X23A                    ;ADDRESS OF ASCIZ STRING
    074532  000004                          .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
 93 074534  005742                          TST     -(R2)
 94 074536  005712                  ERR23A: TST     (R2)
 95 074540  001410                          BEQ     ERR23B
 96 074542  011246                          MOV     (R2),-(SP)              ;PUSH (R2) ON STACK
```

```
                074544  010246                          MOV     R2,-(SP)                ;PUSH R2 ON STACK
                074546  004137  075674                   JSR     R1,LPNTB                ;CALL   LPNTB PRINT ROUTINE
                074552  071431                          .WORD   X23B                    ;ADDRESS OF ASCIZ STRING
                074554  000004                          .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
     97         074556  005304                          DEC     R4
     98         074560  001403                          BEQ     ERR23C
     99         074562  005722                  ERR23B: TST     (R2)+
    100         074564  005303                          DEC     R3
    101         074566  001363                          BNE     ERR23A
    102         074570                          ERR23C:
                074570  004137  075674                   JSR     R1,LPNTB                ;CALL   LPNTB PRINT ROUTINE
                074574  074215                          .WORD   XFRU                    ;ADDRESS OF ASCIZ STRING
                074576  000000                          .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
    103         074600                          L10015:
                074600  104423                          TRAP    C$MSG
    104
    105         074602                          ERR024::
    106         074602  010246                          MOV     R2,-(SP)                ;PUSH R2 ON STACK
                074604  004137  075674                   JSR     R1,LPNTB                ;CALL   LPNTB PRINT ROUTINE
                074610  071445                          .WORD   X24                     ;ADDRESS OF ASCIZ STRING
                074612  000002                          .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
    107         074614                          L10016:
                074614  104423                          TRAP    C$MSG
    108
    109         074616                          ERR025::
    110         074616  010246                          MOV     R2,-(SP)                ;PUSH R2 ON STACK
                074620  010146                          MOV     R1,-(SP)                ;PUSH R1 ON STACK
                074622  004137  075674                   JSR     R1,LPNTB                ;CALL   LPNTB PRINT ROUTINE
                074626  071635                          .WORD   X25                     ;ADDRESS OF ASCIZ STRING
                074630  000004                          .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
    111         074632                          L10017:
                074632  104423                          TRAP    C$MSG
    112
    114         074634                          ERR026::
    115         074634  016446  000002                  MOV     2(R4),-(SP)             ;PUSH 2(R4) ON STACK
                074640  010246                          MOV     R2,-(SP)                ;PUSH R2 ON STACK
                074642  004137  075674                   JSR     R1,LPNTB                ;CALL   LPNTB PRINT ROUTINE
                074646  072006                          .WORD   X26                     ;ADDRESS OF ASCIZ STRING
                074650  000004                          .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
    116         074652                          L10020:
                074652  104423                          TRAP    C$MSG
    117
    118         074654                          ERR027::
    119         074654  016446  000002                  MOV     2(R4),-(SP)             ;PUSH 2(R4) ON STACK
                074660  004137  075674                   JSR     R1,LPNTB                ;CALL   LPNTB PRINT ROUTINE
                074664  072174                          .WORD   X27                     ;ADDRESS OF ASCIZ STRING
                074666  000002                          .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
    120         074670                          L10021:
                074670  104423                          TRAP    C$MSG
    121
    122         074672                          ERR028::
    123         074672  004137  075674                   JSR     R1,LPNTB                ;CALL   LPNTB PRINT ROUTINE
                074676  072321                          .WORD   X28                     ;ADDRESS OF ASCIZ STRING
                074700  000000                          .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
    124         074702                          L10022:
                074702  104423                          TRAP    C$MSG
    125
```

```
126 074704                              ERR029::
127 074704  010146                            MOV     R1,-(SP)        ;PUSH R1 ON STACK
    074706  004137  075674                     JSR     R1,LPNTB        ;CALL   LPNTB PRINT ROUTINE
    074712  072371                            .WORD   X29             ;ADDRESS OF ASCIZ STRING
    074714  000002                            .WORD   ARG.CT          ;ARGUMENT COUNT * 2
128 074716                              L10023:
    074716  104423                            TRAP    C$MSG
130
131 074720                              ERR030::
132 074720  010146                            MOV     R1,-(SP)        ;PUSH R1 ON STACK
    074722  004137  075674                     JSR     R1,LPNTB        ;CALL   LPNTB PRINT ROUTINE
    074726  072662                            .WORD   X30             ;ADDRESS OF ASCIZ STRING
    074730  000002                            .WORD   ARG.CT          ;ARGUMENT COUNT * 2
133 074732                              L10024:
    074732  104423                            TRAP    C$MSG
134
135 074734                              ERR031::
136 074734  004137  075674                     JSR     R1,LPNTB        ;CALL   LPNTB PRINT ROUTINE
    074740  072775                            .WORD   X31             ;ADDRESS OF ASCIZ STRING
    074742  000000                            .WORD   ARG.CT          ;ARGUMENT COUNT * 2
137 074744                              L10025:
    074744  104423                            TRAP    C$MSG
138
139 074746                              ERR032::
140 074746  004137  075674                     JSR     R1,LPNTB        ;CALL   LPNTB PRINT ROUTINE
    074752  073117                            .WORD   X32             ;ADDRESS OF ASCIZ STRING
    074754  000000                            .WORD   ARG.CT          ;ARGUMENT COUNT * 2
141 074756  004737  075150                     CALL    MSGPKT
142 074762                              L10026:
    074762  104423                            TRAP    C$MSG
143
144 074764                              ERR033::
145 074764  004737  075056                     CALL    PNTPKT
146 074770                              L10027:
    074770  104423                            TRAP    C$MSG
147
148 074772                              ERR034::
149 074772  004737  075056                     CALL    PNTPKT
150 074776                              L10030:
    074776  104423                            TRAP    C$MSG
151
152 075000                              ERR035::
153 075000  004137  075674                     JSR     R1,LPNTB        ;CALL   LPNTB PRINT ROUTINE
    075004  073230                            .WORD   X35             ;ADDRESS OF ASCIZ STRING
    075006  000000                            .WORD   ARG.CT          ;ARGUMENT COUNT * 2
154 075010  004737  075150                     CALL    MSGPKT
155 075014                              L10031:
    075014  104423                            TRAP    C$MSG
156
157 075016                              ERR036::
158 075016  004137  075674                     JSR     R1,LPNTB        ;CALL   LPNTB PRINT ROUTINE
    075022  073310                            .WORD   X36             ;ADDRESS OF ASCIZ STRING
    075024  000000                            .WORD   ARG.CT          ;ARGUMENT COUNT * 2
159 075026                              L10032:
    075026  104423                            TRAP    C$MSG
160
161 075030                              ERR037::
```

```
162 075030  010146                    MOV     R1,-(SP)            ;PUSH R1 ON STACK
    075032  004137  075674             JSR     R1,LPNTB            ;CALL   LPNTB PRINT ROUTINE
    075036  073426                     .WORD   X37                 ;ADDRESS OF ASCIZ STRING
    075040  000002                     .WORD   ARG.CT              ;ARGUMENT COUNT * 2
163 075042                      L10033:
    075042  104423                     TRAP    C$MSG
164
165 075044                      ERR038::
166 075044  004137  075674             JSR     R1,LPNTB            ;CALL   LPNTB PRINT ROUTINE
    075050  070460                     .WORD   X38                 ;ADDRESS OF ASCIZ STRING
    075052  000000                     .WORD   ARG.CT              ;ARGUMENT COUNT * 2
167 075054                      L10034:
    075054  104423                     TRAP    C$MSG
168
169 075056                      PNTPKT:
    075056  004137  075674             JSR     R1,LPNTB            ;CALL   LPNTB PRINT ROUTINE
    075062  073644                     .WORD   XPKT1               ;ADDRESS OF ASCIZ STRING
    075064  000000                     .WORD   ARG.CT              ;ARGUMENT COUNT * 2
170 075066  010401                     MOV     R4,R1
171 075070  062701  000020             ADD     #HC.CPK,R1
172 075074  010402                     MOV     R4,R2
173 075076  062702  000020             ADD     #HC.MPK,R2
174 075102  012703  000014             MOV     #12.,R3
175
176 075106                      PNTPKL:
    075106  011246                     MOV     (R2),-(SP)          ;PUSH (R2) ON STACK
    075110  016246  000002             MOV     2(R2),-(SP)         ;PUSH 2(R2) ON STACK
    075114  011146                     MOV     (R1),-(SP)          ;PUSH (R1) ON STACK
    075116  016146  000002             MOV     2(R1),-(SP)         ;PUSH 2(R1) ON STACK
    075122  004137  075674             JSR     R1,LPNTB            ;CALL   LPNTB PRINT ROUTINE
    075126  074135                     .WORD   XPKT2               ;ADDRESS OF ASCIZ STRING
    075130  000010                     .WORD   ARG.CT              ;ARGUMENT COUNT * 2
177 075132  062701  000004             ADD     #4,R1
178 075136  062702  000004             ADD     #4,R2
179 075142  005303                     DEC     R3
180 075144  001360                     BNE     PNTPKL
181 075146  000207                     RETURN
182
183 075150                      MSGPKT:
    075150  004137  075674             JSR     R1,LPNTB            ;CALL   LPNTB PRINT ROUTINE
    075154  073543                     .WORD   XMSG1               ;ADDRESS OF ASCIZ STRING
    075156  000000                     .WORD   ARG.CT              ;ARGUMENT COUNT * 2
184 075160  016504  000016             MOV     C.HCOM(R5),R4
185 075164  062704  000206             ADD     #HC.BF2,R4
186 075170  012703  000005             MOV     #5,R3
187 075174                      MSGPKL:
    075174  016446  000014             MOV     12.(R4),-(SP)       ;PUSH 12.(R4) ON STACK
    075200  016446  000012             MOV     10.(R4),-(SP)       ;PUSH 10.(R4) ON STACK
    075204  016446  000010             MOV     8.(R4),-(SP)        ;PUSH 8.(R4) ON STACK
    075210  016446  000006             MOV     6(R4),-(SP)         ;PUSH 6(R4) ON STACK
    075214  016446  000004             MOV     4(R4),-(SP)         ;PUSH 4(R4) ON STACK
    075220  016446  000002             MOV     2(R4),-(SP)         ;PUSH 2(R4) ON STACK
    075224  011446                     MOV     (R4),(SP)           ;PUSH (R4) ON STACK
    075226  004137  075674             JSR     R1,LPNTB            ;CALL   LPNTB PRINT ROUTINE
    075232  073577                     .WORD   XMSG2               ;ADDRESS OF ASCIZ STRING
    075234  000016                     .WORD   ARG.CT              ;ARGUMENT COUNT * 2
188 075236  062704  000016             ADD     #14.,R4
```

```
189 075242  005303                        DEC     R3
190 075244  001353                        BNE     MSGPKL
191 075246  000207                        RETURN
192
193 075250                          ERR.TN::
194 075250  013702  064444                MOV     TNUM,R2         ;GET TEST NUMBER
195 075254  006302                        ASL     R2              ;DOUBLE
196 075256  012703  067032                MOV     #BASL3,R3       ;GET ADDRESS OF DRIVE PRINT LINE
197 075262  005764  000004                TST     4(R4)           ;CHECK IF DRIVE NUMBER GIVEN
198 075266  100002                        BPL     1$              ;BRANCH IF SO
199 075270  012703  067047                MOV     #BAS,R3
200 075274                          1$:
    075274  016446  000004                MOV     4(R4),-(SP)     ;PUSH 4(R4) ON STACK
    075300  010346                        MOV     R3,-(SP)        ;PUSH R3 ON STACK
    075302  011546                        MOV     (R5),-(SP)      ;PUSH (R5) ON STACK
    075304  012746  067013                MOV     #BASL2,-(SP)    ;PUSH #BASL2 ON STACK
    075310  011446                        MOV     (R4),-(SP)      ;PUSH (R4) ON STACK
    075312  012746  066775                MOV     #BASL1,-(SP)    ;PUSH #BASL1 ON STACK
    075316  016246  076272                MOV     TNAMES-2(R2),-(SP)      ;PUSH TNAMES-2(R2) ON STACK
    075322  004137  075674                JSR     R1,LPNTB        ;CALL   LPNTB PRINT ROUTINE
    075326  067050                        .WORD   BASLN           ;ADDRESS OF ASCIZ STRING
    075330  000016                        .WORD   ARG.CT          ;ARGUMENT COUNT * 2
202 075332  004137  106362                CALL    RNTIME          ;GET RUNTIME PARAMETERS
203 075336  112700  000015                MOVB    #CR,R0          ;STORE #CR IN R0 AND
    075342  004737  075506                JSR     PC,PRINTC       ;PRINT THE CHARACTER.
204 075346  062704  000006                ADD     #6,R4           ;INCREASE R4 TO POINT TO MESSAGE POINTER
205 075352  012402                        MOV     (R4)+,R2        ;GET MESSAGE POINTER
206 075354  006302                        ASL     R2              ;DOUBLE TO MAKE BYTE OFFSET
207 075356  063702  064432                ADD     DMPROG,R2       ;ADD TO START OF MESSAGE STRINGS
208 075362  067702  167044                ADD     $DMPROG,R2      ;ADD SIZE OF MAIN PROGRAM
209 075366  105712                        TSTB    (R2)            ;CHECK FIRST BYTE
210 075370  001001                        BNE     NCON            ;IF ZERO
211 075372  005202                        INC     R2              ;  INCREMENT TO NEXT BYTE
212 075374  012737  075612  075770  NCON: MOV     #PX,PTYPE       ;CHANGE TO EXTENDED OUTPUT
213 075402  004737  075772                CALL    OSTRNG          ;OUTPUT ACCORDING TO STRING
214 075406                          L10035:
    075406  104423                        TRAP    C$MSG
215
```

```
                        .SBTTL  GLOBAL SUBROUTINES SECTION

                        ;MEMORY ALLOCATION ERROR
                        ;
                        ;THIS ROUTINE PRINTS A SYSTEM FATAL ERROR AND EXITS THE TEST

075410                  FMERR:
075410  104454                  TRAP    C$ERSF
075412  000004                  .WORD   4
075414  000000                  .WORD   0
075416  074324                  .WORD   ERR004
                                                        ;DO CLEAN-UP TRAP
075420  104444                  TRAP    C$DCLN
```

```
 1
 2                                      ;ALOCM
 3                                      ;
 4                                      ;ALLOCATE A BLOCK OF FREE MEMORY.  REPORT ERROR IF MEMORY EXHAUSTED.
 5                                      ;
 6                                      ;INPUTS:
 7                                      ;       R1 - NUMBER OF WORDS TO ALLOCATE
 8                                      ;       FFREE - FIRST FREE WORD IN MEMORY
 9                                      ;       FSIZE - SIZE OF FREE MEMORY AVAILABLE IN WORDS
10                                      ;OUTPUTS:
11                                      ;       R1 - ADDRESS OF FIRST WORD OF ALLOCATED MEMORY
12                                      ;       FFREE - NEW FIRST FREE WORD IN MEMORY
13                                      ;       FSIZE - SIZE OF FREE MEMORY LEFT AFTER ALLOCATION
14                                      ;SYSTEM FATAL ERROR WILL BE REPORTED IF NOT ENOUGH MEMORY AVAILABLE
15                                      ;AND ENTIRE PROGRAM WILL BE STOPPED.
16
17 075422                               ALOCM:
   075422  013746  064412                       MOV     FFREE,-(SP)             ;;PUSH FFREE ON STACK
18 075426  160137  064414                       SUB     R1,FSIZE                ;REDUCE SIZE OF FREE MEMORY
19 075432  002766                               BLT     FMERR                   ;REPORT ERROR IF NOT ENOUGH MEMORY
20 075434  060101                               ADD     R1,R1                   ;CHANGE WORDS TO BYTES
21 075436  060137  064412                       ADD     R1,FFREE                ;CALCULATE NEW START OF FREE MEMORY
22 075442  012601                               MOV     (SP)+,R1                ;;POP STACK INTO R1
23 075444  000207                               RTS     PC
```

```
                                ;HCOMM
                                ;
                                ;ALLOCATES MEMORY FOR HOST COMMUNICATION AREA AND PACKET BUFFERS WITH ONE
                                ;DESCRIPTOR IN EACH RING.  TO BE CALLED AFTER INITIALIZING
                                ;A CONTROLLER WITH SA.MSG=0 AND SA.CMD=0.
                                ;
                                ;INPUTS:
                                ;       R5 - ADDRESS OF CONTROLLER TABLE
                                ;OUTPUTS:
                                ;       CONTROLLER TABLE POINTING TO HOST COMMUNICATION AREA,
                                ;       RING POINTERS TO PACKETS,
                                ;       R4 - ADDRESS OF HOST COMMUNICATION AREA

075446  012701  000146          HCOMM:  MOV     #<HC.SIZ>/2,R1          ;GET SIZE OF AREA TO ALLOCATE
075452  004737  075422                  JSR     PC,ALOCM                ;ALLOCATE THE MEMORY
075456  010104                          MOV     R1,R4                   ;GET ADDRESS OF HOST COMM AREA
075460  010465  000016                  MOV     R4,C.HCOM(R5)           ;PLACE BEGINNING ADRS OF HOST COMM AREA IN THE
                                                                        ;CONTROLLER TABLE
075464  062701  000020                  ADD     #HC.MPK,R1              ;COMPUTE START OF MESSAGE PACKET
075470  010164  000004                  MOV     R1,HC.MSG(R4)           ;PLACE IN RING
075474  062701  000000                  ADD     #<HC.CPK-HC.MPK>,R1     ;COMPUTE START OF COMMAND PACKET
075500  010164  000010                  MOV     R1,HC.CMD(R4)           ;PLACE IN RING
075504  000207                          RTS     PC
```

```
 1
 2                                      ;PRINTC
 3                                      ;
 4                                      ;PRINT A CHARACTER
 5                                      ;
 6                                      ;CALL WITH MACRO PRINT
 7
 8 075506  110037  075662      PRINTC: MOVB    R0,TTYOUT           ;SAVE CHARACTER FOR TTY OUTPUT
 9 075512  010146                      MOV     R1,-(SP)            ;;PUSH R1 ON STACK
10 075514  012701  065037              MOV     #FRMTT,R1           ;PICKUP FORMATTED ASCIZ STRING STATEMENT
11 075520  120027  000015              CMPB    R0,#CR              ;IF NOT A CARRIAGE RETURN, THEN
12 075524  001002                      BNE     1$                  ;PRINT SOME OTHER CHARACTER, ELSE
13 075526  012701  065042              MOV     #CRLF,R1            ;PICKUP FORMATTED ASCIZ STRING STATEMENT
14                                                                 ;GO PRINT CR-LF.
15 075532  004777  000232      1$:     JSR     PC,@PTYPE           ;PRINT THE ASCIZ STRING.
16 075536  012601                      MOV     (SP)+,R1            ;;POP STACK INTO R1
17 075540  000207                      RTS     PC
18 075542                      PF:
   075542  012746  075662              MOV     #TTYOUT,-(SP)
   075546  010146                      MOV     R1,-(SP)
   075550  012746  000002              MOV     #2,-(SP)
   075554  010600                      MOV     SP,R0
   075556  104417                      TRAP    C$PNTF
   075560  062706  000006              ADD     #6,SP
19 075564  000207                      RTS     PC
20 075566                      PB:
   075566  012746  075662              MOV     #TTYOUT,-(SP)
   075572  010146                      MOV     R1,-(SP)
   075574  012746  000002              MOV     #2,-(SP)
   075600  010600                      MOV     SP,R0
   075602  104414                      TRAP    C$PNTB
   075604  062706  000006              ADD     #6,SP
21 075610  000207                      RTS     PC
22 075612                      PX:
   075612  012746  075662              MOV     #TTYOUT,-(SP)
   075616  010146                      MOV     R1,-(SP)
   075620  012746  000002              MOV     #2,-(SP)
   075624  010600                      MOV     SP,R0
   075626  104415                      TRAP    C$PNTX
   075630  062706  000006              ADD     #6,SP
23 075634  000207                      RTS     PC
24 075636                      PS:
   075636  012746  075662              MOV     #TTYOUT,-(SP)
   075642  010146                      MOV     R1,-(SP)
   075644  012746  000002              MOV     #2,-(SP)
   075650  010600                      MOV     SP,R0
   075652  104416                      TRAP    C$PNTS
   075654  062706  000006              ADD     #6,SP
25 075660  000207                      RTS     PC
26
27 075662     000      TTYOUT: .BYTE   0                           ;TTY OUTPUT BUFFER
28 075663     000              .BYTE   0                           ;TERMINATOR FOR ASCIZ STRING
29                             .EVEN
```

```
 1
 2                                      ;PRINT FORMATTED MESSAGE
 3                                      ;
 4                                      ;CALL WITH MACRO PNT, PNTF, PNTB, PNTX, OR PNTS
 5
 6 075664  012737  075542  075770 LPNTF:  MOV     #PF,PTYPE
 7 075672  000413                       BR      LPNT
 8
 9 075674  012737  075566  075770 LPNTB:  MOV     #PB,PTYPE
10 075702  000407                       BR      LPNT
11
12 075704  012737  075612  075770 LPNTX:  MOV     #PX,PTYPE
13 075712  000403                       BR      LPNT
14
15 075714  012737  075636  075770 LPNTS:  MOV     #PS,PTYPE
16
17 075722                         LPNT:
   075722  010246                       MOV     R2,-(SP)        ;;PUSH R2 ON STACK
   075724  010346                       MOV     R3,-(SP)        ;;PUSH R3 ON STACK
   075726  010446                       MOV     R4,-(SP)        ;;PUSH R4 ON STACK
   075730  010546                       MOV     R5,-(SP)        ;;PUSH R5 ON STACK
18 075732  012102                       MOV     (R1)+,R2        ;GET ADDRESS OF ASCIZ STRING
19 075734  010604                       MOV     SP,R4           ;COMPUTE ADDRESS OF 1ST ARGUMENT AND
20 075736  062704  000012               ADD     #12,R4          ;SAVE IT IN R4.
21 075742  010146                       MOV     R1,-(SP)        ;;PUSH R1 ON STACK
22 075744  004737  075772               JSR     PC,OSTRNG       ;PRINT THE FORMATTED MESSAGE
23 075750  012600                       MOV     (SP)+,R0        ;;POP STACK INTO R0
   075752  012605                       MOV     (SP)+,R5        ;;POP STACK INTO R5
   075754  012604                       MOV     (SP)+,R4        ;;POP STACK INTO R4
   075756  012603                       MOV     (SP)+,R3        ;;POP STACK INTO R3
   075760  012602                       MOV     (SP)+,R2        ;;POP STACK INTO R2
   075762  012601                       MOV     (SP)+,R1        ;;POP STACK INTO R1
24 075764  062006                       ADD     (R0)+,SP        ;ADJUST STACK POINTER OVER ARGUMENTS
25 075766  000110                       JMP     @R0             ;RETURN
26
27 075770  075542                 PTYPE:  .WORD   PF              ;PRINT TYPE
```

J12


```
                                ;OSTRNG
                                ;
                                ;OUTPUT A MESSAGE ACCORDING TO A FORMAT STRING
                                ;FORMAT OF THE ASCIZ STRING IS AS FOLLOWS:
                                ;
                                ;CHARACTERS ENCLOSED IN QUOTES ARE TO BE PRINTED AS THEY ARE.
                                ;
                                ;OTHERWISE CODE IS A SINGLE LETTER FOLLOWED BY AN OPTIONAL DECIMAL
                                ;NUMBER:
                                ;   On - PRINT OCTAL NUMBER. n REPRESENTS SIZE OF BINARY NUMBER PASSED
                                ;        IN PARAMETER IN BITS. MAY BE IN RANGE 1 TO 32. IF n>16, TWO PARAMETER
                                ;        WORDS ARE USED, OTHERWISE ONLY ONE WORD. LEADING ZEROS ARE PRINTED.
                                ;        n IS ALWAYS SPECIFIED.
                                ;   Dn - PRINT UNSIGNED DECIMAL NUMBER FROM n BIT PARAMETER. LEADING ZEROS
                                ;        ARE NOT PRINTED. A 16 BIT NUMBER EQUAL TO ZERO WILL PRINT "0".
                                ;   Hn - PRINT HEX NUMBER FROM PARAMETER OF n BITS. IF n>16 TWO PARAMETERS
                                ;        ARE USED, OTHERWISE ONLY ONE PARAMETER. LEADING ZEROS ARE PRINTED.
                                ;   Sn - PRINT n SPACES. n ASSUMED TO BE 1.
                                ;   Nn - START NEW LINE (CR-LF SEQUENCE). n ASSUMED TO BE 1.
                                ;   An - PRINT N ASCII CHARACTERS FROM PARAMETERS, n ASSUMED TO BE 1.
                                ;        n/2 PARAMETER WORDS USED.
                                ;   Rn - EXECUTE ROUTINE #n. n MUST BE GIVEN AND DEFINED IN HOST PROGRAM.
                                ;
                                ;A NULL CHARACTER MEANS END OF MESSAGE. A NULL AS FIRST CHARACTER IN STRING
                                ;MUST BE IGNORED.
                                ;
                                ;INPUTS:
                                ;       R2 - ADDRESS OF START OF FORMAT STRING
                                ;       R4 - ADDRESS OF PARAMETERS
                                ;OUTPUTS:
                                ;       R2 AND R4 UPDATED TO END OF STRING AND PARAMETERS

075772  112201                  OSTRNG: MOVB    (R2)+,R1                ;SEE IF TERMINATOR IN ASCIZ STRING,
075774  001421                          BEQ     OSTRE                   ;EXIT
075776  012700  076304                  MOV     #ERRC,R0                ;GET POINTER TO CHARACTER TABLE
076002  120110                  NCONS:  CMPB    R1,(R0)                 ;COMPARE CHARACTER WITH TABLE ENTRY
076004  001407                          BEQ     NCONF                   ;BRANCH IF MATCH FOUND
076006  105720                          TSTB    (R0)+                   ;INCREMENT POINTER
076010  001374                          BNE     NCONS                   ;CONTINUE SEARCH IF NOT END OF TABLE
076012  004137  075664                  JSR     R1,LPNTF                ;CALL   LPNTF PRINT ROUTINE
076016  065101                          .WORD   ERRME1                  ;ADDRESS OF ASCIZ STRING
076020  000000                          .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
076022  000406                          BR      OSTRE
076024  162700  076304          NCONF:  SUB     #ERRC,R0                ;GET INCREMENT INTO TABLE
076030  006300                          ASL     R0                      ;DOUBLE TO WORD COUNT
076032  004770  076316                  JSR     PC,@ERRD(R0)            ;DISPATCH TO PRINT ROUTINE
076036  000755                          BR      OSTRNG                  ;GET NEXT
076040  000207                  OSTRE:  RTS     PC
```

```
 1
 2                                          ;CONTROL CHARACTER WAS A QUOTE, SO  PRINT ALL CHARACTERS TO
 3                                          ;THE NEXT QUOTE.
 4
 5 076042  112200                 CON.QU:  MOVB    (R2)+,R0              ;GET CHARACTER
 6 076044  120027  000042                  CMPB    R0,#'"                ;CHECK IF ENDING QUOTE
 7 076050  001403                          BEQ     CON.QX                ;IF SO, GO GET NEXT CONTROL CHARACTER
 8 076052  004737  075506                  JSR     PC,PRINTC             ;PRINT THE CHARACTER.
 9 076056  000771                          BR      CON.QU                ;CONTINUE PRINTING
10 076060  000207                 CON.QX:  RTS     PC
11
12                                          ;CONTROL CHARACTER WAS AN 'A', SO PRINT ASCII CHARACTERS FROM
13                                          ;PARAMETERS.
14
15 076062  004737  102364         CON.A:   JSR     PC,GETCNT             ;GET COUNT OF CHARACTERS
16 076066                         CON.A1:
   076066  112400                          MOVB    (R4)+,R0                      ;STORE (R4)+ IN R0 AND
   076070  004737  075506                  JSR     PC,PRINTC             ;PRINT THE CHARACTER.
17 076074  005301                          DEC     R1                    ;COUNT THE CHARACTERS
18 076076  001373                          BNE     CON.A1                ;PRINT UNTIL COUNT REACHES ZERO
19 076100  032704  000001                  BIT     #1,R4                 ;CHECK IF R4 NOW ODD
20 076104  001401                          BEQ     CON.A2
21 076106  005204                          INC     R4                    ;IF SO, INCREMENT TO NEXT EVEN ADDRESS
22 076110  000207                 CON.A2:  RTS     PC                    ;NOW GET NEXT CONTROL CHARACTER
23
24                                          ;CONTROL CHARACTER WAS A 'D', SO PRINT A DECIMAL NUMBER.
25
26 076112  012701  000012         CON.D:   MOV     #10.,R1               ;LOAD RADIX
27 076116  004737  102442                  JSR     PC,PNTNUM             ;PRINT NUMBER
28 076122  000207                          RTS     PC                    ;NOW GET NEXT CONTROL CHARACTER
29
30                                          ;CONTROL CHARACTER WAS AN 'H', SO PRINT A HEX NUMBER.
31
32 076124  012701  000020         CON.H:   MOV     #16.,R1               ;LOAD RADIX
33 076130  004737  102442                  JSR     PC,PNTNUM             ;PRINT NUMBER
34 076134  000207                          RTS     PC                    ;NOW GET NEXT CONTROL CHARACTER
```

```
 1
 2                                          ;CONTROL CHARACTER WAS AN 'O', SO PRINT AN OCTAL NUMBER.
 3
 4 076136  012701  000010      CON.O:  MOV     #8.,R1                  ;LOAD RADIX
 5 076142  004737  102442              JSR     PC,PNTNUM               ;PRINT NUMBER
 6 076146  000207                      RTS     PC                      ;NOW GET NEXT CONTROL CHARACTER
 7
 8                                          ;CONTROL CHARACTER WAS AN 'N', SO PRINT A CARRIAGE RETURN-LINE FEED.
 9
10 076150  004737  102364      CON.N:  JSR     PC,GETCNT               ;GET COUNT
11 076154                      CON.N1:
   076154  112700  000015              MOVB    #CR,R0                  ;STORE #CR IN R0 AND
   076160  004737  075506              JSR     PC,PRINTC               ;PRINT THE CHARACTER.
12 076164  005301                      DEC     R1                      ;COUNT THE SEQUENCES
13 076166  001372                      BNE     CON.N1
14 076170  000207                      RTS     PC                      ;NOW GET NEXT CONTROL CHARACTER
15
16                                          ;CONTROL CHARACTER WAS AN 'R', SO CALL ONE OF THE PRE-PROGRAMMED
17                                          ;ROUTINE.
18
19 076172  004737  102364      CON.R:  JSR     PC,GETCNT               ;GET ROUTINE NUMBER
20 076176  020127  000011              CMP     R1,#ERR.SZ              ;CHECK IF DEFINED ROUTINE NUMBER
21 076202  101004                      BHI     CON.R1
22 076204  060101                      ADD     P1,R1                   ;DOUBLE COUNT TO GET WORD INDEX
23 076206  004771  076250              JSR     PC,@ERR.TB-2(R1)        ;CALL ROUTINE
24 076212  000207                      RTS     PC                      ;NOW GET NEXT CONTROL CHARACTER
25
26 076214                      CON.R1:
   076214  004137  075664              JSR     R1,LPNTF                ;CALL   LPNTF PRINT ROUTINE
   076220  065101                      .WORD   ERRME1                  ;ADDRESS OF ASCIZ STRING
   076222  000000                      .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
27 076224  012601                      MOV     (SP)+,R1                ;;POP STACK INTO R1
28 076226  000207                      RTS     PC
29
30                                          ;CONTROL CHARACTER WAS AN 'S', SO PRINT SOME NUMBER OF SPACES.
31
32 076230  004737  102364      CON.S:  JSR     PC,GETCNT               ;GET COUNT
33 076234                      CON.S1:
   076234  112700  000040              MOVB    #' ,R0                  ;STORE #'  IN R0 AND
   076240  004737  075506              JSR     PC,PRINTC               ;PRINT THE CHARACTER.
34 076244  005301                      DEC     R1                      ;COUNT THE SPACES
35 076246  001372                      BNE     CON.S1
36 076250  000207                      RTS     PC                      ;NOW GET NEXT CONTROL CHARACTER
```

```
 1
 2                                        ;PRE-PROGRAMMED ERROR ROUTINE DISPATCH TABLE
 3
 4 076252  101726                        ERR.TB: .WORD CALR1                    ;CALL ALTERNATE PRINT STRING IN DM MEMORY IMAGE
 5 076254  101754                                .WORD CALR2                    ;PRINT AN SDI DIAGNOSE RESPONSE
 6 076256  102052                                .WORD CALR3                    ;DECIDE WHETHER TO PRINT RBN
 7 076260  102066                                .WORD CALR4                    ;PRINT BASIC LINE WITHOUT UDA ADDRESS
 8 076262  102142                                .WORD CALR5                    ;PRINT BASIC LINE WITH UDA ADDRESS
 9 076264  102220                                .WORD CALR6                    ;CALL ALTERNATE PRINT STRING IN PDP-11 MEMORY
10 076266  102234                                .WORD CALR7                    ;PRINT  "REPLACE UDA MODULE M7161"
11 076270  102252                                .WORD CALR8                    ;PRINT  "  UDASA CONTAINS  XXXXXX"
12 076272  102270                                .WORD CALR9                    ;REPRINT LAST NUMBER
13
14         000011                        ERR.SZ  = <.-ERR.TB>/2
15
16 076274                               TNAMES:
18 076274  066670                                .WORD BASN1
19 076276  066714                                .WORD BASN2
20 076300  066734                                .WORD BASN3
23 076302  066754                                .WORD BASN4
25
```

```
                                ;BUILD TWO TABLES
                                ;       FIRST CONTAINING CONTROL CHARACTERS
                                ;       SECOND CONTAINING ROUTINE ADDRESSES

                                ;HERE IS FIRST TABLE

 076304                         ERRC:
 076304  042                            .BYTE   '"
 076305  101                            .BYTE   'A
 076306  104                            .BYTE   'D
 076307  110                            .BYTE   'H
 076310  117                            .BYTE   'O
 076311  116                            .BYTE   'N
 076312  122                            .BYTE   'R
 076313  123                            .BYTE   'S
 076314  000                            .BYTE   0                       ;FOLLOW WITH A NULL BYTE
                                        .EVEN

                                ;HERE IS SECOND TABLE

 076316                         ERRD:
 076316  076042                        .WORD   CON.QU
 076320  076062                        .WORD   CON.A
 076322  076112                        .WORD   CON.D
 076324  076124                        .WORD   CON.H
 076326  076136                        .WORD   CON.O
 076330  076150                        .WORD   CON.N
 076332  076172                        .WORD   CON.R
 076334  076230                        .WORD   CON.S
```

```
 1
 2                                      ;TINIT
 3                                      ;
 4                                      ;INITIALIZE VARIABLES FOR TEST
 5                                      ;
 6                                      ;INPUTS:
 7                                      ;       R1 - TEST NUMBER
 8                                      ;OUTPUTS:
 9                                      ;       LBUFS - CLEARED (DELETES ERROR LOG)
10                                      ;       TNUM - TEST NUMBER FROM R1
11                                      ;       FNUM - LAST LOADED TEST IN TNUM < 4
12                                      ;       ALL REGISTERS CLOBERED
13
14 076336  010137  064444              TINIT:  MOV     R1,TNUM                 ;SAVE TEST NUMBER
15 076342  004737  106260                      CALL    RESET                   ;RESET ALL UDA'S
16 076346  005037  064650                      CLR     LBUFS                   ;CLEAR ERROR LOG BUFFER POINTER
17 076352  013737  064416  064412              MOV     FMEM,FFREE              ;INIT FREE
18 076360  013737  064420  064414              MOV     FMEMS,FSIZE             ;INIT FSIZE
20 076366  022701  000004                      CMP     #4,R1                   ;ARE WE DOING TEST 4 ?
21 076372  001413                              BEQ     TIEXIT                  ; IF SO, EXIT
22 076374  020137  064442                      CMP     R1,FNUM                 ; IF FILE ALREADY IN MEMORY?
23 076400  001410                              BEQ     TIEXIT                  ; IF SO, EXIT
24 076402  012705  001122                      MOV     #<STORAG-DMFRST>,R5     ; R5->ADDRESS TO STORE - DM FIRST ADDRESS
25 076406  012737  002122  064432              MOV     #STORAG,DMPROG          ; SAVE DMPROG ADDRESS
26 076414  004737  105630                      CALL    RDREC                   ; READ IN RECORD
27 076420  103401                              BCS     TINITE                  ; IF ERROR, REPORT
28 076422  000207                      TIEXIT: RETURN
29
30 076424                              TINITE:
   076424  104454                              TRAP    C$ERSF
   076426  000007                              .WORD   7
   076430  000000                              .WORD   0
   076432  074350                              .WORD   ERR007
31
32 076434  104444                              TRAP    C$DCLN                  ;DO CLEAN-UP TRAP
41
```

```
                                ;RNT4DM
                                ;
                                ;LOAD AND RUN A TEST 4 IN THE CONTROLLERS, RETURN WHEN ALL
                                ;DM PROGRAMS HAVE TERMINATED.
                                ;
                                ;INPUTS:
                                ;       TSTTAB - POINTER TO FIRST CONTROLLER TABLE
                                ;       R1 - NUMBER OF CONTROLLERS TO TEST
                                ;OUTPUTS:
                                ;       DMPROG - POINTER TO START OF DM PROGRAM IN MEMORY
                                ;       Z SET IF NO CONTROLLERS SUCCESSFULLY STARTED
                                ;ALL REGISTERS ARE USED AND PREVIOUS CONTENTS DESTROYED.
                                
076436  005037  064450        RNT4DM: CLR     URNING
076442  005037  064532                CLR     TYPCNT                  ; CLEAR FLAGS
076446  010137  064446                MOV     R1,URUN                 ; URUN = # OF UNITS
076452  012737  002122  064432        MOV     #STORAG,DMPROG          ; DMPROG -> WHERE EITHER TEST 4 IS LOADED
076460  013737  064446  064452        MOV     URUN,UCNT
076466  013705  064430                MOV     TSTTAB,R5               ; R5 -> CONTROLLER TABLE
076472  004737  076500                CALL    GTT452                  ; GET TEST 4 FOR U52
076476  000421                        BR      STLDDM                  ; GO START LOADING DM PROGRAMS
```

```
 1
 2                                        ;GTT452
 3                                        ;
 4                                        ;GET TEST 4 FOR UDA52
 5                                        ;
 6 076500  0127    000005        GTT452: MOV     #5.,R1                  ; R1 = T4 FOR 52 FNUM
 7 076504  0127(   001122                MOV     #<STORAG-DMFRST>,R5
 8 076510  02013   064442                CMP     R1,FNUM                 ; DMPROG ALREADY IN MEMORY?
 9 076514  00140(                        BEQ     1$                      ; IF SO, EXIT
10 076516  00473(  105630                CALL    RDREC                   ; ELSE, READ RECORD.
11 076522  103002                       BCC     1$
12 076524  000137  076424                JMP     TINITE                  ; BRANCH IF ERROR
13 076530  000207                 1$:   RETURN
```

```
 1
 2                                      ;RUNDM
 3                                      ;
 4                                      ;LOAD AND RUN A DM PROGRAM IN THE CONTROLLERS. RETURN WHEN ALL
 5                                      ;DM PROGRAMS HAVE TERMINATED.
 6                                      ;
 7                                      ;INPUTS:
 8                                      ;       TSTTAB - POINTER TO FIRST CONTROLLER TABLE
 9                                      ;       R1 - NUMBER OF CONTROLLERS TO TEST
10                                      ;IMPLICIT INPUTS:
11                                      ;       DMPRCG - POINTER TO START OF DM PROGRAM IN MEMORY
12                                      ;OUTPUTS:
13                                      ;       Z SET IF NO CONTROLLERS SUCCESSFULLY STARTED
14                                      ;ALL REGISTERS ARE USED AND PREVIOUS CONTENTS DESTROYED.
15
16 076532  010137  064446          RUNDM:  MOV     R1,URUN                 ;SAVE NUMBER OF UNITS TO RUN
17 076536  005037  064450                  CLR     URNING                  ;CLEAR NUMBER OF UNITS RUNNING
18
19                                      ;LOAD DM PROGRAM INTO EACH CONTROLLER
20
21 076542  013737  064446  064452  STLDDM: MOV     URUN,UCNT                       ;SET COUNTER OF UNITS
22 076550  013705  064430                  MOV     TSTTAB,R5                       ;GET FIRST CONTROLLER TABLE
23 076554                          LDDM:
27 076554  005065  000014                  CLR     C.FLG(R5)               ;CLEAR ALL FLAGS
29 076560  116537  000002  002074          MOVB    C.UNIT(R5),L$LUN                ;SEE IF UNIT TO BE TESTED
30 076566  005765  000002                  TST     C.UNIT(R5)
31 076572  100405                          BMI     LDNEXT                  ;IF NOT, DON'T LOAD THIS UNIT
33 076574  004737  103410                  CALL    LOADDM                  ;LOAD THE DM PROGRAM
34 076600  001402                          BEQ     LDNEXT                  ;IF ERROR, GO TO NEXT CONTROLLER
35 076602  005237  064450                  INC     URNING                  ;IF NO ERROR, COUNT UNIT RUNNING
36 076606  062705  000046          LDNEXT: ADD     #C.SIZE,R5                      ;MOVE TO NEXT CONTROLLER TABLE
37 076612  005337  064452                  DEC     UCNT                    ;CHECK IF MORE CONTROLLERS
38 076616  001356                          BNE     LDDM                    ;LOAD NEXT
39
40                                      ;CHECK IF ANY CONTROLLERS LOADED
41
42 076620  005737  064450                  TST     URNING                  ;ANY UNITS LOADED?
43
44                                      ;THE DM PROGRAMS ARE NOW IN CONTROL
45                                      ;RESPDM MUST BE CALLED TO RESPOND TO THEIR REQUESTS
46
47 076624  000207                          RETURN
```

```
 1
 2                                        ;RESPDM
 3                                        ;
 4                                        ;RESPOND TO DM REQUESTS. RETURN WHEN ALL DM PROGRAMS
 5                                        ;HAVE TERMINATED.
 6
 7 076626  013705  064430           RESPDM: MOV     TSTTAB,R5               ;GET CONTROLLER TABLE ADDRESS
 8 076632  013737  064446  064452           MOV     URUN,UCNT               ;SET COUNTER OF UNITS
 9 076640  016504  000016           RESPCT: MOV     C.HCOM(R5),R4   ;GET HOST COMM AREA ADDRESS
10 076644  032765  000002  000014           BIT     #CT.RN,C.FLG(R5)        ;CHECK IF PROGRAM RUNNING
11 076652  001446                          BEQ     RSPNXT          ;IF NOT, LOOK AT NEXT
12 076654  116537  000002  002074          MOVB    C.UNIT(R5),L$LUN        ;STORE UNIT NUMBER UNDER TEST
13 076662  032765  000010  000014          BIT     #CT.MSG,C.FLG(R5)       ;SEE IF INTERRUPT RECEIVED
14 076670  001071                          BNE     RSPIN           ;IF SO, LOOK AT PACKET
15 076672  032765  000004  000014          BIT     #CT.CMD,C.FLG(R5)       ;SEE IF COMMAND HAS BEEN SENT
16 076700  001520                          BEQ     RSPOU           ;IF NOT, SEND ONE
17
18                                       ;CHECK IF UDA STILL RUNNING
19
20 076702  011503                          MOV     (R5),R3         ;GET ADDRESS OF UDAIP
21 076704  016301  000002                  MOV     2(R3),R1                ;LOOK AT UDASA REGISTER
22 076710  001405                          BEQ     RSPTM           ;IF ZERO, UDA STILL RUNNING
23                                                                 ;REPORT UDA HAS FATAL ERROR
24 076712  104455                          TRAP    C$ERDF
   076714  000036                          .WORD   30
   076716  000000                          .WORD   0
   076720  074720                          .WORD   ERR03C
25 076722  000445                          BR      RSPDRP          ;DROP CONTROLLER FROM TESTING
26
27                                       ;CHECK FOR TIMEOUT OF RESPONSE
28
29 076724                          RSPTM:
39 076724  005737  064616                  TST     KW.CSR          ;SEE IF A CLOCK ON SYSTEM
40 076730  001416                          BEQ     RSPNTO          ;DON'T TIME IF NO CLOCK
41 076732  023765  064630  000042          CMP     KW.EL+2,C.TOH(R5)       ;COMPARE TO TIMEOUT COUNTER
42 076740  101005                          BHI RSPTMO
43 076742  001011                          BNE     RSPNTO
44 076744  023765  064626  000040          CMP     KW.EL,C.TO(R5)
45 076752  103405                          BLO RSPNTO              ;IF TOO MUCH TIME ELAPSED SINCE LAST INTERRUPT
46 076754                          RSPTMO:
   076754  104455                          TRAP    C$ERDF
   076756  000037                          .WORD   31
   076760  000000                          .WORD   0
   076762  074734                          .WORD   ERR031
47 076764  000424                          BR      RSPDRP          ;DROP CONTROLLER FROM TESTING
48 076766                          RSPNTO:
49                                                                 ;>>>>>>>>>>BREAK BACK TO MONITOR<<<<<<<<<<
50 076766  104422                          TRAP    C$BRK
```

```
 1
 2                                        ;CHECK FOR TIME TO PRINT STATISTICAL REPORT
 3
 4 076770  005737  064616          RSPNXT: TST     KW.CSR                  ;ANY CLOCK ON SYSTEM?
 5 076774  001412                          BEQ     RSPNRP                  ;BYPASS IF NOT
 6 076776  023737  064630  064634          CMP     KW.EL+2,STIME+2         ;  A STATISTICAL REPORT
 7 077004  101005                          BHI RSPRPT
 8 077006  001005                          BNE     RSPNRP
 9 077010  023737  064626  064632          CMP     KW.EL,STIME
10 077016  103401                          BLO RSPNRP
11 077020                          RSPRPT:                                 ;PRINT A STATISTICAL REPORT
12 077020  104424                          TRAP    C$DRPT
13
14                                        ;SWITCH TO NEXT CONTROLLER
15
16 077022  062705  000046          RSPNRP: ADD     #C.SIZE,R5                      ;MOVE TO NEXT TABLE
17 077026  005337  064452                  DEC     UCNT                    ;CHECK IF MORE CONTROLLERS
18 077032  001302                          BNE     RESPCT                  ;LOOK AT NEXT CONTROLLER
19 077034  000674                          BR      RESPDM                  ;LOOK AT FIRST CONTROLLER AGAIN
20
21                                        ;REMOVE A CONTROLLER FROM TESTING
22
23 077036  042765  000012  000014  RSPDRP: BIC     #CT.RN+CT.MSG,C.FLG(R5) ;CLEAR PROGRAM RUNNING
24 077044  005337  064450                  DEC     URNING                  ;REDUCE RUNNING CONTROLLERS COUNT
25 077050  001347                          BNE     RSPNXT                  ;IF ANY STILL RUNNING, LOOK AT THEM
26 077052  000207                          RETURN                          ;ELSE RETURN TO TEST SECTION
```

```
 1
 2                                        ;CONTROLLER HAS RESPONDED, LOOK AT MESSAGE PACKET
 3
 4                                        ;CHECK FOR PROPER OPCODE IN END PACKET
 5
 6 077054  012700  000204          RSPIN:  MOV     @OP.END+OP.SSD,R0               ;GET SEND DATA END PACKET OPCODE
 7 077060  032765  000020  000014          BIT     @CT.REQ,C.FLG(R5)               ;LOOK IF SEND DATA OR RECEIVE DATA
 8 077066  001402                          BEQ     RSPMWR
 9 077070  012700  000205                  MOV     @OP.END+OP.RSD,R0               ;CHANGE TO RECEIVE DATA END PACKET OPCODE
10 077074  120064  000030          RSPMWR: CMPB    R0,HC.MPK+P.OPCD(R4)    ;COMPARE TO OPCODE IN END PACKET
11 077100  001010                          BNE     RSPERR
12
13                                        ;LOOK AT STATUS CODE
14
15 077102  032764  000037  000032          BIT     @ST.MSK,HC.MPK+P.STS(R4)        ;CHECK FOR STATUS CODE ST.SUC (ZERO)
16 077110  001004                          BNE     RSPERR
17
18                                        ;CHECK FOR EXPECTED REFERENCE NUMBER
19
20 077112  026564  000044  000020          CMP     C.REF(R5),HC.MPK+P.CRF(R4)      ;CHECK IF CORRECT REF NUMBER
21 077120  001405                          BEQ     RSPPTW
22 077122                          RSPERR:
   077122  104455                          TRAP    C$ERDF
   077124  000041                          .WORD   33
   077126  000000                          .WORD   0
   077130  074764                          .WORD   ERR033
23 077132  000741                          BR      RSPDRP                  ;DROP UNIT FROM TESTING
24
25                                        ;CHECK IF RESPONSE FROM SEND OR RECEIVE DATA COMMAND
26
27 077134  032765  000020  000014  RSPPTW: BIT     @CT.REQ,C.FLG(R5)               ;CHECK IF RESPONSE FROM DM PROGRAM
28 077142  001445                  RSPOU:  BEQ     RSPOUT                  ;LOOK AT REQUEST NUMBER IF SO
```

```
 1
 2                                        ;MAINTENANCE READ END PACKET RECEIVED, LOOK AT REQUEST FROM DM PROGRAM
 3
 4 077144  016401  000206          RSPPT2: MOV     HC.BF2(R4),R1           ;GET REQUEST NUMBER
 5 077150  042701  007777                  BIC     #007777,R1              ;CHECK TYPE
 6 077154  022701  060000                  CMP     #DU.SPC,R1              ;IS SPECIAL TYPE SET?
 7 077160  00101C                          BNE     1$                      ;IF NOT, ERROR
 8 077162  042764  170000  000206          BIC     #^C007777,HC.BF2(R4)    ;CLEAR TYPE
 9 077170  016401  000206                  MOV     HC.BF2(R4),R1           ;GET REQUEST NUMBER
10 077174  020127  000017                  CMP     R1,#DSPSIZ              ;CHECK IF IN EXPECTED RANGE
11 077200  103405                          BLO RSPPT3
12 077202                          1$:
   077202  104455                          TRAP    C$ERDF
   077204  000040                          .WORD   32
   077206  000000                          .WORD   0
   077210  074746                          .WORD   ERR032
13 077212  000711                          BR      RSPDRP                  ;DROP UNIT FROM TESTING
14
15 077214  012700  000004          RSPPT3: MOV     #OP.SSD,R0              ;BUILD A SEND DATA COMMAND PACKET
16 077220  004737  104124                  CALL    BLDCMD                  ;  FOR ANSWER TO DM PROGRAM
17 077224  012700  000100                  MOV     #HC.BF1,R0              ;POINT TO BUFFER IN PACKET
18 077230  004737  104256                  CALL    CLRBUF                  ; AND CLEAR BUFFER
19 077234  010403                          MOV     R4,R3                   ;R3 POINTS TO COMMAND BUFFER
20 077236  062704  000106                  ADD     #HC.BSZ,R4              ;R4 POINTS TO MESSAGE BUFFER
21 077242  011401                          MOV     (R4),R1                 ;GET REQUEST NUMBER
22 077244  012423                          MOV     (R4)+,(R3)+             ;PUT REQUEST NUMBER INTO COMMAND PACKET
23 077246  060101                          ADD     R1,R1                   ;DOUBLE REQUEST NUMBER
24 077250  004771  077360                  CALL    @RSPDSP(R1)             ;CALL REQUESTED ROUTINE
25 077254  001270                          BNE     RSPDRP                  ;ROUTINE RETURNS Z CLEAR TO DROP UNIT FROM TESTING
26                                                                         ; Z SET IF COMMAND READY TO SEND TO UNIT
27
28                                       ;SEND COMMAND BACK TO UDA
29
30 077256  042765  000010  000014  RSPOUT: BIC     #CT.MSG,C.FLG(R5)       ;CLEAR MESSAGE RECEIVED FLAG
31 077264  032765  000020  000014          BIT     #CT.REQ,C.FLG(R5)       ;CHECK WHICH COMMAND TO SEND
32 077272  001014                          BNE     RSPOU2                  ;BRANCH IF RESPONSE TO REQUEST
33
34 077274  012700  000005                  MOV     #OP.RSD,R0              ;BUILD RECEIVE DATA COMMAND
35 077300  004737  104124                  CALL    BLDCMD
36 077304  012700  000206                  MOV     #HC.BF2,R0              ;POINT TO MESSAGE BUFFER
37 077310  004737  104256                  CALL    CLRBUF                  ;  AND CLEAR IT
38 077314  052765  000020  000014          BIS     #CT.REQ,C.FLG(R5)       ;SET REQUEST BIT
39 077322  000403                          BR      RSPOU3
40
41 077324  042765  000020  000014  RSPOU2: BIC     #CT.REQ,C.FLG(R5)       ;CLEAR REQUEST BIT
42 077332                          RSPOU3:
43 077332  004737  104210                  CALL    SNDCMD                  ;SEND COMMAND TO UDA
44 077336  012700  000264                  MOV     #3.*60.,R0              ;SET TIMEOUT FOR 3 MINUTES
45 077342  010501                          MOV     R5,R1
46 077344  062701  000040                  ADD     #C.TO,R1                ;PUT TIME IN CONTROLLER TABLE
47 077350  004737  104530                  CALL    SETTO
48 077354  000137  076770                  JMP     RSPNXT                  ;NOW WAIT FOR END PACKET
```

```
                                ;RESPONSE REQUEST DISPATCH TABLE

077360  077416          RSPDSP: .WORD T1MSIZ            ; 0. SET UP FREE MEMORY FOR ADDRESS TESTING
077362  077536                  .WORD T2DLL             ; 1. PROVIDE DIAGNOSTIC PROGRAM FOR DISK DRIVE
077364  077702                  .WORD T2CMD             ; 2. GET MANUAL INTERVENTION COMMAND
077366  100352                  .WORD T4MPRM            ; 3. TELL DATA PATTERN 16.
077370  100374                  .WORD T4UPRM            ; 4. TELL UNIT PARAMETERS, CLEAR CONTENTS
077372  100654                  .WORD T4BB1             ; 5. TELL BAD BLOCKS (FIRST 14)
077374  100704                  .WORD T4BB2             ; 6. TELL BAD BLOCKS (LAST TWO)
077376  100734                  .WORD T4SOFT            ; 7. ADD TO SOFT ERROR AND ECC COUNTS
077400  100762                  .WORD T4SEEK            ; 8. ADD 1000 TO SEEK COUNT
077402  101002                  .WORD T4MXFR            ; 9. ADD TO MEGABITS READ AND WRITE COUNTS
077404  101144                  .WORD UTOTST            ;10. TELL WHICH DRIVES TO TEST
077406  101250                  .WORD ERRMES            ;11. REPORT ERROR MESSAGE
077410  101470                  .WORD ERRMC             ;12. REPORT ERROR MESSAGE AND COUNT HARD ERROR
077412  101610                  .WORD MESSAG            ;13. PRINT A DESCRIPTIVE MESSAGE
077414  101722                  .WORD DONE              ;14. MARK DM PROGRAM AS NO LONGER RUNNING

000017                          DSPSIZ = <.-RSPDSP>/2   ;LEGAL NUMBERS ARE LOWER THAN THIS
```

```
;NORMAL MAINTENANCE READ BUFFER DESCRIPTION

;BYTE OFFSET FROM
;START OF BUFFER
;
;       0       +-------------------------------+
;               !        REQUEST NUMBER         !  USED TO SELECT ROUTINE
;               +-------------------------------+
;       2       !       DATA ARGUMENT #1        !  R4 CONTAINS THIS ADDRESS
;               +-------------------------------+
;       4       !       DATA ARGUMENT #2        !
;               +-------------------------------+
;       6       !       DATA ARGUMENT #3        !
;               +-------------------------------+
;       8       !       DATA ARGUMENT #4        !
;               +-------------------------------+
;       10      !       DATA ARGUMENT #5        !
;               +-------------------------------+
;       12      !       DATA ARGUMENT #6        !
;               +-------------------------------+
;       14      !       DATA ARGUMENT #7        !
;               +-------------------------------+
;       16      !       DATA ARGUMENT #8        !
;               +-------------------------------+
;       18      !       DATA ARGUMENT #9        !
;               +-------------------------------+
;       20      !       DATA ARGUMENT #10       !
;               +-------------------------------+
;       22      !       DATA ARGUMENT #11       !
;               +-------------------------------+
;
;        .                      .
;        .                      .
;        .                      .
;
;       68      +-------------------------------+
;               !       DATA ARGUMENT #34       !
;               +-------------------------------+
```

```
;NORMAL PSEUDO-TERMINAL IN PACKET DESCRIPTION GIVEN IN RESPONSE TO ABOVE PACKET

;BYTE OFFSET FROM
;START OF PACKET
;        0          +-------------------------------+
;                   !        REQUEST NUMBER         !  ECHOED FROM REQUEST PACKET
;                   +-------------------------------+
;        2          !       DATA ARGUMENT #1        !  R3 CONTAINS THIS ADDRESS
;                   +-------------------------------+
;        4          !       DATA ARGUMENT #2        !  ALL DATA ARGUMENTS ARE RETURNED
;                   +-------------------------------+  CONTAINING ZEROS UNLESS
;        6          !       DATA ARGUMENT #3        !  SPECIFICALLY INDICATED BY
;                   +-------------------------------+  RESPONSE ROUTINE.
;        8          !       DATA ARGUMENT #4        !
;                   +-------------------------------+
;       10          !       DATA ARGUMENT #5        !
;                   +-------------------------------+
;       12          !       DATA ARGUMENT #6        !
;                   +-------------------------------+
;       14          !       DATA ARGUMENT #7        !
;                   +-------------------------------+
;       16          !       DATA ARGUMENT #8        !
;                   +-------------------------------+
;       18          !       DATA ARGUMENT #9        !
;                   +-------------------------------+
;       20          !       DATA ARGUMENT #10       !
;                   +-------------------------------+
;       22          !       DATA ARGUMENT #11       !
;                   +-------------------------------+
;
;        .                          .
;        .                          .
;        .                          .
;
;       68          +-------------------------------+
;                   !       DATA ARGUMENT #34       !
;                   +-------------------------------+
```

```
                                ;T1MSIZ  -  DM REQUEST 0
                                ;
                                ;SET UP MEMORY FOR ADDRESS TESTING FROM UDA.
                                ;PLACE ADDRESS OF EACH LOCATION INTO EACH LOCATION IN FREE
                                ;MEMORY. RETURN FIRST LOCATION OF FREE MEMORY IN CMD.02 (LOW BITS)
                                ;AND CMD.03 (HIGH BITS). RETURN LAST LOCATION OF FREE MEMORY IN
                                ;CMD.04 AND CMD.05. ALSO RETURN FIRST EXISTANT LOCATION IN CMD.06
                                ;AND CMD.07; LAST EXISTANT LOCATION IN CMD.08 AND CMD.09.
                                ;
                                ;INPUTS:
                                ;       R5 - CONTROLLER TABLE ADDRESS
                                ;       R4 - MESSAGE PACKET DATA ADDRESS (POINTING TO MSG.02)
                                ;       R3 - COMMAND PACKET DATA ADDRESS (POINTING TO CMD.02)
                                ;OUTPUTS:
                                ;       COMMAND PACKET CONTAINING:
                                ;         (R3) LOW ADDRESS BITS OF FIRST WRITABLE ADDRESS
                                ;       2.(R3) HIGH ADDRESS BITS OF FIRST WRITABLE ADDRESS
                                ;       4.(R3) LOW ADDRESS BITS OF LAST WRITABLE ADDRESS
                                ;       6.(R3) HIGH ADDRESS BITS OF LAST WRITABLE ADDRESS
                                ;       8.(R3) LOW ADDRESS BITS OF FIRST READABLE ADDRESS
                                ;      10.(R3) HIGH ADDRESS BITS OF FIRST READABLE ADDRESS
                                ;      12.(R3) LOW ADDRESS BITS OF LAST READABLE ADDRESS
                                ;      14.(R3) HIGH ADDRESS BITS OF LAST READABLE ADDRESS
                                ;       Z SET
                                
077416                          T1MSIZ:
077416  013701  064412                  MOV     FFREE,R1                ;GET FIRST ADDRESS OF FREE MEMORY
077422  013702  064414                  MOV     FSIZE,R2                ;GET SIZE
                                
                                        ;FILL MEMORY WITH ADDRESS PATTERN
                                
077426  010111                  MEMFIL: MOV     R1,(R1)                 ;WRITE DATA INTO LOCATION
077430  062701  000002                  ADD     #2,R1                   ;INCREASE ADDRESS TO NEXT LOCATION
077434  005302                          DEC     R2                      ;COUNT THE WORDS
077436  001373                          BNE     MEMFIL                  ;FILL ALL WORDS
                                
                                        ;SEND LOCATION OF FREE MEMORY TO UDA
                                
077440  013723  064412                  MOV     FFREE,(R3)+             ;LOAD FIRST ADDRESS OF FREE MEMORY
077444  005023                          CLR     (R3)+                   ; HIGH ORDER BITS ARE ZERO
077446  013700  064414                  MOV     FSIZE,R0                ;GET SIZE OF FREE MEMORY
077452  006300                          ASL     R0                      ;CONVERT TO BYTES
077454  063700  064412                  ADD     FFREE,R0                ;COMPUTE LAST LOCATION
077460  162700  000002                  SUB     #2,R0
077464  010023                          MOV     R0,(R3)+                ;LOAD LAST LOCATION
077466  005023                          CLR     (R3)+                   ;CLEAR HIGH ORDER BITS
                                
                                        ;SEND LOCATION OF READABLE MEMORY
                                
077470  005023                          CLR     (R3)+                   ;SEND ZERO AS START OF READABLE MEMORY
077472  005023                          CLR     (R3)+
077474  013700  002120                  MOV     L$HIMEM,R0              ;GET HIGH MEMORY ADDRESS
077500  005001                          CLR     R1                      ;CLEAR HIGH BITS
077502  006300                          ASL     R0                      ;SHIFT LEFT 6 PLACES
077504  006300                          ASL     R0
077506  006300                          ASL     R0
```

N13


```
     59 077510  006300                    ASL     R0
     60 077512  006300                    ASL     R0
     61 077514  006101                    ROL     R1
     62 077516  006300                    ASL     R0
     63 077520  006101                    ROL     R1
     64 077522  052700  000076            BIS     #76,R0          ;SET LOW ORDER BITS
     65 077526  010023                    MOV     R0,(R3)+        ;PUT INTO BUFFER
     66 077530  010123                    MOV     R1,(R3)+
     68 077532  000264                    SEZ
     69 077534  000207                    RETURN
```

```
                        ;T2DLL - DM REQUEST 1
                        ;
                        ;PROVIDE DIAGNOSTIC TO DOWNLINE LOAD INTO DISK DRIVE.
                        ;
                        ;THE UDA MAY BE USED TO GET THE DIAGNOSTIC IF THE SYSTEM LOAD DEVICE
                        ;IS ON THE UDA. THIS ACTION WILL CAUSE A REINITIALIZATION OF THE UDA
                        ;AND THE RING STRUCTURE MOVED. SINCE THIS PROGRAM HAS NO WAY TO
                        ;DETERMINE IF THE UDA IS USED, IT WILL ALWAYS ASSUME IT IS USED AND
                        ;WILL INITIALIZE AND RELOAD THE DM PROGRAM AFTER READING THE
                        ;DIAGNOSTIC. THE OUTPUTS OF THIS ROUTINE ARE STORED AND SENT TO THE
                        ;DM PROGRAM IN THE UTOTST REQUEST.
                        ;
                        ;INPUTS:
                        ;       R5 - CONTROLLER TABLE ADDRESS
                        ;       R4 - MESSAGE DATA ADDRESS
                        ;          (R4) DRIVE NUMBER
                        ;        2.(R4) A VALUE THE DM PROGRAM WISHES RETURNED
                        ;        4.(R4) REGION TO WHICH PROGRAM IS TO BE LOADED IN DISK
                        ;        6.(R4) 2 WORD PROGRAM NAME IN RAD50
                        ;       R3 - COMMAND DATA ADDRESS
                        ;OUTPUTS:
                        ;       COMMAND PACKET COULD CONTAIN THE FOLLOWING:
                        ;          (R3) ONE IF PROGRAM PROVIDED, TWO IF PROGRAM NOT AVAILABLE
                        ;        2.(R3) DRIVE NUMBER
                        ;        4.(R3) COPY OF THE VALUE FROM DM PROGRAM
                        ;        6.(R3) REGION TO WHICH PROGRAM IS TO BE LOADED
                        ;        8.(R3) ADDRESS OF FIRST BYTE TO BE DOWNLINE LOADED
                        ;       10.(R3) HIGH ORDER BITS OF ADDRESS
                        ;       12.(R3) BYTE COUNT OF PROGRAM TO BE DOWNLINE LOADED
                        ;       Z SET
                        ;THIS PROGRAM WILL NOT SEND A COMMAND PACKET IN RESPONSE TO THIS REQUEST.
                        ;THE UDA WILL BE REINITIALIZED AND THE DM PROGRAM RELOADED. THEN THIS DATA
                        ;WILL BE APPENDED TO THE NEXT UTOTST REQUEST.

                        ;COPY REQUEST DATA TO STORAGE

077536                  T2DLL:
077536  005037  064656          CLR     DLL                     ;CLEAR CONTROL WORD
077542  012437  064660          MOV     (R4)+,DLLDR             ;DRIVE NUMBER
077546  012437  064662          MOV     (R4)+,DLLV              ;VALUE FROM DM
077552  012437  064664          MOV     (R4)+,DLLR              ;REGION
077556  012437  064674          MOV     (R4)+,DLLNAM            ;PROGRAM NAME
077562  012437  064676          MOV     (R4)+,DLLNAM+2          ;  (TWO WORDS)

                                ;RESET UDA AND READ DM PROGRAM

077566  005075  000000          CLR     @(R5)                   ;RESET THE UDA
077572  013737  064412  064666  MOV     FFREE,DLLADR            ;GET ADDRESS WHERE PROGRAM
077600  005037  064670          CLR     DLLADR+2                ;  TO BE STORED
077604  013737  064414  064672  MOV     FSIZE,DLLSIZ            ;SAVE CURRENT SIZE OF MEMORY
077612  004737  105570          CALL    RODLL                   ;READ DLL PROGRAM FROM DATA FILE
077616  103002                  BCC     1$                      ;PROGRAM NOT FOUND IF CARRY SET
077620  005237  064656          INC     DLL                     ;RETURN 1 IF PROGRAM FOUND
077624  005237  064656  1$:     INC     DLL                     ;RETURN 2 IF PROGRAM NOT FOUND
077630  013737  064672  064414  MOV     DLLSIZ,FSIZE            ;COMPUTE SIZE OF DLL PROGRAM
077636  013737  064412  064672  MOV     FFREE,DLLSIZ            ;  AND RESTORE ORIGINAL FFREE
```

GLOBAL SUBROUTINES SECTION

```
 59 077644  163737  064666  064672          SUB     DLLADR,DLLSIZ           ;  AND SSIZE VALUES
 60 077652  013737  064666  064412          MOV     DLLADR,FFREE
 61 077660  005726                           TST     (SP)+                   ;POP RETURN ADDRESS OFF STACK
 62 077662  012701  000001                   MOV     #1,R1                   ;RUN THE DM PROGRAM AGAIN
 63 077666  004737  076532                   CALL    RUNDM
 64 077672  001402                           BEQ     2$
 65 077674  000137  076626                   JMP     RESPDM
 66 077700  000207                  2$:      RETURN
```

```
                                ;
                                ;T2CMD - DM REQUEST 2
                                ;
                                ;GET MANUAL INTERVENTION COMMAND
                                ;
                                ;INPUTS:
                                ;       R5 - CONTROLLER TABLE ADDRESS
                                ;       R4 - MESSAGE DATA ADDRESS
                                ;          (R4) DRIVE NUMBER
                                ;           2.(R4) OPERATION CODE
                                ;                  0 ON FIRST REQUEST FOR DRIVE. ECHO OF PREVIOUS RESPONSE ALL OTHER TIMES.
                                ;          IF OPERATION CODE = 2
                                ;           4.(R4) DATA BYTE READ (TO BE PRINTED)
                                ;       R3 - COMMAND DATA ADDRESS
                                ;OUTPUTS:
                                ;       COMMAND DATA FILLED WITH THE FOLLOWING:
                                ;          (R3) OPERATION CODE
                                ;                  0 - EXIT
                                ;                  1 - WRITE
                                ;                  2 - READ
                                ;                  3 - DIAGNOSE
                                ;          IF OPERATION CODE = 1, 2 OR 3
                                ;           2.(R3) REGION NUMBER
                                ;           4.(R3) OFFSET INTO REGION
                                ;          IF OPERATION CODE = 1
                                ;           6.(R3) DATA BYTE
                                ;       Z SET IF DATA RETURNED
                                ;       Z CLEAR IF DRIVE NUMBER NOT ON THIS CONTROLLER
077702                          T2CMD:
077702  032737  000200  064400          BIT     #SM.MAN,SFPTBL+S0.BIT   ;LOOK AT MANUAL INTERVENTION MODE
077710  001002                        BNE     T2CMDM                  ;EXIT IF NOT WANTED
077712  000137  100334               JMP     T2CMDX
077716                          T2CMDM:
077716  104450                        TRAP    C$MANI
077720  103406                        BCS     T2CMD0
077722                          T2CMD9:
077722  004137  075664               JSR     R1,LPNTF                ;CALL   LPNTF PRINT ROUTINE
077726  065757                        .WORD   T2WARN                  ;ADDRESS OF ASCIZ STRING
077730  000000                        .WORD   ARG.CT                  ;ARGUMENT COUNT = 2
077732  000137  100334               JMP     T2CMDX
077736  012401                  T2CMD0: MOV     (R4)+,R1                ;GET DRIVE NUMBER
077740  012402                        MOV     (R4)+,R2                ;GET OPERATION CODE
077742  001022                        BNE     T2CMD2                  ;BRANCH IF NOT ZERO
077744  004737  102274               CALL    GTDRVT                  ;GET DRIVE TABLE ADDRESS
077750  001401                        BEQ     1$                      ;CHECK IF DRIVE FOUND
077752  000207                        RETURN                          ;RETURN WITH Z CLEAR IF NOT
                                ;
077754                          1$:
077754  011446                        MOV     (R4),-(SP)              ;PUSH (R4) ON STACK
077756  011546                        MOV     (R5),-(SP)              ;PUSH (R5) ON STACK
077760  016446  000002               MOV     D.UNIT(R4),-(SP)                ;PUSH D.UNIT(R4) ON STACK
077764  004137  075664               JSR     R1,LPNTF                ;CALL   LPNTF PRINT ROUTINE
077770  066056                        .WORD   T2CMS1                  ;ADDRESS OF ASCIZ STRING
077772  000006                        .WORD   ARG.CT                  ;ARGUMENT COUNT = 3
077774  005037  064642               CLR     T2WRR                       ;CLEAR ALL STORAGE WORDS
100000  005037  064644               CLR     T2WR0
100004  005037  064646               CLR     T2DR
```

```
49
50 100010  022702  000002          T2CMD2: CMP     #2,R2                   ;SEE IF LAST OPERATION WAS READ
51 100014  001027                          BNE     T2CMDQ                  ;BRANCH IF NOT TO QUESTION
52 100016  112700  000040                  MOVB    #' ,R0                  ;STORE #'  IN R0 AND
   100022  004737  075506                  JSR     PC,PRINTC               ;PRINT THE CHARACTER.
53 100026  013701  064642                  MOV     T2WRR,R1                ;PRINT REGION
54 100032  004737  103010                  CALL    T2PNTW
55 100036  013701  064644                  MOV     T2WRO,R1                ;PRINT OFFSET
56 100042  004737  103010                  CALL    T2PNTW
57 100046  112700  000057                  MOVB    #'/,R0                  ;STORE #'/ IN R0 AND
   100052  004737  075506                  JSR     PC,PRINTC               ;PRINT THE CHARACTER.
58 100056  012401                          MOV     (R4)+,R1                ;PRINT THE DATA
59 100060  004737  103040                  CALL    T2PNTB
60 100064  112700  000015                  MOVB    #CR,R0                  ;STORE #CR IN R0 AND
   100070  004737  075506                  JSR     PC,PRINTC               ;PRINT THE CHARACTER.
61
62                                         ;NOW ASK FOR COMMAND INPUT
63
64 100074                          T2CMDQ:
   100074  104443                          TRAP    C$GMAN
   100076  000406                          BR      10000$
   100100  064476                          .WORD   TEMP
   100102  000142                          .WORD   T$CODE
   100104  064760                          .WORD   T40PT7
   100106  177777                          .WORD   -1
   100110  000001                          .WORD   T$LOLIM
   100112  000024                          .WORD   T$HILIM
   100114                         10000$:
65 100114  012701  064476                  MOV     #TEMP,R1                ;GET POINTER TO STRING
66 100120  112100                          MOVB    (R1)+,R0                ;GET COMMAND CHARACTER
67 100122  022700  000105                  CMP     #'E,R0
68 100126  001415                          BEQ     T2CMDV
69 100130  022700  000104                  CMP     #'D,R0
70 100134  001016                          BNE     T2CMD3
71 100136  012713  000003                  MOV     #3,(R3)                 ;STORE DIAGNOSE OPERATION CODE
72 100142  004737  103122                  CALL    T2GNUM                  ;GET REGION FROM COMMAND
73 100146  001402                          BEQ     1$
74 100150  010437  064646                  MOV     R4,T2DR
75 100154  013763  064646  000002   1$:    MOV     T2DR,2(R3)
76 100162  004737  103122          T2CMDV: CALL    T2GNUM                  ;MAKE SURE AT END OF LINE
77 100166  001064                          BNE     T2CMDE
78 100170  000461                          BR      T2CMDX
79
80                                         ;COMMAND MUST BE EITHER READ OR WRITE
81
82 100172  012713  000002          T2CMD3: MOV     #2,(R3)                 ;CHECK IF READ
83 100176  022700  000122                  CMP     #'R,R0
84 100202  001415                          BEQ     T2CMDR
85 100204  022700  000127                  CMP     #'W,R0                  ;CHECK IF WRITE
86 100210  001053                          BNE     T2CMDE                  ;  IF NOT - ERROR
87 100212  012713  000001                  MOV     #1,(R3)
88 100216  004737  103122                  CALL    T2GNUM                  ;GET DATA BYTE
89 100222  001446                          BEQ     T2CMDE                  ;ERROR IF NO DATA
90 100224  162700  000002                  SUB     #2,R0
91 100230  003043                          BGT     T2CMDE                  ;OR GREATER THAN TWO DIGITS
92 100232  010463  000006                  MOV     R4,6(R3)                ;STORE DATA BYTES IN BUFFER
93 100236  013763  064642  000002  T2CMDR: MOV     T2WRR,2(R3)             ;PUT REGION AND OFFSET
```

```
 94 100244  013763  064644  000004          MOV     T2WRO,4(R3)             ;  INTO BUFFER
 95 100252  021302                           CMP     (R3),R2                 ;IF SO,
 96 100254  001002                           BNE     T2CMDN
 97 100256  005263  000004                   INC     4(R3)                   ;  INCREMENT OFFSET
 98 100262  004737  103122          T2CMDN:  CALL    T2GNUM
 99 100266  001411                           BEQ     T2CMDW
100 100270  010463  000002                   MOV     R4,2(R3)
101 100274  005063  000004                   CLR     4(R3)
102 100300  004737  103122                   CALL    T2GNUM
103 100304  001402                           BEQ     T2CMDW
104 100306  010463  000004                   MOV     R4,4(R3)
105 100312  004737  103122          T2CMDW:  CALL    T2GNUM
106 100316  001010                           BNE     T2CMDE
107 100320  016337  000002  064642          MOV     2(R3),T2WRR             ;SAVE REGION
108 100326  016337  000004  064644          MOV     4(R3),T2WRO             ;SAVE OFFSET
109 100334  000264          T2CMDX:  SEZ
110 100336  000207                           RETURN
111 100340               T2CMDE:
    100340  004137  075664                   JSR     R1,LPNTF                ;CALL   LPNTF PRINT ROUTINE
    100344  066445                           .WORD   T2CMS5                  ;ADDRESS OF ASCIZ STRING
    100346  000000                           .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
112 100350  000651                           BR      T2CMDQ                  ;GO ASK AGAIN
```

```
                                ;T4MPRM - DM REQUEST 3
                                ;
                                ;REQUEST FOR TEST 4 CONTENTS OF DATA PATTERN 16.
                                ;
                                ;INPUTS:
                                ;       R5 - CONTROLLER TABLE ADDRESS
                                ;       R4 - MESSAGE DATA ADDRESS
                                ;            (NO DATA)
                                ;       R3 - COMMAND DATA ADDRESS
                                ;OUTPUTS:
                                ;       COMMAND DATA FILLED WITH THE FOLLOWING:
                                ;          (R3) NUMBER OF WORDS IN DATA PATTERN 16
                                ;           2.(R3) DATA IN PATTERN 16
                                ;             )             "
                                ;          32.(R3)          "
                                ;          Z SET
                                
100352  012701  000021        T4MPRM: MOV     #17.,R1                 ;GET COUNT
100356  012702  064554                MOV     #PAT16C,R2              ; AND ADDRESS OF PATTERN 16 PARAMETERS
100362  012223                1$:     MOV     (R2)+,(R3)+             ;COPY THE DATA TO BUFFER
100364  005301                        DEC     R1
100366  001375                        BNE     1$
100370  000264                        SEZ                             ;RETURN WITH Z SET
100372  000207                        RETURN
```

```
                        ;T4UPRM - DM REQUEST 4
                        ;
                        ;REQUEST FOR TEST 4 UNIT PARAMETERS
                        ;
                        ;INPUTS:
                        ;       R5 - CONTROLLER TABLE ADDRESS
                        ;       R4 - MESSAGE DATA ADDRESS
                        ;          (R4) DRIVE NUMBER
                        ;           2.(R4) DRIVE SERIAL NUMBER
                        ;            )
                        ;           6.(R4)
                        ;           8.(R4) HDA SERIAL NUMBER
                        ;            )
                        ;          14.(R4)
                        ;       R3 - COMMAND DATA ADDRESS
                        ;OUTPUTS:
                        ;       COMMAND DATA FILLED WITH THE FOLLOWING:
                        ;          (R3) PARAMETER BITS (1 FOR TRUE)
                        ;                BIT     14 - INITIAL WRITE
                        ;                BIT     13 - DIAGNOSTIC CYLINDERS
                        ;                BIT     12 - ECC CORRECTION
                        ;                BIT     11 - READ ONLY
                        ;                BIT     10 - WRITE ONLY
                        ;                BIT      9 - RETRIES
                        ;                BIT      8 - TRACK/GROUP AND CYLINDERS SPECIFIED
                        ;                BIT      7 - (NOT USED)
                        ;                BIT      6 - SEQUENTIAL SEEKS
                        ;                BIT      5 - BEGIN/END SETS SPECIFIED
                        ;                BIT      4 - TRACK SPECIFIED (0 - GROUPS SPECIFIED)
                        ;                    HAS MEANING ONLY WHEN BIT 5 IS ZERO
                        ;                BIT      3 - WRITE CHECKS ENABLED
                        ;                BIT      2 - WRITE CHECKS ALWAYS
                        ;                BIT      1 - DATA COMPARES ENABLED
                        ;                BIT      0 - DATA COMPARE ALWAYS
                        ;           2.(R3) DATA PATTERN NUMBER
                        ;       IF PARAMETER BIT 5 SET
                        ;           4.(R3) COUNT OF BEGIN/END SETS
                        ;           6.(R3) BEGIN BLOCK (2 WORDS) THEN END BLOCK (2 WORDS)
                        ;            )      1 TO 4 SETS
                        ;            )          OR
                        ;            )     IF COUNT OF BEGIN/END BLOCKS = 0
                        ;          36.(R3)  START CYLINDER (2 WORDS) THEN END CYLINDER (2 WORDS)
                        ;           END CYLINDER A NEGATIVE VALUE IF TO TEST ENTIRE AREA
                        ;       IF PARAMETER BIT 5 CLEAR
                        ;           4.(R3) STARTING CYLINDER
                        ;           6.(R3)   (2 WORDS)
                        ;           8.(R3) ENDING CYLINDER (2 WORDS)
                        ;          10.(R3)   NEGATIVE FOR ALL CYLINDERS
                        ;          12.(R3) NUMBER OF TRACKS OR GROUPS SPECIFIED
                        ;          14.(R3) 1 TO 7 TRACK OR GROUP NUMBERS
                        ;            )      DETERMINED BY PARAMETER BIT 4
                        ;          26.(R3)
                        ;          Z SET IF DATA RETURNED
                        ;          Z CLEAR IF UNIT NUMBER NOT ON THIS CONTROLLER
```

```
 1
 2 100374  012401                    T4UPRM: MOV     (R4)+,R1                ;GET DRIVE NUMBER
 3 100376  010402                            MOV     R4,R2                   ;SAVE DATA ADDRESS
 4 100400  004737  102274                    CALL    GTDRVT                  ;GET DRIVE TABLE ADDRESS
 5 100404  001122                            BNE     T4UPRX                  ;CHECK IF DRIVE FOUND
 6 100406  012264  000200                    MOV     (R2)+,D.SERN(R4)        ;COPY DRIVE SERIAL NUMBER TO DRIVE TABLE
 7 100412  012264  000202                    MOV     (R2)+,D.SERN+2(R4)
 8 100416  012264  000204                    MOV     (R2)+,D.SERN+4(R4)
14 100422  016401  000004                    MOV     D.PRM(R4),R1            ;GET PARAMETER BITS
15 100426  042701  140200                    BIC     #D.ZERO,R1              ;CLEAR SOME BITS
16 100432  032737  000020  064440            BIT     #ISTRTH,IFLAGS          ;FIRST TIME TEST 4 BEING RUN,
17 100440  001406                            BEQ     1$                      ;BRANCH IF NOT, ELSE
18 100442  032737  040000  064400            BIT     #SM.IW,SFPTBL+SO.BIT    ;GET INITIAL WRITE BIT.
19 100450  001402                            BEQ     1$
20 100452  052701  040000                    BIS     #D.IW,R1                ;MOVE INTO PARAMETER BITS
21 100456  010123                    1$:     MOV     R1,(R3)+                ;PUT INTO BUFFER
22 100460  016423  000006                    MOV     D.PAT(R4),(R3)+         ;PUT PATTERN NUMBER IN BUFFER
23 100464  032701  000040                    BIT     #D.BE,R1                ;CHECK BEGIN/END PARAMETER BIT
24 100470  001411                            BEQ     3$                      ;BRANCH IF NOT SET
25
26                                          ;RETURN BEGIN/END SETS
27
28 100472  012701  000021                    MOV     #4*4+1,R1               ;COUNT OF SETS TIMES WORDS PER SET PLUS COUNT WORD
29 100476  010402                            MOV     R4,R2                   ;GET INDEX INTO DRIVE TABLE
30 100500  062702  000112                    ADD     #D.BEC,R2
31 100504  012223                    2$:     MOV     (R2)+,(R3)+             ;TRANSFER THE BEGIN/END SETS
32 100506  005301                            DEC     R1
33 100510  001375                            BNE     2$
34 100512  000457                            BR      T4UPRX
35
36 100514  032764  000400  000004  3$:     BIT     #D.CYL,D.PRM(R4)        ;LOOK AT D.CYL BIT
37 100522  001441                            BEQ     8$                      ;BRANCH IF NOT SET
38
39                                          ;RETURN TRACKS/GROUPS AND CYLINDERS
40
41 100524  005764  000112                    TST     D.BEC(R4)               ;CHECK IF ANY TRACKS/GROUPS
42 100530  001421                            BEQ     6$                      ;BRANCH IF NONE
43 100532  012701  000004                    MOV     #4,R1                   ;COUNT OF CYLINDER WORDS
44 100536  010402                            MOV     R4,R2
45 100540  062702  000154                    ADD     #D.BCYL,R2
46 100544  012223                    4$:     MOV     (R2)+,(R3)+             ;CYLINDERS
47 100546  005301                            DEC     R1
48 100550  001375                            BNE     4$
49 100552  012701  000010                    MOV     #8.,R1
50 100556  010402                            MOV     R4,R2
51 100560  062702  000112                    ADD     #D.BEC,R2
52 100564  012223                    5$:     MOV     (R2)+,(R3)+             ;TRACKS/GROUPS
53 100566  005301                            DEC     R1
54 100570  001375                            BNE     5$
55 100572  000427                            BR      T4UPRX
56
57                                          ;RETURN CYLINDERS ONLY
58
59 100574  052763  000040  177774  6$:     BIS     #D.BE,-4(R3)            ;SET D.BE FOR DM PROGRAM
60 100602  005023                            CLR     (R3)+                   ;SEND ZERO BEGIN/END COUNT
61 100604  012701  000004                    MOV     #4,R1
62 100610  010402                            MOV     R4,R2
```

```
     63 100612  062702  000154                    ADD     #D.BCYL,R2
     64 100616  012223                  7$:       MOV     (R2)+,(R3)+             ;CYLINDERS
     65 100620  005301                            DEC     R1
     66 100622  001375                            BNE     7$
     67 100624  000412                            BR      T4UPRX
     68
     69                                           ;RETURN ENTIRE AREA
     70
     71 100626  052763  000040  177774  8$:       BIS     #D.BE,-4(R3)            ;SET D.BE FOR DM PROGRAM
     72 100634  005023                            CLR     (R3)+                   ;BEGIN/END COUNT OF ZERO
     73 100636  005023                            CLR     (R3)+                   ;START CYLINDER OF ZERO
     74 100640  005023                            CLR     (R3)+
     75 100642  005023                            CLR     (R3)+                   ;END CYLINDER NEGATIVE
     76 100644  012723  177777                    MOV     #-1,(R3)+
     77 100650  000264                            SEZ
     78 100652  000207                  T4UPRX:   RETURN
```

```
                                ;T4BB1 - DM REQUEST 5
                                ;
                                ;REQUEST FOR FIRST 14 BAD BLOCKS
                                ;
                                ;INPUTS:
                                ;       R5 - CONTROLLER TABLE ADDRESS
                                ;       R4 - MESSAGE DATA ADDRESS
                                ;          (R4) DRIVE NUMBER
                                ;       R3 - COMMAND DATA ADDRESS
                                ;OUTPUTS:
                                ;       COMMAND DATA FILLED WITH BAD BLOCKS
                                ;          (R3) COUNT OF BAD BLOCKS
                                ;           2.(R3) BAD BLOCK 1 (LOW)
                                ;           4.(R3)             (HIGH)
                                ;              )
                                ;              )
                                ;       56.(R3) BAD BLOCK 14 (LOW)
                                ;       58.(R3)              (HIGH)
                                ;       Z SET IF DATA RETURNED
                                ;       Z CLEAR IF DRIVE NUMBER NOT ON THIS CONTROLLER
                                ;
100654  011401                  T4BB1:  MOV     (R4),R1                 ;GET DRIVE NUMBER
100656  004737  102274                  CALL    GTDRVT                  ;GET DRIVE TABLE ADDRESS
100662  001007                          BNE     T4BB1E                  ;CHECK IF DRIVE FOUND
100664  062704  000010                  ADD     #D.BB,R4                ;INCREASE ADDRESS TO DATA TO COPY
100670  012701  000035                  MOV     #<1.+<14.*2>>,R1        ;GET COUNT OF WORDS
100674  012423                  1$:     MOV     (R4)+,(R3)+             ;COPY THE WORDS
100676  005301                          DEC     R1
100700  001375                          BNE     1$
100702  000207                  T4BB1E: RETURN
```

```
                                ;T4BB2 - DM REQUEST 6
                                ;
                                ;REQUEST LAST TWO BAD BLOCKS
                                ;
                                ;INPUTS:
                                ;       R5 - CONTROLLER TABLE ADDRESS
                                ;       R4 - MESSAGE DATA ADDRESS
                                ;          (R4) DRIVE NUMBER
                                ;       R3 - COMMAND DATA ADDRESS
                                ;OUTPUTS:
                                ;       COMMAND DATA FILLED WITH BAD BLOCKS 15 AND 16
                                ;       Z SET IF DATA RETURNED
                                ;       Z CLEAR IF UNIT NUMBER NOT ON THIS CONTROLLER
                                ;
100704  011401                  T4BB2:  MOV     (R4),R1                 ;GET DRIVE NUMBER
100706  004737  102274                  CALL    GTDRVT                  ;GET DRIVE TABLE ADDRESS
100712  001007                          BNE     T4BB2E                  ;CHECK IF DRIVE FOUND
100714  062704  000102                  ADD     #D.BB15,R4              ;INCREASE ADDRESS TO DATA TO COPY
100720  012701  000004                  MOV     #4,R1                   ;GET COUNT OF WORDS
100724  012423                  1$:     MOV     (R4)+,(R3)+             ;COPY THE WORDS
100726  005301                          DEC     R1
100730  001375                          BNE     1$
100732  000207                  T4BB2E: RETURN
```

```
                                ;T4SOFT - DM REQUEST 7
                                ;
                                ;ADD TO SOFT ERROR AND ECC COUNTS
                                ;
                                ;INPUTS:
                                ;       R5 - CONTROLLER TABLE ADDRESS
                                ;       R4 - MESSAGE DATA ADDRESS
                                ;          (R4) DRIVE NUMBER
                                ;           2.(R4) VALUE TO ADD TO SOFT ERROR COUNT
                                ;           4.(R4) VALUE TO ADD TO ECC COUNT
                                ;       R3 - COMMAND DATA ADDRESS
                                ;
100734  012401                  T4SOFT: MOV     (R4)+,R1                ;GET DRIVE NUMBER
100736  010402                          MOV     R4,R2                   ;SAVE DATA ADDRESS
100740  004737  102274                  CALL    GTDRVT                  ;GET DRIVE TABLE ADDRESS
100744  001005                          BNE     1$                      ;CHECK IF DRIVE FOUND
100746  062264  000172                  ADD     (R2)+,D.SERR(R4)        ;ADD TO SOFT ERROR COUNT
100752  062264  000176                  ADD     (R2)+,D.ECCC(R4)        ;ADD TO ECC COUNT
100756  000264                          SEZ                             ;EXIT
100760  000207                  1$:     RETURN
```

```
                                ;
100762                          T4SEEK:
                                ;       DM REQUEST 8.
                                ;
                                ;RECORD 1000 SEEKS COMPLETED ON DRIVE
                                ;
                                ;INPUTS:
                                ;       R5 - CONTROLLER TABLE ADDRESS
                                ;       R4 - MESSAGE DATA ADDRESS
                                ;          (R4) DRIVE NUMBER
                                ;       R3 - COMMAND DATA ADDRESS
                                ;
100762  011401                          MOV     (R4),R1                 ; GET DRIVE NUMBER
100764  004737  102274                  CALL    GTDRVT                  ; GET DRIVE TABLE ADDRESS
100770  001003                          BNE     SEKERE                  ; CHECK IF DRIVE FOUND
100772  005264  000174                  INC     D.SEEK(R4)              ; COUNT THE BITS TRANSFERRED
100776  000264                          SEZ                             ; NORMAL RETURN
101000  000207                  SEKERE: RETURN
```

```
                                        ;T4MXFR - DM REQUEST 9.
                                        ;
                                        ;RECORD 1M BITS TRANSFERRED ON UNIT, COMPARE TO TRANSFER LIMIT AND
                                        ;REPORT LIMIT REACHED.
                                        ;
                                        ;INPUTS:
                                        ;       R5 - CONTROLLER TABLE ADDRESS
                                        ;       R4 - MESSAGE DATA ADDRESS
                                        ;          (R4) DRIVE NUMBER
                                        ;           2.(R4) VALUE TO ADD TO READ COUNT
                                        ;           4.(R4) VALUE TO ADD TO WRITE COUNT
                                        ;       R3 - COMMAND DATA ADDRESS
                                        ;OUTPUTS:
                                        ;          (R3) BIT 15 SET IF TRANSFER LIMIT REACHED
                                        ;       MESSAGE PRINTED IF TRANSFER LIMIT REACHED
                                        ;       Z CLEAR IF DRIVE NUMBER NOT ON THIS CONTROLLER
                                        ;
101002  010402                         T4MXFR: MOV     R4,R2                   ;GET MESSAGE DATA ADDRESS
101004  011401                                 MOV     (R4),R1                 ;GET DRIVE NUMBER
101006  004737  102274                         CALL    GTDRVT                  ;GET DRIVE TABLE ADDRESS
101012  001053                               BNE     MXFERE                  ;CHECK IF DRIVE FOUND
101014  005764  000002                       TST     D.UNIT(R4)              ;SEE IF UNIT HAS BEEN DROPPED
101020  100003                               BPL     1$                      ;CONTINUE IF STILL TO BE TESTED
101022  052713  100000                       BIS     #BIT15,(R3)             ;TELL DM PROGRAM TO STOP TESTING THIS UNIT
101026  000444                               BR      MXFERX                  ;  AND EXIT WITHOUT ADDING TO ADDING TO COUNTS
                                        ;
101030                                  1$:
101030  066264  000002  000166                ADD     2(R2),D.XFRR(R4)        ;ADD MEGABITS READ
101036  066264  000004  000164                ADD     4(R2),D.XFRW(R4)        ;ADD MEGABITS WRITTEN
101044  005737  064376                       TST     SFPTBL+S0.XL            ;SEE IF LIMIT SPECIFIED
101050  001433                               BEQ     MXFERX                  ;BRANCH IF NOT
101052  026437  000166  064376                CMP     D.XFRR(R4),SFPTBL+S0.XL ;CHECK IF LIMIT REACHED
101060  103427                               BLO     MXFERX                  ;BRANCH IF LIMIT NOT REACHED
101062  104421                               TRAP    C$RFLA
101064  032700  000C40                       BIT     #CDU.RO                 ;SEE IF DROPPING UNITS IS INHIBITED
101070  001023                               BNE     MXFERX
101072  052713  100000                       BIS     #BIT15,(R3)             ;SET DROP UNIT BIT
101076  042765  000010  000014                BIC     #CT.MSG.C.FLG(R5)       ;CLEAR MESSAGE RECEIVED FLAG
101104  011446                               MOV     (R4),-(SP)              ;PUSH (R4) ON STACK
101106  011546                               MOV     (R5),-(SP)              ;PUSH (R5) ON STACK
101110  016446  000002                       MOV     D.UNIT(R4),-(SP)        ;PUSH D.UNIT(R4) ON STACK
101114  004137  075704                       JSR     R1,LPNTX                ;CALL   LPNTX PRINT ROUTINE
101120  065713                               .WORD   MESSG                   ;ADDRESS OF ASCIZ STRING
101122  000006                               .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
101124  004737  106562                       CALL    RNTIME                  ;PRINT RUNTIME
101130  004137  075704                       JSR     R1,LPNTX                ;CALL   LPNTX PRINT ROUTINE
101134  065170                               .WORD   MXFERP                  ;ADDRESS OF ASCIZ STRING
101136  000000                               .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
101140  000264                          MXFERX: SEZ                             ;NORMAL RETURN
101142  000207                          MXFERE: RETURN
```

```
                                ;UTOTST - DM REQUEST 10
                                ;
                                ;TELL DM PROGRAM WHICH DRIVES ARE SELECTED FOR TESTING
                                ;AND CLEAR STATISTICS IN DRIVE TABLE
                                ;
                                ;INPUTS:
                                ;       R5 - CONTROLLER TABLE ADDRESS
                                ;       R4 - MESSAGE DATA ADDRESS
                                ;            (NO DATA)
                                ;       R3 - COMMAND DATA ADDRESS
                                ;OUTPUTS:
                                ;       COMMAND PACKET CONTAINING UP TO 8 DRIVE NUMBERS.
                                ;         LIST IS ENDED BY A WORD WITH BIT 15 SET.
                                ;         FOLLOWING LIST IS THE INFORMATION FROM T2DLL REQUEST IF APPLICABLE.
                                ;       D.XFRW, D.XFRR, D.HERR, D.SERR, D.SEEK AND D.ECC CLEARED IN DRIVE TABLE
                                ;       Z SET

101144  010504                 UTOTST: MOV     R5,R4                   ;GET ADDRESS OF CONTROLLER TABLE
101146  062704  000010                 ADD     #C.DRO,R4               ;BUMP TO DRIVE TABLE POINTERS
101152  012702  000010                 MOV     #8.,R2                  ;GET COUNT OF PORTS
101156  012400                 UTOT1:  MOV     (R4)+,R0                ;SEE IF DRIVE TABLE POINTER EXISTS
101160  001415                         BEQ     UTOT2                   ;BRANCH IF NOT
101162  005760  000002                 TST     D.UNIT(R0)              ;LOOK IF UNIT AVAILABLE FOR TESTING
101166  100410                         BMI     UTOT1A
101170  011023                         MOV     (R0),(R3)+              ;LOAD DRIVE NUMBER FROM TABLE
101172  062700  000164                 ADD     #D.XFRW,R0              ;CLEAR STATISTICS IN DRIVE TABLE
101176  012701  000011                 MOV     #<D.SIZE-D.XFRW>/2,R1
101202  005020                 1$:     CLR     (R0)+
101204  005301                         DEC     R1
101206  001375                         BNE     1$
101210  005302                 UTOT1A: DEC     R2                      ;COUNT THE DRIVE TABLES
101212  001361                         BNE     UTOT1                   ;REPEAT FOR EACH TABLE
101214  012723  100000         UTOT2:  MOV     #BIT15,(R3)+            ;TERMINATE LIST
101220  013723  064656                 MOV     DLL,(R3)+               ;GET DLL CONTROL WORD
101224  001407                         BEQ     UTOT4                   ; IF NON ZERO
101226  012701  064660                 MOV     #DLLDR,R1               ;  TRANSFER ALL DLL WORDS INTO BUFFER
101232  012702  000020                 MOV     #<DLLNAM+4-DLLDR>,R2
101236  012123                 UTOT3:  MOV     (R1)+,(R3)+
101240  005302                         DEC     R2
101242  001375                         BNE     UTOT3
101244  000264                 UTOT4:  SEZ
101246  000207                         RETURN                          ;RETURN WITH Z SET
```

```
                                ;ERRMES  - DM REQUEST 11
                                ;
                                ;PRINT AN ERROR MESSAGE
                                ;
                                ;INPUTS:
                                ;       R5 - CONTROLLER TABLE ADDRESS
                                ;       R4 - MESSAGE DATA ADDRESS
                                ;            (R4)  ERROR PC IN DM PROGRAM
                                ;          2.(R4)  <15:14> ERROR TYPE
                                ;                  <13:0 > ERROR NUMBER
                                ;          4.(R4)  DRIVE NUMBER (-1 IF NOT GIVEN)
                                ;          6.(R4)  MESSAGE POINTER
                                ;          8.(R4)  OPTIONAL PARAMETERS FOR ERROR PRINT ROUTINE
                                ;         10.(R4)                  "
                                ;            )                     "
                                ;            )                     "
                                ;         58.(R4)                  "
                                ;       R3 - COMMAND DATA ADDRESS
                                ;OUTPUTS:
                                ;       COMMAND PACKET CONTAINING THE FOLLOWING:
                                ;            (R3) - BIT 15 SET IF FATAL ERROR TO INDICATE DRIVE SHOULD NO LONGER BE TESTED
                                ;       Z SET TO INDICATE DATA RETURNED
                                ;       Z CLEAR IF DRIVE NUMBER NOT ON THIS CONTROLLER
101250                          ERRMES:
101250  005764  000002                TST     2(R4)                   ;CHECK IF FATAL ERROR
101254  100406                        BMI     5$                      ;BRANCH IF NOT
101256  104421                        TRAP    C$RFLA
101260  032700  000040                BIT     #IDU,R0                 ;SEE IF ALLOWED TO DROP UNITS
101264  001014                        BNE     6$                      ;BRANCH IF NOT
101266  052713  100000                BIS     #BIT15,(R3)             ;SET DROP DRIVE BIT
101272  016400  000002        5$:     MOV     2(R4),R0                ;SEE IF SOFT ERROR
101276  005100                        COM R0
101300  032700  140000                BIT     #140000,R0
101304  001004                        BNE     6$                      ;BRANCH IF NOT
101306  032737  000400  064400        BIT     #SM.SSF,SO.BIT+SFPTBL   ;SEE IF SOFT ERRORS SUPPRESSED
101314  001063                        BNE     ERRMSX                  ;DON'T PRINT IF SO
101316                          6$:
101316  042765  000010  000014        BIC     #CT.MSG,C.FLG(R5)       ;CLEAR MESSAGE RECEIVED FLAG
101324  022737  000004  064444        CMP     #4,TNUM                 ;ARE WE DOING DISK EXERCISER TEST ?
101332  001004                        BNE     7$                      ;BRANCH IF NOT
101334  032737  001000  064400        BIT     #SM.LOG,SFPTBL+SO.BIT   ;   SEE IF LOG BEING USED
101342  001005                        BNE     ERRMSL
101344  004737  103250        7$:     CALL    PNTERR                  ;IF NOT, PRINT THE ERROR MESSAGE
101350  103045                        BCC ERRMSX                      ;IF DRIVE HASN'T BEEN DROPPED, PRINT
101352  000244                        CLZ                             ;ELSE RETURN
101354  000207                        RETURN
```

```
 1
 2 101356  005737  064650          ERRMSL: TST     LBUFS                   ;SEE IF LOG BUFFER ESTABLISHED
 3 101362  001016                          BNE     1$                      ;  LBUFS CONTAINS ADDRESS IF ESTABLISHED
 4 101364  013701  064432                  MOV     DMPROG,R1
 5 101370  005721                          TST     (R1)+                   ; LBUFS <- (DMPROG)+2
 6 101372  010137  064650                  MOV     R1,LBUFS
 7 101376  010137  064652                  MOV     R1,LBUFN
 8 101402  067701  163024                  ADD     @DMPROG,R1
 9 101406  005741                          TST     -(R1)                   ; LBUFE <- (LBUFS) + ((DMPROG)) - 2
10 101410  010137  064654                  MOV     R1,LBUFE
11 101414  005037  064442                  CLR     FNUM
12 101420  013701  064652          1$:     MOV     LBUFN,R1                ;GET ADDRESS OF DATA STORAGE AREA
13 101424  062737  000106  064652          ADD     #HC.BSZ,LBUFN           ;ADD BYTES OF STORAGE NEEDED
14 101432  023737  064652  064654          CMP     LBUFN,LBUFE             ;SEE IF ENOUGH ROOM
15 101440  103007                          BHIS    3$                      ;  BRANCH IF NOT
16 101442  010521                          MOV     R5,(R1)+                ;STORE CONTROLLER TABLE ADDRESS
17 101444  012700  000042                  MOV     #<HC.BSZ-2>/2,R0        ;GET COUNT OF REST OF DATA IN WORDS
18 101450  012421                  2$:     MOV     (R4)+,(R1)+             ;STORE DATA
19 101452  005300                          DEC     R0
20 101454  001375                          BNE     2$
21 101456  000402                          BR      ERRMSX
22 101460  010137  064652          3$:     MOV     R1,LBUFN                ;RESTORE OLD VALUE OF LBUFN
23 101464  000264                  ERRMSX: SEZ
24 101466  000207                          RETURN
```

```
                        ;ERRMC - DM REQUEST 12.
                        ;
                        ;REPORT AN ERROR MESSAGE IDENTICAL TO DM REQUEST ERRMES
                        ;THEN ADD ONE TO THE ERROR COUNT FOR THE DRIVE AND SEE IF
                        ;ERROR LIMIT REACHED.
                        ;
                        ;INPUTS:
                        ;       R5 - CONTROLLER TABLE ADDRESS
                        ;       R4 - MESSAGE DATA ADDRESS
                        ;            (R4)  ERROR PC IN DM PROGRAM
                        ;          2.(R4)  < 9:8 > ERROR TYPE
                        ;                  < 7:0 > ERROR NUMBER
                        ;          4.(R4)  DRIVE NUMBER (-1 IF NOT GIVEN)
                        ;          6.(R4)  <15:12> TYPE
                        ;                  <11:0 > MESSAGE POINTER
                        ;          8.(R4)  OPTIONAL PARAMETERS FOR ERROR PRINT ROUTINE
                        ;         10.(R4)                "
                        ;            )                   "
                        ;            )                   "
                        ;         58.(R4)                "
                        ;       R3 - COMMAND DATA ADDRESS
                        ;OUTPUTS:
                        ;       COMMAND PACKET CONTAINING THE FOLLOWING:
                        ;         (R3) BIT 15 SET IF ERROR COUNT REACHED
                        ;                 TO INDICATE DRIVE SHOULD NO LONGER BE TESTED.
                        ;       Z CLEAR IF DRIVE NUMBER NOT ON THIS CONTROLLER
                        ;       Z SET TO INDICATE DATA RETURNED

101470                  ERRMC:
101470  010446                  MOV     R4,-(SP)                ;PUSH R4 ON STACK
101472  004737  101250          CALL    ERRMES                  ; CALL REQUEST ERRMES
101476  012604                  MOV     (SP)+,R4                ;POP STACK INTO R4
101500  005713                  TST     (R3)                    ;SEE IF UNIT ALREADY TO BE DROPPED
101502  100436                  BMI     3$                      ;  IF SO, JUST EXIT NOW
101504  016401  000004          MOV     4(R4),R1                ; GET DRIVE NUMBER
101510  016402  000002          MOV     2(R4),R2                ;GET ERROR TYPE
101514  004737  102274          CALL    GTDRVT                  ; GET DRIVE TABLE
101520  001031                  BNE     5$                      ; EXIT IF NO TABLE FOR UNIT
101522  042702  037777          BIC     #^C140000,R2
101526  022702  100000          CMP     #100000,R2              ;CHECK IF HARD ERROR
101532  001022                  BNE     3$                      ;BRANCH IF NOT
101534  005264  000170          INC     D.HERR(R4)              ; COUNT THE ERROR
101540  026437  000170  064374  CMP     D.HERR(R4),SPPTBL+SO.EL ; CHECK IF AT LIMIT
101546  103414                  BLO     3$                      ; IF LIMIT REACHED, BRANCH
101550  104421                  TRAP    C$RELA
101552  032700  000040          BIT     #IDU,R0                 ;SEE IF DROPPING UNITS INHIBITED
101556  001010                  BNE     3$                      ;BRANCH IF SO
101560  016446  000002          MOV     D.UNIT(R4),-(SP)        ;PUSH D.UNIT(R4) ON STACK
101564  004137  075704          JSR     R1,LPNTX                ;CALL   LPNTX PRINT ROUTINE
101570  065245                  .WORD   ERRLIM                  ;ADDRESS OF ASCIZ STRING
101572  000002                  .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
101574  052713  100000          BIS     #BIT15,(R3)             ;SET STOP TESTING BIT
101600  000264          3$:     SEZ                             ; SET Z FOR NORMAL RETURN
101602  000207                  RETURN                          ; RETURN TO CALLING PROGRAM

101604  000244          5$:     CLZ                             ; FLAG AS ERROR
```

```
     66 101606  000207                RETURN                          ; RETURN TO CALLING PROGRAM
```

```
 1
 2                                      ;MESSAG - DM REQUEST 13.
 3                                      ;
 4                                      ;PRINT A MESSAGE WITH HEADER AS FOLLOWS:
 5                                      ;   "UNIT XX UDA AT XXXXXX DRIVE XXX RUNTIME HH:MM:SS "
 6                                      ;ENTIRE MESSAGE IS PRINTED WITH PRINTX CALLS.
 7                                      ;
 8                                      ;INPUTS:
 9                                      ;       R5 - CONTROLLER TABLE ADDRESS
10                                      ;       R4 - MESSAGE DATA ADDRESS
11                                      ;          (R4) DRIVE NUMBER
12                                      ;           2.(R4) MESSAGE POINTER
13                                      ;           2.(R4) MESSAGE POINTER
14                                      ;           4.(R4) OPTIONAL MESSAGE PARAMETERS
15                                      ;              )
16                                      ;              )
17                                      ;       58.(R4) COMMAND DATA ADDRESS
18
19 101610  042765  000010  000014  MESSAG: BIC     #CT.MSG,C.FLG(R5)       ;CLEAR MESSAGE RECEIVED FLAG
20 101616  012401                          MOV     (R4)+,R1                ;GET DRIVE NUMBER
21 101620  010446                          MOV     R4,-(SP)                ;;PUSH R4 ON STACK
22 101622  004737  102274                  CALL    GTDRVT                  ;GET DRIVE TABLE ADDRESS
23 101626  001033                          BNE     1$                      ;CHECK IF DRIVE FOUND
24 101630  005764  000002                  TST     D.UNIT(R4)              ;IF UNIT DROPPED FROM TESTING
25 101634  100430                          BMI     1$                      ;   DON'T PRINT ANYTHING
26 101636  011446                          MOV     (R4),-(SP)              ;PUSH (R4) ON STACK
   101640  011546                          MOV     (R5),-(SP)              ;PUSH (R5) ON STACK
   101642  016446  000002                  MOV     D.UNIT(R4),-(SP)                ;PUSH D.UNIT(R4) ON STACK
   101646  004137  075704                  JSR     R1,LPNTX                ;CALL   LPNTX PRINT ROUTINE
   101652  065713                          .WORD   MESSG                   ;ADDRESS OF ASCIZ STRING
   101654  000006                          .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
27 101656  004737  106362                  CALL    RNTIME                  ;GET RUNTIME PARAMETERS
28 101662  012604                          MOV     (SP)+,R4                ;;POP STACK INTO R4
29 101664  012402                          MOV     (R4)+,R2                ;GET MESSAGE POINTER
30 101666  006302                          ASL     R2                      ;DOUBLE TO MAKE BYTE OFFSET
31 101670  063702  064432                  ADD     DMPROG,R2               ;ADD TO START OF MESSAGE STRINGS
32 101674  063702  162532                  ADD     &DMPROG,R2              ;ADD SIZE OF MAIN PROGRAM
33 101700  105712                          TSTB    (R2)                    ;CHECK FIRST BYTE
34 101702  001001                          BNE     2$                      ;IF ZERO
35 101704  005202                          INC     R2                      ;   INCREMENT TO NEXT BYTE
36 101706  004737  075772          2$:     CALL    OSTRNG                  ;OUTPUT ACCORDING TO STRING
37 101712  000264                          SEZ
38 101714  000207                          RETURN
39 101716                          1$:
   101716  012604                          MOV     (SP)+,R4                ;;POP STACK INTO R4
40 101720  000207                          RETURN
```

```
 1
 2                                ;DONE - DM REQUEST 14
 3                                ;
 4                                ;MARK DM PROGRAM AS NO LONGER RUNNING
 5                                ;
 6                                ;INPUTS:
 7                                ;       R5 - CONTROLLER TABLE ADDRESS
 8                                ;       R4 - MESSAGE DATA ADDRESS
 9                                ;            (NO DATA)
10                                ;       R3 - COMMAND DATA ADDRESS
11                                ;OUTPUTS:
12                                ;       Z CLEAR TO DROP UNIT FROM TESTING
13
14 101722  000244                DONE:   CLZ                             ;DROP UNIT FROM TESTING
15 101724  000207                        RETURN
```

```
                                        .SBTTL  PRE-PROGRAMMED SUBROUTINES

                                        ;PRE-PROGRAMMED ROUTINE 1
                                        ;
                                        ;CALL ALTERNATE PRINT STRING IN DM PROGRAM IMAGE

101726                                  CALR1:
101726  010246                                  MOV     R2,-(SP)                ;;PUSH R2 ON STACK
101730  012402                                  MOV     (R4)+,R2                ;GET NEW STRING POINTER
101732  006302                                  ASL     R2                      ;DOUBLE FOR WORD COUNT
101734  063702  064432                          ADD     DMPROG,R2               ;ADD START OF STRING STORAGE
101740  067702  102466                          ADD     @DMPROG,R2              ;ADD SIZE OF MAIN PROGRAM
101744  004737  075772                          CALL    OSTRNG                  ;OUTPUT USING THIS STRING
101750  012602                                  MOV     (SP)+,R2                ;;POP STACK INTO R2
101752  000207                                  RETURN                          ;NOW CONTINUE THE OLD STRING
```

```
                                ;PRE-PROGRAMMED ROUTINE 2
                                ;
                                ;PRINT AN SDI DIACNOSE RESPONSE

 101754                         CALR2:
 101754  010246                         MOV     R2,-(SP)        ;;PUSH R2 ON STACK
 101756  012402                         MOV     (R4)+,R2        ;GET COUNTS
 101760  010246                         MOV     R2,-(SP)        ;;PUSH R2 ON STACK
 101762  042702  177400                 BIC     #177400,R2      ;GET BINARY COUNT
 101766  001414                         BEQ     2$              ;BYPASS BINARY IF COUNT IS ZERO
 101770  012700  000020         1$:     MOV     #16.,R0         ;RADIX IS HEX
 101774  012701  000040                 MOV     #32.,R1         ;32 BIT NUMBERS
 102000  004737  102450                 CALL    PNTNUS          ;PRINT THE NUMBER
 102004  112700  000015                 MOVB    #CR,R0          ;STORE #CR IN R0 AND
 102010  004737  075506                 JSR     PC,PRINTC       ;PRINT THE CHARACTER.
 102014  005302                         DEC     R2
 102016  001364                         BNE     1$
 102020                         2$:
 102020  012601                         MOV     (SP)+,R1        ;;POP STACK INTO R1
 102022  000301                         SWAB R1                 ;GET ASCII COUNT
 102024  042701  177400                 BIC     #177400,R1
 102030  001406                         BEQ     3$              ;BYPASS IS COUNT IS ZERO
 102032  004737  076066                 CALL    CON.A1          ;PRINT THE ASCII
 102036  112700  000015                 MOVB    #CR,R0          ;STORE #CR IN R0 AND
 102042  004737  075506                 JSR     PC,PRINTC       ;PRINT THE CHARACTER.
 102046                         3$:
 102046  012602                         MOV     (SP)+,R2        ;;POP STACK INTO R2
 102050  000207                         RETURN
```

```
                                ;PRE-PROGRAMMED ROUTINE 3
                                ;
                                ;DECIDE WHETHER TO PRINT RBN

                                ;FOUR PARAMETERS ARE PROVIDED FOR THIS ROUTINE. THE FIRST PARAMETER
                                ;SHOULD BE CHECKED TO SEE IF BIT 7 IS SET:
                                ;   IF SET - TURN INTO A CALL TO ROUTINE 1 (WHICH WILL USE OTHER 3 PARAMETERS)
                                ;   IF CLEAR - SKIP OVER NEXT 3 PARAMETERS AND END ROUTINE

102052  032724  000200        CALR3:  BIT     #BIT7,(R4)+             ;CHECK BIT 7 IN FIRST PARAMETER WORD
102056  001323                        BNE     CALR1                   ;IF SET, TURN INTO A CALR1
102060  062704  000006                ADD     #6,R4                   ;ELSE, SKIP OVER NEXT 3 PARAMETERS
102064  000207                        RETURN
```

```
                                ;PRE-PROGRAMMED ROUTINE 4
                                ;
                                ;PRINT BASIC LINE FOR HOST PROGRAM ERROR WITHOUT UDA ADDRESS
                                ;THEN SWITCH TO EXTENDED FORMAT
                                ;
102066                          CALR4:
102066  012746  067047                  MOV     @BAS,-(SP)          ;PUSH @BAS ON STACK
102072  012746  067047                  MOV     @BAS,-(SP)          ;PUSH @BAS ON STACK
102076  012746  067047                  MOV     @BAS,-(SP)          ;PUSH @BAS ON STACK
102102  012746  066651                  MOV     @BASNO,-(SP)        ;PUSH @BASNO ON STACK
102106  004137  075674                  JSR     R1,LPNTB            ;CALL   LPNTB PRINT ROUTINE
102112  067050                        .WORD   BASLN               ;ADDRESS OF ASCIZ STRING
102114  000010                        .WORD   ARG.CT              ;ARGUMENT COUNT * 2
102116  004737  106362                  CALL    RNTIME
102122  112700  000015                  MOVB    @CR,R0              ;STORE @CR IN R0 AND
102126  004737  075506                  JSR     PC,PRINTC           ;PRINT THE CHARACTER.
102132  012737  075612  075770          MOV     @PX,PTYPE
102140  000207                          RETURN
```

```
                                        ;PRE-PROGRAMMED ROUTINE 5
                                        ;
                                        ;PRINT BASIC LINE FOR HOST PROGRAM ERROR WITH UDA ADDRESS
                                        ;THEN SWITCH TO EXTENDED FORMAT
                                        ;
 102142                                 CALR5:
 102142  012746  067047                         MOV     @BAS,-(SP)          ;PUSH @BAS ON STACK
 102146  012746  067047                         MOV     @BAS,-(SP)          ;PUSH @BAS ON STACK
 102152  011546                                 MOV     (R5),-(SP)          ;PUSH (R5) ON STACK
 102154  012746  067013                         MOV     @BASL2,-(SP)        ;PUSH @BASL2 ON STACK
 102160  012746  066651                         MOV     @BASNO,-(SP)        ;PUSH @BASNO ON STACK
 102164  004137  075674                         JSR     R1,LPNTB            ;CALL   LPNTB PRINT ROUTINE
 102170  067050                                 .WORD   BASLN               ;ADDRESS OF ASCIZ STRING
 102172  000012                                 .WORD   ARG.CT              ;ARGUMENT COUNT * 2
 102174  004737  106362                         CALL    RNTIME
 102200  112700  000015                         MOVB    @CR,R0              ;STORE @CR IN R0 AND
 102204  004737  075506                         JSR     PC,PRINTC           ;PRINT THE CHARACTER.
 102210  012737  075612  075770                 MOV     @PX,PTYPE
 102216  000207                                 RETURN
```

```
                                        ;PRE PROGRAMMED ROUTINE 6
                                        ;
                                        ;CALL ALTERNATE PRINT ROUTINE IN PDP-11 MEMORY
                                        ;
102220                                  CALR6:
102220  010246                                  MOV     R2, (SP)        ;;PUSH R2 ON STACK
102222  012402                                  MOV     (R4)+,R2        ;GET NEW STRING POINTER
102224  004737  075772                         CALL    OSTRNG          ;OUTPUT USING THIS STRING.
102230  012602                                  MOV     (SP)+,R2        ;;POP STACK INTO R2
102232  000207                                  RETURN                  ;NOW CONTINUE THE OLD STRING
```

```
                        ;PRE-PROGRAMMED ROUTINE 7
                        ;
                        ;PRINT "REPLACE UDA MODULE M7161"
                        ;
102234                  CALR7:
102234  010246                  MOV     R2, (SP)        ;;PUSH R2 ON STACK
102236  012702  074215          MOV     #XFRU,R2
102242  004737  075772          CALL    OSTRNG
102246  012602                  MOV     (SP)+,R2        ;;POP STACK INTO R2
102250  000207                  RETURN
```

```
                                ;PRE-PROGRAMMED ROUTINE 8
                                ;
                                ;PRINT   "  UDASA CONTAINS  XXXXXX"
                                ;
102252                          CALR8:
102252  010246                          MOV     R2,-(SP)                ;;PUSH R2 ON STACK
102254  012702  074164                  MOV     #XSA,R2
102260  004737  075772                  CALL    OSTRNG
102264  012602                          MOV     (SP)+,R2                ;;POP STACK INTO R2
102266  000207                          RETURN
```

```
1
2                                       ;PRE-PROGRAMMED ROUTINE 9
3                                       ;
4                                       ;       REPRINT LAST NUMBER
5                                       ;               R4 -> TABLE
6  102270  005744                       CALR9:  TST     -(R4)
7  102272  000207                               RETURN
```

```
 1
 2                                      ;GTDRVT
 3                                      ;
 4                                      ;GET DRIVE TABLE POINTER
 5                                      ;
 6                                      ;INPUTS:
 7                                      ;       R5 - CONTROLLER TABLE ADDRESS
 8                                      ;       R1 - DRIVE NUMBER
 9                                      ;OUTPUTS:
10                                      ;       R4 - DRIVE TABLE ADDRESS
11                                      ;       L$LUN - LOADED WITH UNIT NUMBER OF DRIVE
12                                      ;       Z CLEAR IF DRIVE TABLE NOT FOUND AFTER ERROR PRINTED
13
14 102274                              GTDRVT:
   102274  010246                              MOV     R2,-(SP)                ;;PUSH R2 ON STACK
15 102276  010504                              MOV     R5,R4                   ;GET CONTROLLER TABLE ADRESS
16 102300  062704  000020                      ADD     #C.DRO,R4               ;ADD OFFSET TO DRIVE TABLE ADDRESS
17 102304  012702  000010                      MOV     #8.,R2                  ;GET COUNT OF DRIVES
18 102310  005714                      1$:     TST     (R4)                    ;CHECK IF AN ADDRESS HERE
19 102312  001406                              BEQ     3$
20 102314  027401  000000                      CMP     @(R4),R1                ;COMPARE DRIVE NUMBERS
21 102320  001412                              BEQ     4$                      ;BRANCH IF A MATCH
22 102322  005724                      2$:     TST     (R4)+                   ;BUMP ADDRESS
23 102324  005302                              DEC     R2
24 102326  001370                              BNE     1$                      ;LOOK AT ALL OF THEM
25 102330                              3$:
   102330  104455                              TRAP    C$ERDF
   102332  000043                              .WORD   35
   102334  000000                              .WORD   0
   102336  075000                              .WORD   ERR035
26 102340  012602                              MOV     (SP)+,R2                ;;POP STACK INTO R2
27 102342  000244                              CLZ                             ;CLEAR Z AS ERROR FLAG
28 102344  000207                              RETURN
29
30 102346  011404                      4$:     MOV     (R4),R4                 ;GET ADDRESS OF TABLE
31 102350  116437  000002  002074              MOVB    D.UNIT(R4),L$LUN        ;GET UNIT NUMBER
32 102356  012602                              MOV     (SP)+,R2                ;;POP STACK INTO R2
33 102360  000264                              SEZ                             ;SET Z FLAG
34 102362  000207                              RETURN
```

```
 1
 2                                      ;GETCNT
 3                                      ;
 4                                      ;GET COUNT IN NEXT CHARACTERS OF STRING POINTED TO BY R2.
 5                                      ;NUMBER WILL BE IN DECIMAL. IF NO NUMBER, RETURN A
 6                                      ;DEFAULT OF 1.
 7                                      ;
 8                                      ;INPUTS:
 9                                      ;       R2 - POINTER TO ASCII STRING
10                                      ;OUTPUTS:
11                                      ;       R1 - NUMBER READ OR A ONE
12                                      ;       R2 - POINTING TO CHARACTER AFTER NUMBER
13
14 102364                              GETCNT:
   102364  010046                              MOV     R0,-(SP)                ;;PUSH R0 ON STACK
15 102366  005001                              CLR     R1                      ;START WITH ZERO COUNT
16 102370  121227  000060           GETCNX: CMPB    (R2),#'0                ;CHECK IF CHARACTER A DIGIT
17 102374  103415                              BLO     GETCDN                  ;BRANCH IF LOWER THAN ZERO
18 102376  121227  000071                      CMPB    (R2),#'9
19 102402  101012                              BHI     GETCDN                  ;BRANCH IF HIGHER THAN NINE
20 102404  006301                              ASL     R1                      ;MULTIPLY NUMBER BY 10
21 102406  010100                              MOV     R1,R0                   ; SAVE 2N
22 102410  006301                              ASL     R1                      ; COMPUTE 4N
23 102412  006301                              ASL     R1                      ; COMPUTE 8N
24 102414  060001                              ADD     R0,R1                   ; 8N + 2N = 10N
25 102416  112200                              MOVB    (R2)+,R0                ;GET DIGIT FROM STING
26 102420  162700  000060                      SUB     #'0,R0                  ;GET RID OF ASCII
27 102424  060001                              ADD     R0,R1                   ;ADD TO NUMBER
28 102426  000760                              BR      GETCNX                  ;GO TO NEXT CHARACTER
29 102430  005701                  GETCDN:     TST     R1                      ;CHECK IF NUMBER IS ZERO
30 102432  001001                              BNE     GETCXX                  ;IF ZERO, CHANGE
31 102434  005201                              INC     R1                      ; TO DEFAULT OF ONE
32 102436                          GETCXX:
   102436  012600                              MOV     (SP)+,R0                ;;POP STACK INTO R0
33 102440  000207                              RTS     PC
```

```
                                        ;PNTNUM
                                        ;
                                        ;PRINT A NUMBER
                                        ;
                                        ;INPUTS:
                                        ;       R1 - RADIX OF NUMBER
                                        ;       R2 - ASCII STRING TO COUNT OF BITS IN NUMBER
                                        ;       R4 - POINTER TO NUMBER (LOW WORD)
                                        ;OUTPUTS:
                                        ;       NUMBER IS PRINTED. LEADING ZEROS ARE PRINTED EXCEPT FOR
                                        ;            DECIMAL NUMBERS (LEFT JUSTIFIED).
                                        ;       R0 - CONTENTS DESTROYED
                                        ;
102442  010100                  PNTNUM: MOV     R1,R0                   ;SAVE RADIX
102444  004737  102364                  JSR     PC,GETCNT               ;GET COUNT OF BITS
102450                          PNTNUS:
102450  010246                          MOV     R2,-(SP)                ;;PUSH R2 ON STACK
102452  010346                          MOV     R3,-(SP)                ;;PUSH R3 ON STACK
102454  010546                          MOV     R5,-(SP)                ;;PUSH R5 ON STACK
102456  012403                          MOV     (R4)+,R3                ;GET ONE PARAMETER WORD
102460  005005                          CLR     R5                      ;CLEAR STORAGE FOR OTHER
102462  020127  000020                  CMP     R1,#16.                 ;MORE THAN 16 BITS IN NUMBER?
102466  003401                          BLE     1$
102470  012405                          MOV     (R4)+,R5                ;YES, GET SECOND PARAMETER WORD
102472                          1$:
102472  010446                          MOV     R4,-(SP)                ;;PUSH R4 ON STACK
102474  010504                          MOV     R5,R4                   ;PUT HIGH WORD IN R4
102476  012702  000020                  MOV     #16.,R2                 ;COMPUTE BITS NOT WANTED
102502  160102                          SUB     R1,R2                   ;BY SUBTRACTING BITS TO USE
102504  002002                          BGE     2$                      ;FROM 16.
102506  062702  000020                  ADD     #16.,R2                 ;IF NEGATIVE, ADD 16 FOR FIRST WORD
102512  001414                  2$:     BEQ     6$                      ;IF ZERO, NO BITS NEED BE CLEARED
102514  012705  100000                  MOV     #BIT15,R5               ;START MASK WITH SIGN BIT SET
102520  005302                  3$:     DEC     R2                      ;COUNT BITS IN MASK
102522  001402                          BEQ     4$
102524  006205                          ASR     R5                      ;SHIFT MORE BITS TO RIGHT
102526  000774                          BR      3$
102530  020127  000020          4$:     CMP     R1,#16.                 ;MORE THAN 16 BITS IN NUMBER?
102534  003402                          BLE     5$
102536  040504                          BIC     R5,R4                   ;YES, CLEAR IN HIGH WORD
102540  000401                          BR      6$
102542  040503                  5$:     BIC     R5,R3                   ;NO, CLEAR IN LOW WORD
102544  004737  102704          6$:     JSR     PC,DIVIDE               ;DIVIDE BY RADIX IN R0
102550  010546                          MOV     R5,-(SP)                ;;PUSH R5 ON STACK
102552  005202                          INC     R2                      ;COUNT DIGITS ON STACK
102554  005703                          TST     R3                      ;CHECK IF QUOTIENT IS ZERO
102556  001372                          BNE     6$
102560  005704                          TST     R4
102562  001370                          BNE     6$
102564  020027  000012                  CMP     R0,#10.                 ;IF RADIX IS DECIMAL
102570  001423                          BEQ     10$                     ; JUST GO PRINT DIGITS ON STACK
102572  010103                          MOV     R1,R3                   ;OTHERWISE COMPUTE NUMBER OF LEADING ZEROS
102574  162700  000014                  SUB     #12.,R0                 ;DIVIDEND IS BITS IN NUMBER
102600  003002                          BGT     7$                      ;DIVISOR IS BITS PER DIGIT PRINTED
102602  012700  000003                  MOV     #3,R0                   ;   (3 OR 4)
102606  004737  102704          7$:     JSR     PC,DIVIDE
```

```
54 102612  005705                    TST     R5              ;IF REMAINDER NOT ZERO
55 102614  001401                    BEQ     8$              ;INCREMENT QUOTIENT
56 102616  005203                    INC     R3
57 102620  160203            8$:     SUB     R2,R3           ;SUBTRACT DIGITS ON STACK
58 102622  001406                    BEQ     10$             ;NO LEADING ZEROS IF ZERO
59 102624                    9$:
   102624  112700  000060            MOVB    #'0,R0          ;STORE #'0 IN R0 AND
   102630  004737  075506            JSR     PC,PRINTC       ;PRINT THE CHARACTER.
60 102634  005303                    DEC     R3
61 102636  001372                    BNE     9$              ;REPEAT UNTIL COUNT REACHES ZERO
62 102640                    10$:
   102640  012605                    MOV     (SP)+,R5        ;;POP STACK INTO R5
63 102642  062705  000060            ADD     #'0,R5          ;CNVERT TO ASCII DIGIT
64 102646  020527  000071            CMP     R5,#'9          ;IF GREATER THAN A 9
65 102652  003402                    BLE     11$             ; CONVERT TO A OR HIGHER
66 102654  062705  000007            ADD     #<'A-'9-1>,R5   ; FOR HEX DIGIT
67 102660                    11$:
   102660  110500                    MOVB    R5,R0           ;STORE R5 IN R0 AND
   102662  004737  075506            JSR     PC,PRINTC       ;PRINT THE CHARACTER.
68 102666  005302                    DEC     R2              ;REPEAT FOR ALL DIGITS
69 102670  001363                    BNE     10$             ; ON STACK
70 102672  012604                    MOV     (SP)+,R4        ;;POP STACK INTO R4
   102674  012605                    MOV     (SP)+,R5        ;;POP STACK INTO R5
   102676  012603                    MOV     (SP)+,R3        ;;POP STACK INTO R3
   102700  012602                    MOV     (SP)+,R2        ;;POP STACK INTO R2
71 102702  000207                    RTS     PC
```

```
                                        ;DIVIDE
                                        ;
                                        ;DIVIDE A 32 BIT UNSIGNED NUMBER BY A 16 BIT UNSIGNED NUMBER.
                                        ;REPLACE DIVIDEND WITH QUOTIENT AND RETURN REMAINDER.
                                        ;WILL NOT CHECK FOR DIVIDE BY ZERO.
                                        ;
                                        ;INPUTS:
                                        ;       R3 - LOW 16 BITS OF DIVIDEND
                                        ;       R4 - HIGH 16 BITS OF DIVIDEND
                                        ;       R0 - DIVISOR
                                        ;OUTPUTS:
                                        ;       R3 - LOW 16 BITS OF QUOTIENT
                                        ;       R4 - HIGH 16 BITS OF QUOTIENT
                                        ;       R5 - REMAINDER

102704                                  DIVIDE:
102704  010246                                  MOV     R2,-(SP)                ;;PUSH R2 ON STACK
102706  012702  000040                          MOV     #32.,R2                 ;SET UP SHIFT COUNT
102712  005005                                  CLR     R5                      ;START WITH ZERO REMAINDER
102714  006303                          1$:     ASL     R3                      ;SHIFT LEFT INTO R5
102716  006104                                  ROL     R4
102720  006105                                  ROL     R5
102722  020005                                  CMP     R0,R5                   ;WILL DIVISOR GO INTO REMAINDER
102724  101002                                  BHI     2$                      ;ONLY SUBTRACT IF IT WILL
102726  160005                                  SUB     R0,R5                   ;SUBTRACT DIVISOR
102730  005203                                  INC     R3                      ;PUT A ONE INTO QUOTIENT
102732  005302                          2$:     DEC     R2                      ;COUNT THE SHIFTS
102734  001367                                  BNE     1$
102736  012602                                  MOV     (SP)+,R2                ;;POP STACK INTO R2
102740  000207                                  RTS     PC
```

```
 1
 2                                      ;DIV10
 3                                      ;
 4                                      ;DIVIDE A 64 BIT UNSIGNED NUMBER BY A 10.
 5                                      ;REPLACE DIVIDEND WITH QUOTIENT AND RETURN REMAINDER.
 6                                      ;WILL NOT CHECK FOR DIVIDE BY ZERO.
 7                                      ;
 8                                      ;INPUTS:
 9                                      ;       R1 - LOW  16 BITS OF DIVIDEND
10                                      ;       R2 - NEXT 16 BITS OF DIVIDEND
11                                      ;       R3 - NEXT 16 BITS OF DIVIDEND
12                                      ;       R4 - HIGH 16 BITS OF DIVIDEND
13                                      ;OUTPUTS:
14                                      ;       R1 - QUOTIENT,
15                                      ;       R2 - QUOTIENT,
16                                      ;       R3 - QUOTIENT,
17                                      ;       R4 - QUOTIENT,
18                                      ;       R5 - REMAINDER
19
20 102742                              DIV10:
   102742  010046                               MOV     R0,-(SP)                ;;PUSH R0 ON STACK
21 102744  012700  000100                       MOV     #64.,R0                 ;SET UP SHIFT COUNT
22 102750  005005                               CLR     R5                      ;START WITH ZERO REMAINDER
23 102752  006301                      1$:      ASL     R1
24 102754  006102                               ROL     R2                      ;SHIFT LEFT INTO R5
25 102756  006103                               ROL     R3
26 102760  006104                               ROL     R4
27 102762  006105                               ROL     R5
28 102764  022705  000012                       CMP     #10.,R5                 ;SILL DIVISOR GO INTO REMAINDER?
29 102770  101003                               BHI     2$                      ;ONLY SUBTRACT IF IT WILL
30 102772  162705  000012                       SUB     #10.,R5                 ;SUBTRACT DIVISOR
31 102776  005201                               INC     R1                      ;PUT A ONE INTO QUOTIENT
32 103000  005300                      2$:      DEC     R0                      ;COUNT THE SHIFTS
33 103002  001363                               BNE     1$
34 103004  012600                               MOV     (SP)+,R0                ;;POP STACK INTO R0
35 103006  000207                               RTS     PC                      ;  <R4,R3,R2,R1> AND REMAINDER IN R5
```

```
                                        ;PRINT HEX NUMBERS WITH LEADING SPACE

103010                                  T2PNTW:
103010  112700  000040                          MOVB    #' ,R0          ;STORE #'  IN R0 AND
103014  004737  075506                          JSR     PC,PRINTC       ;PRINT THE CHARACTER.
103020  010146                                  MOV     R1,-(SP)        ;;PUSH R1 ON STACK
103022  000301                                  SWAB R1
103024  004737  103050                          CALL    T2PNT           ;PRINT HIGH TWO DIGITS
103030  012601                                  MOV     (SP)+,R1        ;;POP STACK INTO R1
103032  004737  103050                          CALL    T2PNT           ;PRINT LOW TWO DIGITS
103036  000207                                  RETURN

103040                                  T2PNTB:
103040  112700  000040                          MOVB    #' ,R0          ;STORE #'  IN R0 AND
103044  004737  075506                          JSR     PC,PRINTC       ;PRINT THE CHARACTER.

                                        ;PRINT TWO HEX DIGITS FROM NUMBER IN R1

103050                                  T2PNT:
103050  010146                                  MOV     R1,-(SP)        ;;PUSH R1 ON STACK
103052  006001                                  RCR     R1                      ;SHIFT TO GET HIGH DIGIT
103054  006001                                  ROR     R1
103056  006001                                  ROR     R1
103060  006001                                  ROR     R1
103062  004737  103070                          CALL    T2PNTO          ;PRINT TWO DIGITS
103066  012601                                  MOV     (SP)+,R1        ;;POP STACK INTO R1
103070  042701  177760                  T2PNTO: BIC     #^C17,R1                ;CLEAR OTHER BITS
103074  062701  000060                          ADD     #'0,R1          ;CONVERT TO ASCII CHARACTER
103100  020127  000071                          CMP     R1,#'9          ;IF GREATER THAN A 9
103104  003402                                  BLE T2PNTD              ;  CONVERT TO A OR HIGHER
103106  062701  000007                          ADD     #<'A-'9-1>,R1   ;  FOR HEX DIGIT
103112                                  T2PNTD:
103112  110100                                  MOVB    R1,R0           ;STORE R1 IN R0 AND
103114  004737  075506                          JSR     PC,PRINTC       ;PRINT THE CHARACTER.
103120  000207                                  RETURN
```

```
 1
 2                                      ;T2GNUM
 3                                      ;
 4                                      ;GET A HEX DIGIT FROM AN ASCII INPUT STRING
 5                                      ;
 6                                      ;INPUTS:
 7                                      ;       R1 - STRING POINTER
 8                                      ;OUTPUTS:
 9                                      ;       R4 - NUMBER
10                                      ;       R1 - UPDATED STRING TO CHARACTER AFTER NUMBER
11                                      ;       R0 - COUNT OF DIGITS (0 IF END OF LINE FOUND)
12
13 103122  005000                      T2GNUM: CLR     R0                      ;CLEAR DIGIT COUNT
14 103124  105711                              TSTB    (R1)                    ;CHECK IF END OF LINE
15 103126  001442                              BEQ     T2GNX                   ;REPORT NULL CHARACTER FOUND
16 103130  121127  000040                      CMPB    (R1),#' '               ;CHECK IF A SPACE
17 103134  001002                              BNE     T2GND1                  ;IF SO, IGNORE IT
18 103136  005201                              INC     R1
19 103140  000770                              BR      T2GNUM
20 103142  005004                      T2GND1: CLR     R4                      ;CLEAR NUMBER STORAGE
21 103144                               T2GND2:
   103144  010246                              MOV     R2,-(SP)                ;;PUSH R2 ON STACK
22 103146  112102                              MOVB    (R1)+,R2                ;GET CHARACTER
23 103150  162702  000060                      SUB     #'0,R2                  ;CONVERT TO HEX DIGIT
24 103154  100431                              BMI     T2GNE
25 103156  020227  000011                      CMP     R2,#9.
26 103162  003410                              BLE  T2GND3
27 103164  020227  000021                      CMP     R2,#<'A-'0>
28 103170  103423                              BLO  T2GNE
29 103172  020227  000026                      CMP     R2,#<'F-'0>
30 103176  101020                              BHI  T2GNE
31 103200  162702  000007                      SUB     #<'A-'9-1>,R2
32 103204  006304                      T2GND3: ASL     R4
33 103206  006304                              ASL     R4
34 103210  006304                              ASL     R4
35 103212  006304                              ASL     R4
36 103214  050204                              BIS     R2,R4
37 103216  005200                              INC     R0
38 103220  012602                              MOV     (SP)+,R2                ;;POP STACK INTO R2
39 103222  105711                              TSTB    (R1)
40 103224  001403                              BEQ     T2GNX
41 103226  121127  000040                      CMPB    (R1),#' '
42 103232  001344                              BNE     T2GND2
43 103234  005700                      T2GNX:  TST     R0
44 103236  000207                              RETURN
45
46 103240                               T2GNE:
   103240  012602                              MOV     (SP)+,R2                ;;POP STACK INTO R2
   103242  012600                              MOV     (SP)+,R0                ;;POP STACK INTO R0
47 103244  000137  100340                      JMP     T2CMDE
```

USER DOCUMENTATION B1
USER DOCUMENTATION C1
USER DOCUMENTATION D1
USER DOCUMENTATION E1
USER DOCUMENTATION F1
USER DOCUMENTATION G1
USER DOCUMENTATION H1
USER DOCUMENTATION I1
USER DOCUMENTATION J1
USER DOCUMENTATION K1
USER DOCUMENTATION L1
USER DOCUMENTATION M1
USER DOCUMENTATION N1

USER DOCUMENTATION B2
USER DOCUMENTATION C2
USER DOCUMENTATION D2
USER DOCUMENTATION E2
USER DOCUMENTATION F2
USER DOCUMENTATION G2
USER DOCUMENTATION H2
USER DOCUMENTATION I2
USER DOCUMENTATION J2
USER DOCUMENTATION K2
USER DOCUMENTATION L2
USER DOCUMENTATION M2
USER DOCUMENTATION N2

USER DOCUMENTATION B3
USER DOCUMENTATION C3
USER DOCUMENTATION D3
USER DOCUMENTATION E3
USER DOCUMENTATION F3
USER DOCUMENTATION G3
USER DOCUMENTATION H3
USER DOCUMENTATION I3
USER DOCUMENTATION J3
USER DOCUMENTATION K3
USER DOCUMENTATION L3
USER DOCUMENTATION M3
USER DOCUMENTATION N3

USER DOCUMENTATION B4
USER DOCUMENTATION C4
USER DOCUMENTATION D4
USER DOCUMENTATION E4
USER DOCUMENTATION F4
USER DOCUMENTATION G4
USER DOCUMENTATION H4
USER DOCUMENTATION I4
USER DOCUMENTATION J4
USER DOCUMENTATION K4
USER DOCUMENTATION L4
USER DOCUMENTATION M4
USER DOCUMENTATION N4

USER DOCUMENTATION B5
USER DOCUMENTATION C5
USER DOCUMENTATION D5
USER DOCUMENTATION E5
USER DOCUMENTATION F5
USER DOCUMENTATION G5
USER DOCUMENTATION H5
USER DOCUMENTATION I5
USER DOCUMENTATION J5
USER DOCUMENTATION K5
USER DOCUMENTATION L5
USER DOCUMENTATION M5
USER DOCUMENTATION N5

USER DOCUMENTATION B6
USER DOCUMENTATION C6
USER DOCUMENTATION D6
USER DOCUMENTATION E6
USER DOCUMENTATION F6
USER DOCUMENTATION G6
USER DOCUMENTATION H6
USER DOCUMENTATION I6
USER DOCUMENTATION J6
USER DOCUMENTATION K6
USER DOCUMENTATION L6
USER DOCUMENTATION M6
USER DOCUMENTATION N6

USER DOCUMENTATION B7
USER DOCUMENTATION C7
USER DOCUMENTATION D7
USER DOCUMENTATION E7
USER DOCUMENTATION F7
USER DOCUMENTATION G7
USER DOCUMENTATION H7
USER DOCUMENTATION I7
USER DOCUMENTATION J7
USER DOCUMENTATION K7
USER DOCUMENTATION L7
USER DOCUMENTATION M7
USER DOCUMENTATION N7

USER DOCUMENTATION B8
USER DOCUMENTATION C8
USER DOCUMENTATION D8
USER DOCUMENTATION E8
USER DOCUMENTATION F8
USER DOCUMENTATION G8
USER DOCUMENTATION H8
USER DOCUMENTATION I8
USER DOCUMENTATION J8
USER DOCUMENTATION K8
USER DOCUMENTATION L8
USER DOCUMENTATION M8
USER DOCUMENTATION N8

USER DOCUMENTATION B9
USER DOCUMENTATION C9
USER DOCUMENTATION D9
USER DOCUMENTATION E9
USER DOCUMENTATION F9
USER DOCUMENTATION G9
USER DOCUMENTATION H9
USER DOCUMENTATION I9
USER DOCUMENTATION J9
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HOST COMMUNICATION A....H10
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COMMAND PACKET OPCOD....J10
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CONTROLLER TABLE DEF....C11
CONTROLLER TABLE DEF....D11
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GLOBAL DATA SECTION F11
GLOBAL DATA SECTION G11
GLOBAL TEXT SECTION H11
GLOBAL TEXT SECTION I11
GLOBAL TEXT SECTION J11
GLOBAL TEXT SECTION K11
GLOBAL ERROR REPORT L11
GLOBAL ERROR REPORT M11
GLOBAL ERROR REPORT N11

GLOBAL ERROR REPORT B12
GLOBAL ERROR REPORT C12
GLOBAL ERROR REPORT D12
GLOBAL SUBROUTINES S....E12
GLOBAL SUBROUTINES S....F12
GLOBAL SUBROUTINES S....G12
GLOBAL SUBROUTINES S....H12
GLOBAL SUBROUTINES S....I12
GLOBAL SUBROUTINES S....J12
GLOBAL SUBROUTINES S....K12
GLOBAL SUBROUTINES S....L12
GLOBAL SUBROUTINES S....M12
GLOBAL SUBROUTINES S....N12

GLOBAL SUBROUTINES S....B13
GLOBAL SUBROUTINES S....C13
GLOBAL SUBROUTINES S....D13
GLOBAL SUBROUTINES S....E13
GLOBAL SUBROUTINES S....F13
GLOBAL SUBROUTINES S....G13
GLOBAL SUBROUTINES S....H13
GLOBAL SUBROUTINES S....I13
GLOBAL SUBROUTINES S....J13
GLOBAL SUBROUTINES S....K13
GLOBAL SUBROUTINES S....L13
GLOBAL SUBROUTINES S....M13
GLOBAL SUBROUTINES S....N13

GLOBAL SUBROUTINES S....B14
GLOBAL SUBROUTINES S....C14
GLOBAL SUBROUTINES S....D14
GLOBAL SUBROUTINES S....E14
GLOBAL SUBROUTINES S....F14
GLOBAL SUBROUTINES S....G14
GLOBAL SUBROUTINES S....H14
GLOBAL SUBROUTINES S....I14
GLOBAL SUBROUTINES S....J14
GLOBAL SUBROUTINES S....K14
GLOBAL SUBROUTINES S....L14
GLOBAL SUBROUTINES S....M14
GLOBAL SUBROUTINES S....N14

GLOBAL SUBROUTINES S....B15
GLOBAL SUBROUTINES S....C15
GLOBAL SUBROUTINES S....D15
GLOBAL SUBROUTINES S....E15
GLOBAL SUBROUTINES S....F15
GLOBAL SUBROUTINES S....G15
GLOBAL SUBROUTINES S....H15
GLOBAL SUBROUTINES S....I15
PRE-PROGRAMMED SUBRO....J15
PRE-PROGRAMMED SUBRO....K15
PRE-PROGRAMMED SUBRO....L15
PRE-PROGRAMMED SUBRO....M15
PRE-PROGRAMMED SUBRO....N15

PRE-PROGRAMMED SUBRO....B16
PRE-PROGRAMMED SUBRO....C16
PRE-PROGRAMMED SUBRO....D16
PRE-PROGRAMMED SUBRO....E16
PRE-PROGRAMMED SUBRO....F16
PRE-PROGRAMMED SUBRO....G16
PRE-PROGRAMMED SUBRO....H16
PRE-PROGRAMMED SUBRO....I16
PRE-PROGRAMMED SUBRO....J16
PRE-PROGRAMMED SUBRO....K16
PRE-PROGRAMMED SUBRO....L16
PRE-PROGRAMMED SUBRO....M16

```
                                        ;PNTERR
                                        ;
                                        ;PRINT ERROR MESSAGE FROM DM PROGRAM REQUEST 11 OR 12.
                                        ;
                                        ;INPUTS:
                                        ;       R5 - CONTROLLER TABLE ADDRESS
                                        ;       R4 - MESSAGE DATA ADDRESS
                                        ;       R3 - COMMAND DATA ADDRESS
                                        ;OUTPUTS:
                                        ;       ERROR MESSAGE PRINTED
                                        ;       BIT     15 SET IN COMMAND DATA IF DRIVE HAS BEEN DROPPED

103250                                  PNTERR:
103250  010046                                  MOV     R0,-(SP)                ;;PUSH R0 ON STACK
103252  010146                                  MOV     R1,-(SP)                ;;PUSH R1 ON STACK
103254  010246                                  MOV     R2,-(SP)                ;;PUSH R2 ON STACK
103256  005764  000004                          TST     4(R4)                   ;GET DRIVE NUMBER
103262  002004                                  BGE 1$                          ;CHECK IF BIT 15 SET
103264  116537  000002  002074                  MOVB    C.UNIT(R5),L$LUN        ;IF SO, GET UNIT FROM CONTROLLER TABLE
103272  000416                                  BR      2$
103274                                  1$:
103274  010446                                  MOV     R4,-(SP)                ;;PUSH R4 ON STACK
103276  016401  000004                          MOV     4(R4),R1                ;GET DRIVE NUMBER
103302  004737  102274                          CALL    GTDRVT                  ;GET DRIVE TABLE ADDRESS
103306  001036                                  BNE     3$                      ;IF UNIT DROPPED, EXIT
103310  005764  000002                          TST     D.UNIT(R4)              ;SEE IF UNIT HAS BEEN DROPPED FROM TESTING
103314  100004                                  BPL     3$                      ;  PROCEED IF STILL TO BE TESTED
103316  052713  100000                          BIS     #BIT15,(R3)             ;TELL DM PROGRAM TO STOP TESTING THIS UNIT
103322  012604                                  MOV     (SP)+,R4                ;;POP STACK INTO R4
103324  000423                                  BR      4$
103326                                  3$:
103326  012604                                  MOV     (SP)+,R4                ;;POP STACK INTO R4
103330  012703  064402                  2$:     MOV     #ERRTYP,R2              ;GET POINTER TO ERROR TABLE
103334  016412  000002                          MOV     2(R4),(R2)              ;GET ERROR TYPE
103340  006112                                  ROL     (R2)
103342  006112                                  ROL     (R2)
103344  006112                                  ROL     (R2)
103346  042722  177774                          BIC     #^C3,(R2)+              ;CLEAR LOW 2 BITS
103352  016412  000002                          MOV     2(R4),(R2)
103356  042722  140000                          BIC     #140000,(R2)+           ;MASK LOW 14 BITS
103362  005022                                  CLR     (R2)+                   ;CLEAR MESSAGE POINTER
103364  012712  075250                          MOV     #ERR.IN,(R2)            ;GET ROUTINE NUMBER
103370  104460                                  TRAP    C$ERROR
103372  000241                                  CLC                             ;DRIVE HAS NOT BEEN DROPPED
103374                                  4$:
103374  012602                                  MOV     (SP)+,R2                ;;POP STACK INTO R2
103376  012601                                  MOV     (SP)+,R1                ;;POP STACK INTO R1
103400  012600                                  MOV     (SP)+,R0                ;;POP STACK INTO R0
103402  000207                                  RETURN
103404  000261                          5$:     SEC                             ;DRIVE HAS BEEN DROPPED
103406  000772                                  BR      4$
```

```
                                        ;UDAINT
                                        ;
                                        ;FUNCTIONAL DESCRIPTION:
                                        ;       SUBROUTINE TO INITIALIZE A UDA AND BRING IT ON-LINE.
                                        ;       ALL STEPS ARE CHECKED. AN ERROR MESSAGE IS REPORTED IF ANY ERROR
                                        ;       DETECTED.
                                        ;
                                        ;INPUTS:
                                        ;       R5 - ADDRESS OF CONTROLLER TABLE.
                                        ;       R4 - LENGTH, INTERRUPT AND VECTOR FIELDS TO SEND TO UDA
                                        ;IMPLICIT INPUTS:
                                        ;       FFREE - FIRST FREE ADDRESS OF MEMORY. THIS ADDRESS IS GIVEN TO UDA
                                        ;               AS START OF RING BUFFER.
                                        ;       FSIZE - SIZE OF FREE MEMORY AVAILABLE IN WORDS.
                                        ;OUTPUTS:
                                        ;       R1 - SIZE OF RING BUFFER IN WORDS IF NO ERROR,
                                        ;       R4 - ADDRESS OF UDAIP REGISTER IN UDA,
                                        ;       R5 - UNCHANGED,
                                        ;
                                        ;       Z CLR   IF NO ERROR,
                                        ;       Z SET   IF ANY ERROR REPORTED
                                        ;
                                        ;CHECK IF ENOUGH FREE MEMORY FOR RING BUFFER

104612                                  UDAINT:
104612  010346                                  MOV     R3,-(SP)                ;;PUSH R3 ON STACK
104614  010400                                  MOV     R4,R0                   ;GET MESSAGE LENGTH
104616  000300                                  SWAB    R0
104620  042700  177770                         BIC     #177770,R0
104624  004737  105550                         JSR     PC,CLOG                 ;COMPUTE LOGARITHMIC VALUE
104630  010102                                  MOV     R1,R2                   ;SAVE RESULT IN R2
104632  010400                                  MOV     R4,R0                   ;GET COMMAND LENGTH
104634  000300                                  SWAB    R0
104636  006000                                  ROR     R0
104640  006000                                  ROR     R0
104642  006000                                  ROR     R0
104644  042700  177770                         BIC     #177770,R0
104650  004737  105550                         JSR     PC,CLOG                 ;COMPUTE LOGARITHMIC VALUE
104654  060201                                  ADD     R2,R1                   ;ADD THE TWO RESULTS
104656  006301                                  ASL     R1                      ;MULTIPLY BY 2 WORDS PER RING
104660  062701  000002                         ADD     #<HC.ISZ>/2,R1          ;ADD SPACE FOR INTERRUPT INDICATORS
104664  020137  064414                         CMP     R1,FSIZE                ;COMPARE WITH SIZE OF FREE MEMORY
104670  101402                                  BLOS    1$
104672  000137  075410                         JMP     FMERR                   ;FATAL ERROR IF NOT ENOUGH MEMORY

                                        ;FILL HOST COMMUNICATION AREA WITH ALL ONES

104676  013702  064412          1$:           MOV     FFREE,R2                ;GET FIRST ADDRESS OF RING BUFFER
104702  010103                                  MOV     R1,R3                   ;GET SIZE OF RING BUFFER
104704  012722  177777          2$:           MOV     #-1,(R2)+               ;WRITE ONES TO BUFFER
104710  005303                                  DEC     R3                      ;COUNT THE WORDS IN BUFFER
104712  003374                                  BGT     2$                      ;LOOP UNTIL ENTIRE BUFFER WRITTEN

                                        ;DO THE INITIALIZATION

104714  004737  105070                         JSR     PC,UDAIS1               ;DO FIRST THREE STEPS
```

```
                104720  103460                  BCS     9$                      ;GET OUT IF UDA MICROCODE REPORTED FAILURE
                104722  012364  000002          MOV     (R3)+,2(R4)             ;WRITE NEXT WORD TO UDASA REGISTER
                104726  012700  000310          MOV     #200.,R0                ;GET TRY COUNTER
                104732  016402  000002  3$:     MOV     2(R4),R2                ;LOOK AT UDASA
                104736  001410                  BEQ     5$
                104740  100005                  BPL     4$
                104742  104455                  TRAP    C$ERDF
                104744  000030                  .WORD   24
                104746  000000                  .WORD   0
                104750  074602                  .WORD   ERR024
                104752  000443                  BR      9$

                104754  005300          4$:     DEC     R0
                104756  001365                  BNE     3$
                104760  010264  000002  5$:     MOV     R2,2(R4)                ;WRITE 0 TO UDASA (PURGE)
                104764  011402                  MOV     (R4),R2                 ;READ FROM UDAIP (POLL)
                104766  004737  105410          JSR     PC,UDARSP               ;WAIT FOR STEP OR ERROR BIT
                104772  103433                  BCS     9$                      ;GET OUT IF UDA MICROCODE REPORTED FAILURE
                104774  010146                  MOV     R1,-(SP)                ;;PUSH R1 ON STACK
                104776  004733                  JSR     PC,@(R3)+               ;CALL LAST ROUTINE
                105000  012601                  MOV     (SP)+,R1                ;;POP STACK INTO R1

                                                ;CHECK HOST COMMUNICATION AREA FOR ALL ZEROS

                105002  013702  064412          MOV     FFREE,R2                ;GET FIRST ADDRESS OF RING BUFFER
                105006  010103                  MOV     R1,R3                   ;GET SIZE OF RING BUFFER
                105010  005722          6$:     TST     (R2)+                   ;CHECK WORD IN BUFFER
                105012  001003                  BNE     7$                      ;GO TO ERROR REPORTER IF NOT ZERO
                105014  005303                  DEC     R3                      ;COUNT THE WORDS IN BUFFER
                105016  003374                  BGT     6$                      ;LOOP UNTIL ALL WORDS CHECKED
                105020  000405                  BR      8$

                105022          7$:
                105022  104455                  TRAP    C$ERDF
                105024  000027                  .WORD   23
                105026  000000                  .WORD   0
                105030  074516                  .WORD   ERR023
                105032  000413                  BR      9$

                                                ;SEND GO BIT TO UDASA REGISTER TO END INITIALIZATION

                105034  016500  000006  8$:     MOV     C.BST(R5),R0            ;GET BURST VALUE
                105040  006300                  ASL     R0                      ;SHIFT TO POSITION
                105042  006300                  ASL     R0
                105044  052700  000001          BIS     #SA.GO,R0               ;SET THE GO BIT
                105050  010064  000002          MOV     R0,2(R4)                ;SEND TO UDA
                105054  012603                  MOV     (SP)+,R3                ;;POP STACK INTO R3
                105056  000244                  CLZ                             ;CLEAR Z AS NO ERROR INDICATION
                105060  000207                  RTS     PC

                                                ;ERROR RETURN

                105062          9$:
                105062  012603                  MOV     (SP)+,R3                ;;POP STACK INTO R3
                105064  000264                  SEZ                             ;SET Z TO INDICATE ERROR OCCURRED
                105066  000207                  RTS     PC
```

```
 1
 2                                          ;LOAD DM PROGRAM FROM MEMORY SPACE TESTED DURING
 3                                          ;INITIALIZATION IN TEST 1
 4
 5 103674  017704  160532        LOADT1: MOV     @DMPROG,R4          ;GET SIZE OF DM PROGRAM IN BYTES
 6 103700  162704  000040                SUB     #DMMAIN,R4
 7 103704  013700  064432                MOV     DMPROG,R0           ;GET ADDRESS OF DM PROGRAM
 8 103710  062700  000040                ADD     #DMMAIN,R0
 9 103714  005001                        CLR     R1                  ;START WITH OFFSET OF ZERO
10
11 103716  012703  000214        LT1L1:  MOV     #<HC.BSZ*2>,R3      ;GET SIZE OF BOTH BUFFERS
12 103722  020403                        CMP     R4,R3               ;IF FEWER BYTES REMAINING IN PROGRAM
13 103724  103001                        BHIS    LT11
14 103726  010403                        MOV     R4,R3               ;USE ACTUAL BYTE COUNT
15 103730                        LT11:
   103730  010346                        MOV     R3,-(SP)            ;;PUSH R3 ON STACK
16 103732  013702  064412                MOV     FFREE,R2            ;GET ADDRESS OF BUFFER
17 103736  162702  000214                SUB     #<HC.BSZ*2>,R2
18 103742  010246                        MOV     R2,-(SP)            ;;PUSH R2 ON STACK
19 103744  012022                LT1L2:  MOV     (R0)+,(R2)+         ;MOVE DATA TO BUFFER
20 103746  162703  000002                SUB     #2,R3               ;COUNT BYTES
21 103752  001374                        BNE     LT1L2
22 103754  012602                        MOV     (SP)+,R2            ;;POP STACK INTO R2
23 103756  012603                        MOV     (SP)+,R3            ;;POP STACK INTO R3
24 103760  004737  104006                CALL    LOAD                ;LOAD INTO UDA
25 103764  001455                        BEQ     LOADER              ;IF ERROR, GET OUT NOW
26 103766  006203                        ASR     R3                  ;CONVERT BYTES TO WORDS
27 103770  060301                        ADD     R3,R1               ;INCREASE OFFSET FOR NEXT BUFFER
28 103772  006303                        ASL     R3                  ;CONVERT WORDS TO BYTES
29 103774  160304                        SUB     R3,R4               ;REDUCE REMAINING BYTE COUNT
30 103776  001347                        BNE     LT1L1               ;GET NEXT BUFFER
31 104000  012701  000040                MOV     #DMMAIN,R1          ;GET A BYTE COUNT OF HEADER ONLY
32 104004  000675                        BR      LOADB               ;NOW START
```

```
 105244  103412                         BCS     4$                      ;GET OUT IF ERROR
 105246  006337  105546                 ASL     UDARSD                  ;SHIFT TO NEXT STEP BIT
 105252  032737  040000  105546         BIT     @SA.S4,UDARSD           ;CHECK IF NOW AT STEP 4
 105260  001003                         BNE     3$                      ;GET OUT IF SO
 105262  012364  000002                 MOV     (R3)+,2(R4)             ;WRITE DATA TO UDASA REGISTER
 105266  000762                         BR      2$                      ;STAY IN LOOP

 105270  000241              3$:        CLC                             ;CLEAR CARRY FOR NO ERROR INDICATION
 105272                     4$:
 105272  012601                         MOV     (SP)+,R1                ;;POP STACK INTO R1
 105274  000207                         RTS     PC

                                        ;DATA TO BE SENT AND RECEIVED BY UDA INITIALIZATION

 105276  105314            INITBL:     .WORD   RSP.S1                  ;1ST WORD RESPONSE CHECK ROUTINE
 105300  000000            SND.S1:     .WORD   0                       ;1ST WORD TO SEND TO UDASA
 105302  105322                        .WORD   RSP.S2                  ;2ND WORD RESPONSE CHECK ROUTINE
 105304  000000            SND.S2:     .WORD   0                       ;2ND WORD TO SEND TO UDASA
 105306  105342                        .WORD   RSP.S3                  ;3RD WORD RESPONSE CHECK ROUTINE
 105310  000000            SND.S3:     .WORD   0                       ;3RD WORD TO SEND TO UDASA
 105312  105360                        .WORD   RSP.S4                  ;4TH WORD RESPONSE CHECK ROUTINE

                                        ;RESPONSE CHECK FOR FIRST WORD (STEP 1) FROM UDASA
                                        ;CHECK FOR PROPER CONTROLLER TYPE

 105314  012701  004400      RSP.S1:   MOV     @SA.S1+SA.DI,R1           ;SET STEP ONE BIT
 105320  000422                        BR      RSP.CK                    ;NOW DO A RESPONSE CHECK

                                        ;RESPONSE CHECK FOR SECOND WORD (STEP 2) FROM UDASA
                                        ;CHECK FOR ECHO OF INTI AND VECTOR

 105322  013701  105300      RSP.S2:   MOV     SND.S1,R1                 ;GET WORD SENT TO UDASA
 105326  000301                        SWAB    R1                        ;GET HIGH 8 BITS
 105330  042701  177400                BIC     @177400,R1
 105334  052701  010000                BIS     @SA.S2,R1                 ;SET STEP 2 BIT
 105340  000412                        BR      RSP.CK                    ;NOW DO A RESPONSE CHECK

                                        ;RESPONSE CHECK FOR THIRD WORD (STEP 3) FROM UDASA
                                        ;CHECK FOR ECHO OF MESSAGE AND COMMAND RING LENGTHS

 105342  013701  105300      RSP.S3:   MOV     SND.S1,R1                 ;GET WORD SENT TO UDASA
 105346  042701  177400                BIC     @177400,R1                ;JUST LOW 8 BITS
 105352  052701  020000                BIS     @SA.S3,R1                 ;SET STEP 3 BIT
 105356  000403                        BR      RSP.CK                    ;NOW DO A RESPONSE CHECK

                                        ;RESPONSE CHECK FOR FOURTH WORD (STEP 4) FROM UDASA
                                        ;CHECK FOR ECHO OF PURGE AND LFAIL BITS

 105360  010201      RSP.S4:   MOV     R2,R1                     ;GET RESPONSE FROM UDA AND
 105362  010237  105406          MOV     R2,SSTEP4                 ;SAVE STEP 4 VALUE.

                                        ;RESPONSE CHECK, COMPARE EXPECTED DATA IN R1 WITH ACTUAL DATA IN R2

 105366  020102      RSP.CK:   CMP     R1,R2                     ;COMPARE THE DATA
 105370  001405                BEQ     1$                        ;EXIT IF COMPARED CORRECTLY
                                                                  ;ERROR, 'UDA DID NOT RETURN CORRECT DATA IN
                                                                  ;        UDASA REGISTER DURING INITIALIZATION'
```

```
    105 105372  104455                      TRAP    C$ERDF
        105374  000031                      .WORD   25
        105376  000000                      .WORD   0
        105400  074616                      .WORD   ERR025
    106 105402  000261                      SEC
    107 105404  000207              1$:     RTS     PC
    108
    109 105406  000000              SSTEP4: .WORD   0                       ;SAVE STEP 4 VALUE HERE
```

Cross reference table (CREF V05.00)

	207-66#	207-73	207-73#												
T$EXCP	130-64	130-64#	218-65	218-65#	218-67	218-67#	218-69	218-69#	218-71	218-71#	218-73	218-73#	220-12	220-12#	
	220-15	220-15#													
T$FLAG	186-169	186-169#	186-169#	197-31	197-31	197-31#	197-31#	200-28	200-28	200-28#	200-28#	201-19	201-19#	201-19#	
	202-20	202-20#	202-20#	203-70	203-70	203-70#	203-70#	216-54	216-54	216-54#	216-54#				
T$FREE	220-100	221-24#													
T$CMAN	83-374#	130-64	130-64#	130-64#											
T$HILI	130-64	130-64#	218-65	218-65#	218-67	218-67#	218-69	218-69#	218-71	218-71#	218-73	218-73#	220-12	220-12#	
	220-15	220-15#													
T$LAST	83-374#	220-100#	221-15												
T$LOLI	130-64	130-64#	218-65	218-65#	218-67	218-67#	218-69	218-69#	218-71	218-71#	218-73	218-73#	220-12	220-12#	
	220-15	220-15#													
T$LSYM	83-374	83-374#	86-27	87-30	106-28	106-32	106-36	106-40	106-45	106-49	106-54	106-58	106-62	106-84	
	106-89	106-103	106-107	106-111	106-116	106-120	106-124	106-128	106-133	106-137	106-142	106-146	106-150	106-155	
	106-159	106-163	106-167	106-214	171-13	172-22	181-10	181-14	186-200	198-43	199-18	200-43	201-34	202-35	
	204-17	205-16	206-33	207-79	208-5	209-8	210-9	210-29	211-40	212-34	216-73	218-79	220-32		
T$LTNO	220-100#														
T$NEST	83-374#	83-401	83-401	83-401#	86-10	86-10	86-10#	86-27	86-27	86-27	86-27#	87-10	87-10	87-10#	
	87-30	87-30	87-30	87-30#	87-31	87-31	87-31	87-31#	88-51	88-51	88-51#	106-26	106-26	106-26#	
	106-28	106-28	106-28	106-28#	106-30	106-30	106-30#	106-32	106-32	106-32	106-32#	106-34	106-34	106-34#	
	106-36	106-36	106-36	106-36#	106-38	106-38	106-38#	106-40	106-40	106-40	106-40#	106-43	106-43	106-43#	
	106-45	106-45	106-45	106-45#	106-47	106-47	106-47#	106-49	106-49	106-49	106-49#	106-52	106-52	106-52#	
	106-54	106-54	106-54	106-54#	106-56	106-56	106-56#	106-58	106-58	106-58	106-58#	106-60	106-60	106-60#	
	106-62	106-62	106-62	106-62#	106-75	106-75	106-75#	106-84	106-84	106-84	106-84#	106-86	106-86	106-86#	
	106-89	106-89	106-89	106-89#	106-91	106-91	106-91#	106-103	106-103	106-103	106-103#	106-105	106-105	106-105#	
	106-107	106-107	106-107	106-107#	106-109	106-109	106-109#	106-111	106-111	106-111	106-111#	106-114	106-114	106-114#	
	106-116	106-116	106-116	106-116#	106-118	106-118	106-118#	106-120	106-120	106-120	106-120#	106-122	106-122	106-122#	
	106-124	106-124	106-124	106-124#	106-126	106-126	106-126#	106-128	106-128	106-128	106-128#	106-131	106-131	106-131#	
	106-133	106-133	106-133	106-133#	106-135	106-135	106-135#	106-137	106-137	106-137	106-137#	106-139	106-139	106-139#	
	106-142	106-142	106-142	106-142#	106-144	106-144	106-144#	106-146	106-146	106-146	106-146#	106-148	106-148	106-148#	
	106-150	106-150	106-150	106-150#	106-152	106-152	106-152#	106-155	106-155	106-155	106-155#	106-157	106-157	106-157#	
	106-159	106-159	106-159	106-159#	106-161	106-161	106-161#	106-163	106-163	106-163	106-163#	106-165	106-165	106-165#	
	106-167	106-167	106-167	106-167#	106-193	106									

```
    108 107062  016503  000204                  MOV     D.SERN+4(R5),R3
    109 107066  005004                          CLR     R4
    110 107070  004737  102742          2$:     CALL    DIV10                   ;DIVIDE BY 10
    111 107074  062705  000060                  ADD     #'0,R5                  ;CONVERT TO ASCII CHARACTER
    112 107100  110540                          MOVB    R5,-(R0)                ;PUT DIGIT INTO TEMP STORAGE
    113 107102  010146                          MOV     R1,-(SP)
    114 107104  050216                          BIS     R2,(SP)                 ;SEE IF QUOTIENT IS ZERO
    115 107106  050316                          BIS     R3,(SP)
    116 107110  050426                          BIS     R4,(SP)+
    117 107112  001366                          BNE     2$                      ;IF NOT, DIVIDE AGAIN
    118 107114  012601                          MOV     (SP)+,R1                ;;POP STACK INTO R1
    119 107116  016146  000164                  MOV     D.XFRW(R1),-(SP)
        107122  016146  000166                  MOV     D.XFRR(R1),-(SP)
        107126  016146  000174                  MOV     D.SEEK(R1),-(SP)
        107132  012746  064476                  MOV     #TEMP,-(SP)
        107136  011146                          MOV     (R1),-(SP)
        107140  016146  000002                  MOV     D.UNIT(R1),-(SP)
        107144  012746  107534                  MOV     #RPTMSD,-(SP)
        107150  012746  000007                  MOV     #7,-(SP)
        107154  010600                          MOV     SP,R0
        107156  104416                          TRAP    C$PNTS
        107160  062706  000020                  ADD     #20,SP
    121 107164  016146  000176                  MOV     D.ECCC(R1),-(SP)
        107170  016146  000172                  MOV     D.SERR(R1),-(SP)
        107174  016146  000170                  MOV     D.HERR(R1),-(SP)
        107200  012746  107603                  MOV     #RPTMD2,-(SP)
        107204  012746  000004                  MOV     #4,-(SP)
        107210  010600                          MOV     SP,R0
        107212  104416                          TRAP    C$PNTS
        107214  062700  000012                  ADD     #12,SP
    145 107220  012605                          MOV     (SP)+,R5                ;;POP STACK INTO R5
        107222  012604                          MOV     (SP)+,R4                ;;POP STACK INTO R4
        107224  012603                          MOV     (SP)+,R3                ;;POP STACK INTO R3
    146 107226  005303                  RPTDTN: DEC     R3                      ;COUNT THE DRIVE TABLES
    147 107230  003265                          BGT RPTDT\                      ;REPEAT FOR ALL DRIVE TABLES
    148 107232  062705  000046          RPTCTN: ADD     #C.SIZE,R5              ;GO TO NEXT CONTROLLER TABLE
    149 107236  005715                          TST     (R5)
    154 107240  001251                          BNE     RPTCT
    156 107242                          RPTXX:
        107242  012605                          MOV     (SP)+,R5                ;;POP STACK INTO R5
        107244  012604                          MOV     (SP)+,R4                ;;POP STACK INTO R4
        107246  012603                          MOV     (SP)+,R3                ;;POP STACK INTO R3
        107250  012602                          MOV     (SP)+,R2                ;;POP STACK INTO R2
        107252  012601                          MOV     (SP)+,R1                ;;POP STACK INTO R1
        107254  012600                          MOV     (SP)+,R0                ;;POP STACK INTO R0
    168
    169 107256  000167                          .WORD   J$JMP
        107260  000344                          .WORD   L10042-2-.
    170
    174 107262     116     042     124  RPTMSG: .ASCIZ  \N"TEST "D3" IN PROGRESS.  "\
    175 107316     116     042     125  RPTMSH: .ASCII  \N"UNIT DRIVE      SERIAL NUMBER SEEKS MBYTES  MBYTES  HARD   SOFT    ECC"N\
    176 107430     042     040     040          .ASCIZ  \"                                  X1000  READ  WRITTEN ERRORS ERRORS"N\
    177 107534     045     123     062  RPTMSD: .ASCIZ  \%S2%D2%S3%D3%S1%T%S1%D5%S2%D5%S3%D5%S2\
    178 107603     045     104     065  RPTMD2: .ASCIZ  \%D5%S2%D5%S1%D5%N\
    198                                          .EVEN
    199
    200 107626                          L10042:
```

```
 1
 2                                      ;CLOG
 3                                      ;
 4                                      ;COMPUTE LOGARITHMIC VALUE OF NUMBER TO BASE 2.
 5                                      ;
 6                                      ;INPUTS:
 7                                      ;       R0 - LOGARITHM TO BE CONVERTED
 8                                      ;OUTPUTS:
 9                                      ;       R1 - VALUE OF 2 RAISED TO POWER OF INPUT NUMBER
10
11 105550                              CLOG:
   105550  010046                              MOV     R0,-(SP)                ;;PUSH R0 ON STACK
12 105552  005001                              CLR     R1                      ;SET UP ZERO START VALUE
13 105554  000261                              SEC                             ;WITH CARRY READY TO SHIFT IN
14 105556  006101                      1$:     ROL     R1                      ;SHIFT TO LEFT
15 105560  005300                              DEC     R0                      ;UNTIL R0
16 105562  100375                              BPL     1$                      ;GOES NEGATIVE
17 105564  012600                              MOV     (SP)+,R0                ;;POP STACK INTO R0
18 105566  000207                              RTS     PC
```

```
                                ;CLOG
                                ;
                                ;COMPUTE LOGARITHMIC VALUE OF NUMBER TO BASE 2.
                                ;
                                ;INPUTS:
                                ;       R0 - LOGARITHM TO BE CONVERTED
                                ;OUTPUTS:
                                ;       R1 - VALUE OF 2 RAISED TO POWER OF INPUT NUMBER
                                ;
105550                          CLOG:
105550  010046                          MOV     R0,-(SP)        ;;PUSH R0 ON STACK
105552  005001                          CLR     R1              ;SET UP ZERO START VALUE
105554  000261                          SEC                     ;WITH CARRY READY TO SHIFT IN
105556  006101                  1$:     ROL     R1              ;SHIFT TO LEFT
105560  005300                          DEC     R0              ;UNTIL R0
105562  100375                          BPL     1$              ;GOES NEGATIVE
105564  012600                          MOV     (SP)+,R0        ;;POP STACK INTO R0
105566  000207                          RTS     PC
```

```
 1
 2                                      ;APRINT
 3                                      ;
 4                                      ;CONVERT AN 18 BIT ADDRESS STORED IN TWO WORDS INTO A FORMAT
 5                                      ;THAT WILL ALLOW PRINTING OF THE 18 BIT NUMBER.
 6                                      ;
 7                                      ;INPUTS:
 8                                      ;       R0 - ADDRESS OF TWO WORD BLOCK CONTAINING ADDRESS.
 9                                      ;               FIRST WORD CONTAINING LOW 16 BITS.
10                                      ;               SECOND WORD CONTAINING HIGH 2 BITS.
11                                      ;OUTPUTS:
12                                      ;       R1 - HIGH 3 BITS OF ADDRESS
13                                      ;       R2 - LOW 15 BITS OF ADDRESS
14
15 104472  016001  000002          APRINT: MOV     2(R0),R1                ;GET HIGH 2 BITS
16 104476  006301                          ASL     R1                      ;SHIFT LEFT
17 104500  011002                          MOV     (R0),R2                 ;GET LOW 16 BITS
18 104502  100001                          BPL     APRIZ                   ;IF 16TH BIT SET
19 104504  005201                          INC     R1                      ;PLACE IT IN WITH HIGH 2 BITS
20 104506  000207                  APRIZ:  RETURN
```

```
                                ;RDREC
                                ;
                                ;READ A RECORD FROM THE INPUT FILE. PLACE DATA INTO FREE MEMORY.
                                ;
                                ;INPUTS:
                                ;       R1 - FILE TYPE
                                ;               1 - UDA52 TEST 1 DM PROGRAM
                                ;               2 - UDA52 TEST 2 DM PROGRAM
                                ;               3 - UDA52 TEST 3 DM PROGRAM
                                ;               4 - TEST 4 QUESTIONS
                                ;               5 - UDA52 TEST 4 DM PROGRAM
                                ;               6 - DRIVE DIAGNOSTIC DOWNLINE LOAD PROGRAM
                                ;       DLLNAM - IF R1 CONTAINS 6, TWO WORDS AT THIS ADDRESS CONTAIN
                                ;               NAME OF PROGRAM IN RAD50.
                                ;       R5 - ADJUSTED ADDRESS WHERE TO BRING DATA INTO.
                                ;OUTPUTS:
                                ;       DATA FROM RECORD IN MEMORY
                                ;       CARRY CLEAR IF NO ERROR, CARRY SET IF ERROR

105630                          RDREC:
105630  010046                          MOV     R0,-(SP)                ;;PUSH R0 ON STACK
105632  010146                          MOV     R1,-(SP)                ;;PUSH R1 ON STACK
105634  010246                          MOV     R2,-(SP)                ;;PUSH R2 ON STACK
105636  010346                          MOV     R3,-(SP)                ;;PUSH R3 ON STACK
105640  010446                          MOV     R4,-(SP)                ;;PUSH R4 ON STACK
105642  010546                          MOV     R5,-(SP)                ;;PUSH R5 ON STACK
105644  005037  064442                  CLR     FNUM
105650  005737  064474                  TST     FILOPN                  ;SEE IF FILE ALREADY OPEN
105654  001005                          BNE     RDSTS
105656  012700  064456                  MOV     #FNAME,R0
105662  104434                          TRAP    C$OPEN
105664  005237  064474                  INC     FILOPN                  ;AND MARK AS OPEN
105670  005105                  RDSTS:  COM     R5                      ;COMPLEMENT LOAD ADDRESS (SEARCH MODE)
105672                          RDST:                                   ;>>>>>>>>>>BREAK BACK TO MONITOR<<<<<<<<<<
105672  104422                          TRAP    C$BRK
                                                                        ;READ A BYTE FROM FILE
105674  104426                          TRAP    C$GETB
105676  110004                          MOVB    R0,R4
105700  005704                          TST     R4                      ;IF ZERO
105702  001773                          BEQ     RD                      ; KEEP READING
105704  022704  000001                  CMP     #1,R4                   ;WHEN NOT ZERO
105710  001142                          BNE     RWRDE1                  ; IT BETTER BE A ONE
                                                                        ;READ A BYTE FROM FILE
105712  104426                          TRAP    C$GETB
105714  060004                          ADD     R0,R4
105716  005700                          TST     R0                      ; IF ZERO, PROCESS DATA
105720  001431                          BEQ     RDDAT
105722  020001                          CMP     R0,R1                   ;CHECK IF TYPE OF FILE LOOKING FOR
105724  103427                          BLO     RDDAT                   ;IF TOO SOON IN FILE, KEEP SEARCHING
105726  101121                          BHI     RDERR                   ;IF PAST TYPE, GIVE ERROR RETURN
105730  004737  106150                  CALL    FWORD                   ;GET NEXT TWO WORDS
105734  013702  064472                  MOV     FDATA,R2
105740  004737  106150                  CALL    FWORD
                                                                        ;READ A BYTE FROM FILE
105744  104426                          TRAP    C$GETB
105746  060004                          ADD     R0,R4                   ;ADD TO COMPUTED SUM
```

```
 1
 2                                      ;UDASRV
 3                                      ;
 4                                      ;UDA INTERRUPT SERVICE ROUTINE. MARKS UDA CONTROLLER TABLE THAT AN
 5                                      ;INTERRUPT HAS BEEN RECEIVED.
 6                                      ;
 7                                      ;THIS ROUTINE IS CALLED BY A [JSR R0,UDASRV] INSTRUCTION FROM WITHIN
 8                                      ;THE CONTROLLER TABLE. THE PC STORED IN R0 IS THE ADDRESS OF THE C.FLG
 9                                      ;WORD IN THE CONTROLLER TABLE. THE STACK CONTAINS THE SAVED CONTENTS
10                                      ;OF R0 FOLLOWED BY THE INTERRUPTED PC AND PS.
11                                      ;
12                                      ;INPUTS:
13                                      ;       R0 - ADDRESS OF C.FLG WORD IN CONTROLLER TABLE
14                                      ;       STACK - SAVED CONTENTS OF R0
15                                      ;OUTPUTS:
16                                      ;       CT.CMD CLEARED AND CT.MSG SET IN C.FLG WORD OF CONTROLLER TABLE
17                                      ;       R0 - RESTORED FROM STACK
18
19 104520                              UDASRV::
20 104520  052710  000010                   BIS     #CT.MSG,(R0)            ;SET CT.MSG
21 104524  012600                           MOV     (SP)+,R0                ;;POP STACK INTO R0
22 104526                              L10037:
   104526  000002                           RTI
```

```
 1
 2                                      ;SETTO
 3                                      ;
 4                                      ;SET TIMEOUT COUNTER TO SOME NUMBER OF SECONDS FROM CURRENT TIME.
 5                                      ;
 6                                      ;INPUTS:
10                                      ;       R0 - NUMBER OF SECONDS FOR TIMEOUT
11                                      ;       R1 - ADDRESS WHERE TWO WORD TIME TO BE PUT
12                                      ;OUTPUTS:
13                                      ;       R0 - CONTENTS DESTROYED
14                                      ;       R1 - INCREMENTED BY 2
15
16                                      ;COMPUTE CLOCK TICKS TIL TIMEOUT
17
28 104530                               SETTO:
   104530  010246                              MOV     R2,-(SP)                ;;PUSH R2 ON STACK
   104532  010346                              MOV     R3,-(SP)                ;;PUSH R3 ON STACK
30 104534  005002                              CLR     R2                      ;CLEAR PRODUCT
31 104536  013703  064624                      MOV     KW.HZ,R3                ;GET MULTIPLICAND
46 104542  006200                      SETO0:  ASR     R0                      ;SHIFT MULTIPLIER TO RIGHT
47 104544  103001                              BCC     SETO1                   ;IF A ONE BIT SHIFTED OUT
48 104546  060302                              ADD     R3,R2                   ;  ADD MULTIPLICAND TO PRODUCT
49 104550  006303                      SETO1:  ASL     R3                      ;DOUBLE THE MULTIPLICAND
50 104552  005700                              TST     R0
51 104554  001372                              BNE     SETO0                   ;CONTINUE UNTIL MULTIPLIER IS ZERO
53                                              ;GET CURRENT TIME
54
55 104556  013700  064626          SETO2:  MOV     KW.EL,R0                ;GET TIME
56 104562  013703  064630                  MOV     KW.EL+2,R3
57 104566  020037  064626                  CMP     R0,KW.EL                ;IF CHANGED DURING RETRIEVAL
58 104572  001371                          BNE     SETO2                   ;  GET IT AGAIN
59
60                                      ;ADD TIME TIL TIMEOUT
61
62 104574  060200                      ADD     R2,R0                   ;ADD
63 104576  005503                      ADC     R3
67
68                                      ;PUT RESULT IN STORAGE
69
70 104600  010021                      MOV     R0,(R1)+
71 104602  010311                      MOV     R3,(R1)
72
76 104604  012603                      MOV     (SP)+,R3                ;;POP STACK INTO R3
   104606  012602                      MOV     (SP)+,R2                ;;POP STACK INTO R2
78 104610  000207                      RETURN
```

```
 1
 2                                      ;UDAINT
 3                                      ;
 4                                      ;FUNCTIONAL DESCRIPTION:
 5                                      ;       SUBROUTINE TO INITIALIZE A UDA AND BRING IT ON-LINE.
 6                                      ;       ALL STEPS ARE CHECKED. AN ERROR MESSAGE IS REPORTED IF ANY ERROR
 7                                      ;       DETECTED.
 8                                      ;
 9                                      ;INPUTS:
10                                      ;       R5 - ADDRESS OF CONTROLLER TABLE.
11                                      ;       R4 - LENGTH, INTERRUPT AND VECTOR FIELDS TO SEND TO UDA
12                                      ;IMPLICIT INPUTS:
13                                      ;       FFREE - FIRST FREE ADDRESS OF MEMORY. THIS ADDRESS IS GIVEN TO UDA
14                                      ;               AS START OF RING BUFFER.
15                                      ;       FSIZE - SIZE OF FREE MEMORY AVAILABLE IN WORDS.
16                                      ;OUTPUTS:
17                                      ;       R1 - SIZE OF RING BUFFER IN WORDS IF NO ERROR,
18                                      ;       R4 - ADDRESS OF UDAIP REGISTER IN UDA,
19                                      ;       R5 - UNCHANGED,
20                                      ;
21                                      ;       Z CLR   IF NO ERROR,
22                                      ;       Z SET   IF ANY ERROR REPORTED
23                                      ;
24                                      ;CHECK IF ENOUGH FREE MEMORY FOR RING BUFFER
25
26 104612                               UDAINT:
   104612  010346                               MOV     R3,-(SP)                ;;PUSH R3 ON STACK
27 104614  010400                               MOV     R4,R0                   ;GET MESSAGE LENGTH
28 104616  000300                               SWAB    R0
29 104620  042700  177770                       BIC     #177770,R0
30 104624  004737  105550                       JSR     PC,CLOG                 ;COMPUTE LOGARITHMIC VALUE
31 104630  010102                               MOV     R1,R2                   ;SAVE RESULT IN R2
32 104632  010400                               MOV     R4,R0                   ;GET COMMAND LENGTH
33 104634  000300                               SWAB    R0
34 104636  006000                               ROR     R0
35 104640  006000                               ROR     R0
36 104642  006000                               ROR     R0
37 104644  042700  177770                       BIC     #177770,R0
38 104650  004737  105550                       JSR     PC,CLOG                 ;COMPUTE LOGARITHMIC VALUE
39 104654  060201                               ADD     R2,R1                   ;ADD THE TWO RESULTS
40 104656  006301                               ASL     R1                      ;MULTIPLY BY 2 WORDS PER RING
41 104660  062701  000002                       ADD     #<HC.ISZ>/2,R1          ;ADD SPACE FOR INTERRUPT INDICATORS
42 104664  020137  064414                       CMP     R1,FSIZE                ;COMPARE WITH SIZE OF FREE MEMORY
43 104670  101402                               BLOS    1$
44 104672  000137  075410                       JMP     FMERR                   ;FATAL ERROR IF NOT ENOUGH MEMORY
45
46                                      ;FILL HOST COMMUNICATION AREA WITH ALL ONES
47
48 104676  013702  064412              1$:      MOV     FFREE,R2                ;GET FIRST ADDRESS OF RING BUFFER
49 104702  010103                               MOV     R1,R3                   ;GET SIZE OF RING BUFFER
50 104704  012722  177777              2$:      MOV     #-1,(R2)+               ;WRITE ONES TO BUFFER
51 104710  005303                               DEC     R3                      ;COUNT THE WORDS IN BUFFER
52 104712  003374                               BGT     2$                      ;LOOP UNTIL ENTIRE BUFFER WRITTEN
53
54                                      ;DO THE INITIALIZATION
55
56 104714  004737  105070                       JSR     PC,UDAIS1               ;DO FIRST THREE STEPS
```

```
 57 104720  103460                    BCS     9$                      ;GET OUT IF UDA MICROCODE REPORTED FAILURE
 58 104722  012364  000002            MOV     (R3)+,2(R4)             ;WRITE NEXT WORD TO UDASA REGISTER
 59 104726  012700  000310            MOV     #200.,R0                ;GET TRY COUNTER
 60 104732  016402  000002    3$:     MOV     2(R4),R2                ;LOOK AT UDASA
 61 104736  001410                    BEQ     5$
 62 104740  100005                    BPL     4$
 63 104742  104455                    TRAP    C$ERDF
    104744  000030                    .WORD   24
    104746  000000                    .WORD   0
    104750  074602                    .WORD   ERR024
 64 104752  000443                    BR      9$
 65
 66 104754  005300            4$:     DEC     R0
 67 104756  001365                    BNE     3$
 68 104760  010264  000002    5$:     MOV     R2,2(R4)                ;WRITE 0 TO UDASA (PURGE)
 69 104764  011402                    MOV     (R4),R2                 ;READ FROM UDAIP (POLL)
 70 104766  004737  105410            JSR     PC,UDARSP               ;WAIT FOR STEP OR ERROR BIT
 71 104772  103433                    BCS     9$                      ;GET OUT IF UDA MICROCODE REPORTED FAILURE
 72 104774  010146                    MOV     R1,-(SP)                ;;PUSH R1 ON STACK
 73 104776  004733                    JSR     PC,@(R3)+               ;CALL LAST ROUTINE
 74 105000  012601                    MOV     (SP)+,R1                ;;POP STACK INTO R1
 75
 76                                   ;CHECK HOST COMMUNICATION AREA FOR ALL ZEROS
 77
 78 105002  013702  064412            MOV     FFREE,R2                ;GET FIRST ADDRESS OF RING BUFFER
 79 105006  010103                    MOV     R1,R3                   ;GET SIZE OF RING BUFFER
 80 105010  005722            6$:     TST     (R2)+                   ;CHECK WORD IN BUFFER
 81 105012  001003                    BNE     7$                      ;GO TO ERROR REPORTER IF NOT ZERO
 82 105014  005303                    DEC     R3                      ;COUNT THE WORDS IN BUFFER
 83 105016  003374                    BGT     6$                      ;LOOP UNTIL ALL WORDS CHECKED
 84 105020  000405                    BR      8$
 85
 86 105022                    7$:
    105022  104455                    TRAP    C$ERDF
    105024  000027                    .WORD   23
    105026  000000                    .WORD   0
    105030  074516                    .WORD   ERR023
 87 105032  000413                    BR      9$
 88
 89                                   ;SEND GO BIT TO UDASA REGISTER TO END INITIALIZATION
 90
 91
100 105034  016500  000006    8$:     MOV     C.BST(R5),R0            ;GET BURST VALUE
102 105040  006300                    ASL     R0                      ;SHIFT TO POSITION
103 105042  006300                    ASL     R0
104 105044  052700  000001            BIS     #SA.GO,R0               ;SET THE GO BIT
105 105050  010064  000002            MOV     R0,2(R4)                ;SEND TO UDA
106 105054  012603                    MOV     (SP)+,R3                ;;POP STACK INTO R3
107 105056  000244                    CLZ                             ;CLEAR Z AS NO ERROR INDICATION
108 105060  000207                    RTS     PC
109
110                                   ;ERROR RETURN
111
112 105062                    9$:
    105062  012603                    MOV     (SP)+,R3                ;;POP STACK INTO R3
113 105064  000264                    SEZ                             ;SET Z TO INDICATE ERROR OCCURRED
114 105066  000207                    RTS     PC
```

```
                                ;UDAIST
                                ;
                                ;START THE INITIALIZATION PROCESS ON THE SELECTED UDA.
                                ;STOP BEFORE WRITING THE THIRD WORD SO UDA DOES NOT
                                ;ATTEMPT ANY UNIBUS TRANSFERS.
                                ;
                                ;INPUTS:
                                ;       R5 - ADDRESS OF CONTROLLER TABLE
                                ;       R4 - LEN, INTI AND VECTOR FIELDS TO SEND TO UDA
                                ;
                                ;LOAD TABLE OF DATA TO SEND TO UDASA REGISTER

105070                          UDAIST:                                 ;>>>>>>>>>>BREAK BACK TO MONITOR<<<<<<<<<<
105070  104422                          TRAP    C$BRK
105072  010146                          MOV     R1,-(SP)                ;;PUSH R1 ON STACK
105074  052704  100000                  BIS     @SA.STP,R4              ;SET STEP BIT IN DATA WORD
105100  010437  105300                  MOV     R4,SND.S1               ;LOAD SEND DATA FOR STEP 1 OF UDA INIT
105104  013737  064412  105304          MOV     FFREE,SND.S2            ;GET MEMORY ADDRESS AND
105112  062737  000004  105304          ADD     @HC.MSG,SND.S2          ;LOAD SEND DATA FOR STEP 2 OF UDA INIT
105120  012737  100000  105310          MOV     @SA.TST,SND.S3          ;LOAD SEND DATA FOR STEP 3 OF UDA INIT

                                ;START THE INITIALIZATION BY WRITING TO UDAIP REGISTER

105126  016504  000000                  MOV     C.UADR(R5),R4           ;GET ADDRESS OF UDAIP REGISTER
105132  005037  064636                  CLR     NXMAD                   ;CLEAR MEMORY ERROR FLAG
                                                                        ;SETUP TIMEOUT ERROR VECTOR
105136  012746  000340                  MOV     @PRI07,-(SP)
105142  012746  104510                  MOV     @NXMI,-(SP)
105146  012746  000004                  MOV     @ERRVEC,-(SP)
105152  012746  000003                  MOV     @3,-(SP)
105156  104437                          TRAP    C$SVEC
105160  062706  000010                  ADD     @10,SP
105164  005764  000002                  TST     2(R4)                   ;ACCESS UDASA REGISTER
105170  005014                          CLR     (R4)                    ;WRITE TO UDAIP
                                                                        ;RETURN TIMEOUT ERROR VECTOR
105172  012700  000004                  MOV     @ERRVEC,R0
105176  104436                          TRAP    C$CVEC
105200  005737  064636                  TST     NXMAD                   ;SEE IF A MEMORY ERROR OCCURRED
105204  001406                          BEQ     1$
105206  104455                          TRAP    C$ERDF
105210  000046                          .WORD   38
105212  000000                          .WORD   0
105214  075044                          .WORD   ERR038
105216  000261                          SEC
105220  000424                          BR      4$

                                ;SET UP LOOP PARAMETERS TO EXECUTE THE FOUR STEPS OF INITIALIZATION

105222  012737  004000  105546  1$:     MOV     @SA.S1,UDARSD           ;STORE RESPONSE MASK
105230  012703  105276                  MOV     @INITBL,R3              ;GET INDEX TO UDA SEND/REPOND INITIALIZE TABLE

                                ;WAIT FOR AND CHECK RESPONSE DATA

105234  004737  105410          2$:     JSR     PC,UDARSP               ;WAIT FOR STEP OR ERROR BITS
105240  103414                          BCS     4$                      ;EXIT IF ERROR
105242  004733                          JSR     PC,@(R3)+               ;CALL RESPONSE CHECKER FOR STEP
```

```
 49 105244  103412                          BCS     4$                      ;GET OUT IF ERROR
 50 105246  006337  105546                  ASL     UDARSD                  ;SHIFT TO NEXT STEP BIT
 51 105252  032737  040000  105546          BIT     #SA.S4,UDARSD           ;CHECK IF NOW AT STEP 4
 52 105260  001003                          BNE     3$                      ;GET OUT IF SO
 53 105262  012364  000002                  MOV     (R3)+,2(R4)             ;WRITE DATA TO UDASA REGISTER
 54 105266  000762                          BR      2$                      ;STAY IN LOOP
 55
 56 105270  000241                  3$:     CLC                             ;CLEAR CARRY FOR NO ERROR INDICATION
 57 105272                          4$:
    105272  012601                          MOV     (SP)+,R1                ;;POP STACK INTO R1
 58 105274  000207                          RTS     PC
 59
 60                                         ;DATA TO BE SENT AND RECEIVED BY UDA INITIALIZATION
 61
 62 105276  105314                  INITBL: .WORD   RSP.S1                  ;1ST WORD RESPONSE CHECK ROUTINE
 63 105300  000000                  SND.S1: .WORD   0                       ;1ST WORD TO SEND TO UDASA
 64 105302  105322                          .WORD   RSP.S2                  ;2ND WORD RESPONSE CHECK ROUTINE
 65 105304  000000                  SND.S2: .WORD   0                       ;2ND WORD TO SEND TO UDASA
 66 105306  105342                          .WORD   RSP.S3                  ;3RD WORD RESPONSE CHECK ROUTINE
 67 105310  000000                  SND.S3: .WORD   0                       ;3RD WORD TO SEND TO UDASA
 68 105312  105360                          .WORD   RSP.S4                  ;4TH WORD RESPONSE CHECK ROUTINE
 69
 70                                         ;RESPONSE CHECK FOR FIRST WORD (STEP 1) FROM UDASA
 71                                         ;CHECK FOR PROPER CONTROLLER TYPE
 72
 73 105314  012701  004400          RSP.S1: MOV     #SA.S1+SA.DI,R1         ;SET STEP ONE BIT
 74 105320  000422                          BR      RSP.CK                  ;NOW DO A RESPONSE CHECK
 75
 76                                         ;RESPONSE CHECK FOR SECOND WORD (STEP 2) FROM UDASA
 77                                         ;CHECK FOR ECHO OF INTI AND VECTOR
 78
 79 105322  013701  105300          RSP.S2: MOV     SND.S1,R1               ;GET WORD SENT TO UDASA
 80 105326  000301                          SWAB    R1                      ;GET HIGH 8 BITS
 81 105330  042701  177400                  BIC     #177400,R1
 82 105334  052701  010000                  BIS     #SA.S2,R1               ;SET STEP 2 BIT
 83 105340  000412                          BR      RSP.CK                  ;NOW DO A RESPONSE CHECK
 84
 85                                         ;RESPONSE CHECK FOR THIRD WORD (STEP 3) FROM UDASA
 86                                         ;CHECK FOR ECHO OF MESSAGE AND COMMAND RING LENGTHS
 87
 88 105342  013701  105300          RSP.S3: MOV     SND.S1,R1               ;GET WORD SENT TO UDASA
 89 105346  042701  177400                  BIC     #177400,R1              ;JUST LOW 8 BITS
 90 105352  052701  020000                  BIS     #SA.S3,R1               ;SET STEP 3 BIT
 91 105356  000403                          BR      RSP.CK                  ;NOW DO A RESPONSE CHECK
 92
 93                                         ;RESPONSE CHECK FOR FOURTH WORD (STEP 4) FROM UDASA
 94                                         ;CHECK FOR ECHO OF PURGE AND LFAIL BITS
 95
 96 105360  010201                  RSP.S4: MOV     R2,R1                   ;GET RESPONSE FROM UDA AND
 97 105362  010237  105406                  MOV     R2,SSTEP4               ;SAVE STEP 4 VALUE.
 98
 99                                         ;RESPONSE CHECK, COMPARE EXPECTED DATA IN R1 WITH ACTUAL DATA IN R2
100
101 105366  020102                  RSP.CK: CMP     R1,R2                   ;COMPARE THE DATA
102 105370  001405                          BEQ     1$                      ;EXIT IF COMPARED CORRECTLY
103                                                                         ;ERROR, 'UDA DID NOT RETURN CORRECT DATA IN
104                                                                         ;       UDASA REGISTER DURING INITIALIZATION'
```

```
105 105372  104455                      TRAP    C$ERDF
    105374  000031                      .WORD   25
    105376  000000                      .WORD   0
    105400  074616                      .WORD   ERR025
106 105402  000261                      SEC
107 105404  000207              1$:     RTS     PC
108
109 105406  000000              SSTEP4: .WORD   0                       ;SAVE STEP 4 VALUE HERE
```

```
 1
 2                                      ;UDARSP
 3                                      ;
 4                                      ;WAIT FOR UDA TO RESPOND WITH DATA IN UDASA REGISTER.
 5                                      ;EITHER STEP BIT FROM MASK IN LOCATION UDARSD OR ERROR BIT
 6                                      ;WILL CAUSE A TERMINATION.
 7                                      ;AN ERROR MESSAGE WILL BE PRINTED IF THE UDA DOES NOT RESPOND
 8                                      ;IN 10 SECONDS OR IF ERROR SETS.
 9                                      ;
10                                      ;INPUTS:
11                                      ;       UDASRD - MASK OF STEP BIT TO LOOK FOR
12                                      ;       R5 - ADDRESS OF CONTROLLER TABLE
13                                      ;       R4 - ADDRESS OF UDAIP REGISTER
14                                      ;OUTPUTS:
15                                      ;       ERROR MESSAGE IF TIME OUT ON RESPONSE OR ERROR BIT SETS
16                                      ;       R2 - DATA FROM UDASA REGISTER
17                                      ;       CARRY SET IF ERROR BIT SETS OR TIME OUT
18
19 105410                               UDARSP:
   105410  010146                              MOV     R1,-(SP)                ;;PUSH R1 ON STACK
20 105412  052737  100000  105546              BIS     #SA.ERR,UDARSD          ;SET ERROR BIT IN MASK WORD
21 105420  012700  000012                      MOV     #10.,R0                 ;SET UP FOR 10 SECOND TIMEOUT
22 105424  010501                              MOV     R5,R1                   ;POINT TO COUNTER IN CONTROLLER TABLE
23 105426  062701  000040                      ADD     #C.TO,R1
24 105432  004737  104530                      JSR     PC,SETTO
25 105436  012601                              MOV     (SP)+,R1                ;;POP STACK INTO R1
26 105440  033764  105546  000002  1$:         BIT     UDARSD,2(R4)            ;LOOK AT ERROR AND STEP BIT
27 105446  001024                              BNE     3$                      ;BRANCH IF EITHER SET
28                                                                             ;>>>>>>>>>>BREAK BACK TO MONITOR<<<<<<<<<<
29 105450  104422                              TRAP    C$BRK
30 105452  005737  064616                      TST     KW.CSR                  ;SEE IF CLOCK ON SYSTEM
31 105456  001770                              BEQ     1$
32 105460  023765  064630  000042              CMP     KW.EL+2,C.TOH(R5)       ;CHECK IF TIME OUT OCCURRED
33 105466  101005                              BHI     2$
34 105470  001363                              BNE     1$
35 105472  023765  064626  000040              CMP     KW.EL,C.TO(R5)
36 105500  103757                              BLO     1$
37 105502  016402  000002          2$:         MOV     2(R4),R2                ;GET REGISTER CONTENTS
38 105506  104455                              TRAP    C$ERDF
   105510  000026                              .WORD   22
   105512  000000                              .WORD   0
   105514  074470                              .WORD   ERR022
39 105516  000407                              BR      4$
40
41                                      ;CHECK IF ERROR BIT SET
42
43 105520  016402  000002          3$:         MOV     2(R4),R2                ;GET REGISTER CONTENTS
44 105524  100006                              BPL     5$                      ;EXIT IF ERROR NOT SET
45 105526  104455                              TRAP    C$ERDF
   105530  000025                              .WORD   21
   105532  000000                              .WORD   0
   105534  074430                              .WORD   ERR021
46 105536  000261                  4$:         SEC
47 105540  000207                              RTS     PC
48
49                                      ;NORMAL EXIT
50
```

```
     51 105542  000241                5$:     CLC                             ;CLEAR CARRY AS NO ERROR INDICATION
     52 105544  000207                        RTS     PC
     53
     54                                         ;LOCATION FOR STEP BIT MASK
     55
     56 105546  000000                UDARSD: .WORD   0                       ;LOAD BY CALLING ROUTINE
```

```
                                ;CLOG
                                ;
                                ;COMPUTE LOGARITHMIC VALUE OF NUMBER TO BASE 2.
                                ;
                                ;INPUTS:
                                ;       R0 - LOGARITHM TO BE CONVERTED
                                ;OUTPUTS:
                                ;       R1 - VALUE OF 2 RAISED TO POWER OF INPUT NUMBER
                                
105550                          CLOG:
105550  010046                        MOV     R0,-(SP)                ;;PUSH R0 ON STACK
105552  005001                        CLR     R1                      ;SET UP ZERO START VALUE
105554  000261                        SEC                             ;WITH CARRY READY TO SHIFT IN
105556  006101                1$:     ROL     R1                      ;SHIFT TO LEFT
105560  005300                        DEC     R0                      ;UNTIL R0
105562  100375                        BPL     1$                      ;GOES NEGATIVE
105564  012600                        MOV     (SP)+,R0                ;;POP STACK INTO R0
105566  000207                        RTS     PC
```

```
 1
 2                                      ;RDDLL
 3                                      ;
 4                                      ;READ DISK DRIVE DOWNLINE LOAD PROGRAM INTO MEMORY
 5                                      ;
 6                                      ;INPUTS:
 7                                      ;       DLLNAM - NAME OF PROGRAM IN RAD50 (TWO WORDS)
 8                                      ;OUTPUTS:
 9                                      ;       FREE MEMORY CONTAINING PROGRAM
10                                      ;       CARRY CLEAR IF NO ERROR, CARRY SET IF PROGRAM NOT FOUND
11
16 105570  012701  000006      RDDLL:  MOV     #6.,R1                  ;TYPE OF PROGRAM IN DATA FILE
17 105574  004737  105630              CALL    RDREC                   ;READ PROGRAM INTO MEMORY
18 105600  006101                      ROL     R1                              ;PRESERVE CARRY STATE IN R1
19 105602  004737  105612              CALL    CLOSEF                  ;  WHILE CLOSING THE DATA FILE
20 105606  006001                      ROR     R1                              ;  AS NORMAL POSITION IS LOST
21 105610  000207                      RETURN
```

```
 1
 2                                      ;CLOSEF
 3                                      ;
 4                                      ;CLOSE DATA FILE FOR DM PROGRAMS
 5                                      ;
 6                                      ;INPUTS:
 7                                      ;       FILOPN - ZERO IF FILE NOT OPEN
 8                                      ;OUTPUTS:
 9                                      ;       NONE
10
12 105612  005737  064474          CLOSEF: TST     FILOPN                  ;SEE IF FILE CURRENTLY OPEN
13 105616  001403                          BEQ     1$
14 105620  104435                          TRAP    C$CLOS
15 105622  005037  064474                  CLR     FILOPN                  ;AND MARK AS SO
16 105626  000207                  1$:     RETURN
```

```
                                ;RDREC
                                ;
                                ;READ A RECORD FROM THE INPUT FILE. PLACE DATA INTO FREE MEMORY.
                                ;
                                ;INPUTS:
                                ;       R1 - FILE TYPE
                                ;               1 - UDA52 TEST 1 DM PROGRAM
                                ;               2 - UDA52 TEST 2 DM PROGRAM
                                ;               3 - UDA52 TEST 3 DM PROGRAM
                                ;               4 - TEST 4 QUESTIONS
                                ;               5 - UDA52 TEST 4 DM PROGRAM
                                ;               6 - DRIVE DIAGNOSTIC DOWNLINE LOAD PROGRAM
                                ;       DLLNAM - IF R1 CONTAINS 6, TWO WORDS AT THIS ADDRESS CONTAIN
                                ;               NAME OF PROGRAM IN RAD50.
                                ;       R5 - ADJUSTED ADDRESS WHERE TO BRING DATA INTO.
                                ;OUTPUTS:
                                ;       DATA FROM RECORD IN MEMORY
                                ;       CARRY CLEAR IF NO ERROR, CARRY SET IF ERROR

105630                          RDREC:
105630  010046                          MOV     R0,-(SP)                ;;PUSH R0 ON STACK
105632  010146                          MOV     R1,-(SP)                ;;PUSH R1 ON STACK
105634  010246                          MOV     R2,-(SP)                ;;PUSH R2 ON STACK
105636  010346                          MOV     R3,-(SP)                ;;PUSH R3 ON STACK
105640  010446                          MOV     R4,-(SP)                ;;PUSH R4 ON STACK
105642  010546                          MOV     R5,-(SP)                ;;PUSH R5 ON STACK
105644  005037  064442                  CLR     FNUM
105650  005737  064474                  TST     FILOPN                  ;SEE IF FILE ALREADY OPEN
105654  001005                          BNE     RDSTS
105656  012700  064456                  MOV     #FNAME,R0
105662  104434                          TRAP    C$OPEN
105664  005237  064474                  INC     FILOPN                  ;AND MARK AS OPEN
105670  005105                  RDSTS:  COM     R5                      ;COMPLEMENT LOAD ADDRESS (SEARCH MODE)
105672                          RDST:                                   ;>>>>>>>>>>BREAK BACK TO MONITOR<<<<<<<<<<
105672  104422                          TRAP    C$BRK
                                                                        ;READ A BYTE FROM FILE
105674  104426                          TRAP    C$GETB
105676  110004                          MOVB    R0,R4
105700  005704                          TST     R4                      ;IF ZERO
105702  001773                          BEQ     RD                      ; KEEP READING
105704  022704  000001                  CMP     #1,R4                   ;WHEN NOT ZERO
105710  001142                          BNE     RWRDE1                  ; IT BETTER BE A ONE
                                                                        ;READ A BYTE FROM FILE
105712  104426                          TRAP    C$GETB
105714  060004                          ADD     R0,R4
105716  005700                          TST     R0                      ; IF ZERO, PROCESS DATA
105720  001431                          BEQ     RDDAT
105722  020001                          CMP     R0,R1                   ;CHECK IF TYPE OF FILE LOOKING FOR
105724  103427                          BLO     RDDAT                   ;IF TOO SOON IN FILE, KEEP SEARCHING
105726  101121                          BHI     RDERR                   ;IF PAST TYPE, GIVE ERROR RETURN
105730  004737  106150                  CALL    FWORD                   ;GET NEXT TWO WORDS
105734  013702  064472                  MOV     FDATA,R2
105740  004737  106150                  CALL    FWORD
                                                                        ;READ A BYTE FROM FILE
105744  104426                          TRAP    C$GETB
105746  060004                          ADD     R0,R4                   ;ADD TO COMPUTED SUM
```

```
 50 105750  105704                    TSTB    R4              ;SEE IF THIS SUM IS ZERO
 51 105752  001121                    BNE     RWRDE1          ;  IF NOT, REPORT CHECKSUM ERROR
 52 105754  020127  000006            CMP     R1,#6           ;IF FILE TYPE IS A 6
 53 105760  001007                    BNE     1$
 54 105762  023702  064674            CMP     DLLNAM,R2       ;  MATCH THE PROGRAM NAME
 55 105766  001341                    BNE     RDST            ;KEEP SEARCHING IF NOT DESIRED PROGRAM
 56 105770  023737  064676  064472    CMP     DLLNAM+2,FDATA
 57 105776  001335                    BNE     RDST
 58 106000  005105            1$:     COM     R5              ;GET STORAGE ADDRESS
 59 106002  000733                    BR      RDST            ;SWITCH FROM SEARCH TO STORE MODE
 60
 61 106004  004737  106150    RDDAT:  CALL    FWORD           ;READ BYTE COUNT
 62 106010  013703  064472            MOV     FDATA,R3        ;SAVE IN R3
 63 106014  004737  106150            CALL    FWORD           ;READ LOAD ADDRESS
 64 106020  162703  000006            SUB     #6,R3           ;SUBTRACT BYTES ALREADY READ FROM BYTE COUNT
 65 106024  001431                    BEQ     RWORDT          ;IF RESULT IS ZERO, THIS IS A TRANSFER BLOCK
 66 106026  005705                    TST     R5              ;IF IN SEARCH MODE,
 67 106030  100413                    BMI     1$              ;  BYPASS TRANSFER ADDRESS COMPUTATION
 68 106032  013701  064472            MOV     FDATA,R1        ;GET LOAD ADDRESS
 69 106036  060501                    ADD     R5,R1           ; R1 -> REAL STARTING ADDRESS
 70 106040  020127  002122            CMP     R1,#STORAG      ; R1 MUST BE GREATER THAN STORAG
 71 106044  103452                    BLO     RDERR           ; IF NOT, ERROR
 72 106046  060301                    ADD     R3,R1           ;ADD BYTES IN RECORD
 73 106050  022701  064342            CMP     #<STORAG+STOSIZ>,R1     ; R1 MUST BE LESS THAN ENDING ADDRESS
 74 106054  103446                    BLO     RDERR           ; IF NOT, ERROR
 75 106056  160301                    SUB     R3,R1
 76 106060                    1$:
 77 106060  104426                    TRAP    C$GETB          ;READ A BYTE FROM FILE
 78 106062  005705                    TST     R5              ;IF IN SEARCH MODE,
 79 106064  100401                    BMI     2$              ;  BYPASS DATA STORAGE
 80 106066  110021                    MOVB    R0,(R1)+        ;STORE IN MEMORY
 81 106070  060004            2$:     ADD     R0,R4           ;UPDATE CHECKSUM
 82 106072  005303                    DEC     R3              ;COUNT THE BYTE
 83 106074  001371                    BNE     1$              ;GET THEM ALL
 84                                                          ;READ A BYTE FROM FILE
 85 106076  104426                    TRAP    C$GETB
 86 106100  060004                    ADD     R0,R4           ;ADD
 87 106102  105704                    TSTB    R4              ;IF CHECKSUM CORRECT,
 88 106104  001672                    BEQ     RDST            ;  THEN GO READ NEXT RECORD
 89 106106  000443                    BR      RWRDE1          ;  ELSE REPORT ERROR
 90
 91 106110                    RWORDT:                         ;READ A BYTE FROM FILE
 92 106110  104426                    TRAP    C$GETB
 93 106112  060004                    ADD     R0,R4           ;ADD TO COMPUTED CHECKSUM
 94 106114  105704                    TSTB    R4              ;CHECK LOW BYTE OF SUM
 95 106116  001037                    BNE     RWRDE1          ;BRANCH IF CHECKSUM ERROR
 96 106120  005705                    TST     R5              ;IF IN SEARCH MODE,
 97 106122  100663                    BMI     RDST            ;  KEEP ON SEARCHING
 98 106124  012605                    MOV     (SP)+,R5        ;;POP STACK INTO R5
    106126  012604                    MOV     (SP)+,R4        ;;POP STACK INTO R4
    106130  012603                    MOV     (SP)+,R3        ;;POP STACK INTO R3
    106132  012602                    MOV     (SP)+,R2        ;;POP STACK INTO R2
    106134  012601                    MOV     (SP)+,R1        ;;POP STACK INTO R1
    106136  012600                    MOV     (SP)+,R0        ;;POP STACK INTO R0
 99 106140  010137  064442            MOV     R1,FNUM
100 106144  000241                    CLC
101 106146  000207                    RETURN
```

```
102
103 106150                          FWORD:                          ;READ A BYTE FROM FILE
104 106150  104426                          TRAP    C$GETB
105 106152  060004                          ADD     R0,R4           ;UPDATE CHECKSUM ERROR
106 106154  110037  064472              MOVB    R0,FDATA        ;START TO BUILD WORD
107                                                                 ;READ A BYTE FROM FILE
108 106160  104426                          TRAP    C$GETB
109 106162  060004                          ADD     R0,R4           ;UPDATE CHECKSUM
110 106164  110037  064473              MOVB    R0,FDATA+1      ;COMPLETE WORD
111 106170  000207                          RETURN
112
113 106172  004737  105612          RDERR:  CALL    CLOSEF          ;CLOSE FILE AS POSITION IS LOST
114 106176  012605                          MOV     (SP)+,R5        ;;POP STACK INTO R5
    106200  012604                          MOV     (SP)+,R4        ;;POP STACK INTO R4
    106202  012603                          MOV     (SP)+,R3        ;;POP STACK INTO R3
    106204  012602                          MOV     (SP)+,R2        ;;POP STACK INTO R2
    106206  012601                          MOV     (SP)+,R1        ;;POP STACK INTO R1
    106210  012600                          MOV     (SP)+,R0        ;;POP STACK INTO R0
115 106212  000261                          SEC                     ;ERROR RETURN, FILE NOT FOUND
116 106214  000207                          RETURN
117
118 106216                          RWRDE1:
    106216  104454                          TRAP    C$ERSF
    106220  000005                          .WORD   5
    106222  000000                          .WORD   0
    106224  074336                          .WORD   ERR005
119
120 106226  104444                          TRAP    C$DCLN          ;DO CLEAN-UP TRAP
```

```
 1
 2                                          ;KW11I
 3                                          ;
 4                                          ;CLOCK INTERRUPT SERVICE ROUTINE
 5
 6  106230                                  KW11I::
 7  106230  062737  000001  064626                ADD     #1,KW.EL                ;COUNT THE INTERRUPT
 8  106236  005537  064630                      ADC KW.EL+2
 9  106242  012777  000105  156346              MOV     #KW.OUT,@KW.CSR         ;RESTART THE CLOCK
10  106250                                  L10040:
    106250  000002                              RTI
11
12  106252                                  INTSRV::
13  106252  005237  064454                      INC     INTRCV                  ; FLAG INTERRUPT AS RECEIVED
14  106256                                  L10041:
    106256  000002                              RTI
```

```
 1
 2                                      ;RESET
 3                                      ;
 4                                      ; RESET ALL UDA-50S IN THE CONTROLLER TABLES
 5                                      ;
 6                                      ; INPUTS:
 7                                      ;       IPADRS - CONTAINS ALL IP ADDRESSES
 8                                      ; OUTPUTS:
 9                                      ;       NONE
10                                      ;
11
12 106260  005037  064636          RESET:  CLR     NXMAD                   ;CLEAR NON-EXISTANT MEMORY ADDRESS
13 106264  010346                          MOV     R3,-(SP)                ;;PUSH R3 ON STACK
   106266  010446                          MOV     R4,-(SP)                ;;PUSH R4 ON STACK
14                                                                         ;SETUP TIMEOUT ERROR VECTOR
15 106270  012746  000340                  MOV     @PRIO7,-(SP)
   106274  012746  104510                  MOV     @NXMI,-(SP)
   106300  012746  000004                  MOV     @ERRVEC,-(SP)
   106304  012746  000003                  MOV     @3,-(SP)
   106310  104437                          TRAP    C$SVEC
   106312  062706  000010                  ADD     @10,SP
16 106316  012703  000010                  MOV     @8.,R3                  ;R3 = COUNTER OF ENTRIES
17 106322  012704  064534                  MOV     @IPADRS,R4              ;R4 -> IP ADDRESS
18 106326  005714                  1$:     TST     (R4)                    ;IS THERE AN ENTRY?
19 106330  001403                          BEQ     2$                      ;IF NOT, DONE
20 106332  005034                          CLR     @(R4)+                  ;INIT UDA
21 106334  005303                          DEC     R3                      ;MAKE SURE WE DO NOT EXTEND OVER AREA
22 106336  001373                          BNE     1$                      ;IF NOT DONE, BRANCH
23 106340  005737  064616          2$:     TST     KW.CSR                  ;SEE IF CLOCK PRESENT,
24 106344  001403                          BEQ     3$                      ;BRANCH IF NOT, ELSE
25 106346  012777  000105  156242          MOV     @KW.OUT,@KW.CSR         ;START THE CLOCK.
26 106354                          3$:
   106354  012604                  MOV     (SP)+,R4                        ;;POP STACK INTO R4
   106356  012603                  MOV     (SP)+,R3                        ;;POP STACK INTO R3
27 106360  000207                  RETURN
```

```
 1
 2                                      ;RNTIME
 3                                      ;
 4                                      ;PRINT RUNTIME
 5                                      ;
 6                                      ;INPUTS:
 7                                      ;       KW.EL - CONTAINS ELAPSED TIME
 8                                      ;       KW.HZ - HERTZ OF CLOCK
 9                                      ;OUTPUTS:
10                                      ;       IF CLOCK ON SYSTEM:
11                                      ;          "  RNTIME HH:MM:SS " PRINTED
12                                      ;       IF NO CLOCK: ONE SPACE IS PRINTED
13
14 106362  005737  064616          RNTIME: TST     KW.CSR                  ;CHECK IF A CLOCK PRESENT
15 106366  001465                          BEQ     RNTIMX                  ;BRANCH IF NOT
16 106370  010046                          MOV     R0,-(SP)                ;;PUSH R0 ON STACK
   106372  010346                          MOV     R3,-(SP)                ;;PUSH R3 ON STACK
   106374  010446                          MOV     R4,-(SP)                ;;PUSH R4 ON STACK
   106376  010546                          MOV     R5,-(SP)                ;;PUSH R5 ON STACK
17 106400  013703  064626                  MOV     KW.EL,R3                        ;GET ELAPSED TIME
18 106404  013704  064630                  MOV     KW.EL+2,R4
19 106410  013700  064624                  MOV     KW.HZ,R0                        ;GET SPEED OF CLOCK
20 106414  004737  102704                  CALL    DIVIDE                  ;COMPUTE SECONDS OF ELAPSED TIME
21 106420  012700  000074                  MOV     #60.,R0                 ;NOW DIVIDE BY 60
22 106424  004737  102704                  CALL    DIVIDE                  ; TO COMPUTE MINUTES
23 106430  010546                          MOV     R5,-(SP)                ;;PUSH R5 ON STACK
24 106432  004737  102704                  CALL    DIVIDE                  ;DIVIDE BY 60 AGAIN
25 106436  010346                          MOV     R3,-(SP)                ;PUSH R3 ON STACK
   106440  004137  075722                  JSR     R1,LPNT         ;CALL   LPNT PRINT ROUTINE
   106444  065045                          .WORD   RNTIM                   ;ADDRESS OF ASCIZ STRING
   106446  000002                          .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
26 106450  020527  000011                  CMP     R5,#9.                  ;IF MINUTES 9 OR LESS
27 106454  003004                          BGT 1$
28 106456  112700  000060                  MOVB    #'0,R0                  ;STORE #'0 IN R0 AND
   106462  004737  075506                  JSR     PC,PRINTC               ;PRINT THE CHARACTER.
29 106466                          1$:
   106466  010546                          MOV     R5,-(SP)                ;PUSH R5 ON STACK
   106470  004137  075722                  JSR     R1,LPNT         ;CALL   LPNT PRINT ROUTINE
   106474  065070                          .WORD   RNTIM1                  ;ADDRESS OF ASCIZ STRING
   106476  000002                          .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
30 106500  012605                          MOV     (SP)+,R5                ;;POP STACK INTO R5
31 106502  020527  000011                  CMP     R5,#9.                  ;IF 9 OR LESS
32 106506  003004                          BGT 2$
33 106510  112700  000060                  MOVB    #'0,R0                  ;STORE #'0 IN R0 AND
   106514  004737  075506                  JSR     PC,PRINTC               ;PRINT THE CHARACTER.
34 106520                          2$:
   106520  010546                          MOV     R5,-(SP)                ;PUSH R5 ON STACK
   106522  004137  075722                  JSR     R1,LPNT         ;CALL   LPNT PRINT ROUTINE
   106526  065076                          .WORD   RNTIM2                  ;ADDRESS OF ASCIZ STRING
   106530  000002                          .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
35 106532  012605                          MOV     (SP)+,R5                ;;POP STACK INTO R5
   106534  012604                          MOV     (SP)+,R4                ;;POP STACK INTO R4
   106536  012603                          MOV     (SP)+,R3                ;;POP STACK INTO R3
   106540  012600                          MOV     (SP)+,R0                ;;POP STACK INTO R0
36 106542                          RNTIMX:
   106542  112700  000040                  MOVB    #' ,R0                  ;STORE #'  IN R0 AND
   106546  004737  075506                  JSR     PC,PRINTC               ;PRINT THE CHARACTER.
```

F3


```
     37 106552  000207                      RETURN
```

```
                                        ;WCHNG
                                        ;
                                        ;       WAIT UNTIL UDASA CHANGES FROM WHAT IS IN WCHNGD
                                        
106554  012700  000012          WCHNG:  MOV     #10.,R0                 ;SET TIMEOUT FOR 10 SECONDS
106560  010501                          MOV     R5,R1                   ;POINT TO CONTROLLER TABLE
106562  062701  000040                  ADD     #C.TO,R1
106566  004737  104530                  CALL    SETTO
106572  026437  000002  106650  1$:     CMP     2(R4),WCHNGD            ;SEE IF CHANGED
106600  001022                          BNE     2$
                                                                        ;>>>>>>>>>>BREAK BACK TO MONITOR<<<<<<<<<<
106602  104422                          TRAP    C$BRK
106604  005737  064616                  TST     KW.CSR                  ;SEE IF CLOCK ON SYSTEM
106610  001770                          BEQ     1$
106612  023765  064630  000042          CMP     KW.EL+2,C.TOH(R5)       ;CHECK IF TIME OUT OCCURRED
106620  101005                          BHI 3$
106622  001363                          BNE     1$
106624  023765  064626  000040          CMP     KW.EL,C.TO(R5)
106632  103757                          BLO 1$
106634                          3$:
106634  104455                          TRAP    C$ERDF
106636  000033                          .WORD   27
106640  000000                          .WORD   0
106642  074654                          .WORD   ERR027
106644  000264                          SEZ                             ; FLAG AS ERROR
106646  000207                  2$:     RETURN                          ; RETURN TO CALLING PROGRAM

106650                          WCHNGD: .BLKW   1                       ; OLD PORT CONTENTS
106652                          BRLEV:  .BLKW   1                       ; WORD FOR BRANCH LEVEL STORAGE
```

```
                                .SBTTL  REPORT CODING SECTION

                                ;++
                                ; THE REPORT CODING SECTION CONTAINS THE
                                ; "PRINTS" CALLS THAT GENERATE STATISTICAL REPORTS.
                                ;--

106654                          L$RPT::

106654  010046                          MOV     R0,-(SP)                ;;PUSH R0 ON STACK
106656  010146                          MOV     R1,-(SP)                ;;PUSH R1 ON STACK
106660  010246                          MOV     R2,-(SP)                ;;PUSH R2 ON STACK
106662  010346                          MOV     R3,-(SP)                ;;PUSH R3 ON STACK
106664  010446                          MOV     R4,-(SP)                ;;PUSH R4 ON STACK
106666  010546                          MOV     R5,-(SP)                ;;PUSH R5 ON STACK
106670  013746  064444                  MOV     TNUM,-(SP)              ;PUSH TNUM ON STACK
106674  004137  075714                  JSR     R1,LPNTS                ;CALL   LPNTS PRINT ROUTINE
106700  107262                          .WORD   RPTMSG                  ;ADDRESS OF ASCIZ STRING
106702  000002                          .WORD   ARG.CT                  ;ARGUMENT COUNT = 2
106704  004737  106362                  CALL    RNTIME                  ;GET RUNTIME PARAMETERS
106710  112700  000015                  MOVB    #CR,R0                  ;STORE #CR IN R0 AND
106714  004737  075506                  JSR     PC,PRINTC               ;PRINT THE CHARACTER.
106720  012701  064632                  MOV     #STIME,R1               ;AT 15 MINUTES FROM NOW
106724  012700  001604                  MOV     #15.*60.,R0             ;SET TIME FOR NEXT REPORT
106730  004737  104530                  CALL    SETTO
106734  022737  000004  064444          CMP     #4,TNUM                 ;IF NOT TEST 4
106742  001402                          BEQ     1$                      ;BRANCH IF SO, ELSE
106744  000137  107242                  JMP     RPTXX                   ;EXIT REPORT SECTION.

106750                          1$:
106750  004137  075714                  JSR     R1,LPNTS                ;CALL   LPNTS PRINT ROUTINE
106754  107316                          .WORD   RPTMSH                  ;ADDRESS OF ASCIZ STRING
106756  000000                          .WORD   ARG.CT                  ;ARGUMENT COUNT = 2
106760  013705  064424                  MOV     CTABS,R5                ;GET ADDRESS OF 1ST CONTROLLER TABLE

106764  005765  000002          RPTCT:  TST     C.UNIT(R5)              ;SEE IF CONTROLLER AVAILABLE FOR TESTING
106770  100520                          BMI     RPTCTN
106772  010504                          MOV     R5,R4                   ;COMPUTE ADDRESS OF DRIVE TABLE POINTERS
106774  062704  000020                  ADD     #C.DRO,R4
107000  012703  000010                  MOV     #8.,R3                  ;GET COUNT OF DRIVES
107004  012401                  RPTDT:  MOV     (R4)+,R1                ;LOOK AT POINTER
107006  001511                          BEQ     RPTCTN                  ;GO TO NEXT IF NO TABLE
107010  005761  000002                  TST     D.UNIT(R1)              ;SEE IF DRIVE AVAILABLE
107014  100504                          BMI     RPTDTN
107016  010346                          MOV     R3,-(SP)                ;;PUSH R3 ON STACK
107020  010446                          MOV     R4,-(SP)                ;;PUSH R4 ON STACK
107022  010546                          MOV     R5,-(SP)                ;;PUSH R5 ON STACK
107024  010146                          MOV     R1,-(SP)                ;;PUSH R1 ON STACK
107026  012700  064476                  MOV     #TEMP,R0                ;PLACE 18 SPACE CHARACTERS INTO
107032  012701  000022                  MOV     #18.,R1                 ;  TEMP STORAGE
107036  112720  000040          1$:     MOVB    #' ,(R0)+
107042  005301                          DEC     R1
107044  001374                          BNE     1$
107046  005010                          CLR     (R0)                    ;THEN A NULL CHARACTER
107050  011605                          MOV     (SP),R5                 ;GET DRIVE TABLE STORAGE ADDRESS
107052  016501  000200                  MOV     D.SERN(R5),R1           ;GET SERIAL NUMBER
107056  016502  000202                  MOV     D.SERN+2(R5),R2
```

```
    108 107062  016503  000204                  MOV     D.SERN+4(R5),R3
    109 107066  005004                          CLR     R4
    110 107070  004737  102742          2$:     CALL    DIV10                   ;DIVIDE BY 10
    111 107074  062705  000060                  ADD     #'0,R5                  ;CONVERT TO ASCII CHARACTER
    112 107100  110540                          MOVB    R5,-(R0)                ;PUT DIGIT INTO TEMP STORAGE
    113 107102  010146                          MOV     R1,-(SP)
    114 107104  050216                          BIS     R2,(SP)                 ;SEE IF QUOTIENT IS ZERO
    115 107106  050316                          BIS     R3,(SP)
    116 107110  050426                          BIS     R4,(SP)+
    117 107112  001366                          BNE     2$                      ;IF NOT, DIVIDE AGAIN
    118 107114  012601                          MOV     (SP)+,R1                ;;POP STACK INTO R1
    119 107116  016146  000164                  MOV     D.XFRW(R1),-(SP)
        107122  016146  000166                  MOV     D.XFRR(R1),-(SP)
        107126  016146  000174                  MOV     D.SEEK(R1),-(SP)
        107132  012746  064476                  MOV     #TEMP,-(SP)
        107136  011146                          MOV     (R1),-(SP)
        107140  016146  000002                  MOV     D.UNIT(R1),-(SP)
        107144  012746  107534                  MOV     #RPTMSD,-(SP)
        107150  012746  000007                  MOV     #7,-(SP)
        107154  010600                          MOV     SP,R0
        107156  104416                          TRAP    C$PNTS
        107160  062706  000020                  ADD     #20,SP
    121 107164  016146  000176                  MOV     D.ECCC(R1),-(SP)
        107170  016146  000172                  MOV     D.SERR(R1),-(SP)
        107174  016146  000170                  MOV     D.HERR(R1),-(SP)
        107200  012746  107603                  MOV     #RPTMD2,-(SP)
        107204  012746  000004                  MOV     #4,-(SP)
        107210  010600                          MOV     SP,R0
        107212  104416                          TRAP    C$PNTS
        107214  062700  000012                  ADD     #12,SP
    145 107220  012605                          MOV     (SP)+,R5                ;;POP STACK INTO R5
        107222  012604                          MOV     (SP)+,R4                ;;POP STACK INTO R4
        107224  012603                          MOV     (SP)+,R3                ;;POP STACK INTO R3
    146 107226  005303                  RPTDTN: DEC     R3                      ;COUNT THE DRIVE TABLES
    147 107230  003265                          BGT RPTDT                       ;REPEAT FOR ALL DRIVE TABLES
    148 107232  062705  000046          RPTCTN: ADD     #C.SIZE,R5              ;GO TO NEXT CONTROLLER TABLE
    149 107236  005715                          TST     (R5)
    154 107240  001251                          BNE     RPTCT
    156 107242                          RPTXX:
        107242  012605                          MOV     (SP)+,R5                ;;POP STACK INTO R5
        107244  012604                          MOV     (SP)+,R4                ;;POP STACK INTO R4
        107246  012603                          MOV     (SP)+,R3                ;;POP STACK INTO R3
        107250  012602                          MOV     (SP)+,R2                ;;POP STACK INTO R2
        107252  012601                          MOV     (SP)+,R1                ;;POP STACK INTO R1
        107254  012600                          MOV     (SP)+,R0                ;;POP STACK INTO R0
    168
    169 107256  000167                          .WORD   J$JMP
        107260  000344                          .WORD   L10042-2-.
    170
    174 107262     116     042     124  RPTMSG: .ASCIZ  \N"TEST "D3" IN PROGRESS.  "\
    175 107316     116     042     125  RPTMSH: .ASCII  \N"UNIT DRIVE      SERIAL NUMBER SEEKS MBYTES  MBYTES  HARD   SOFT    ECC"N\
    176 107430     042     040     040          .ASCIZ  \"                                    X1000  READ  WRITTEN ERRORS ERRORS"N\
    177 107534     045     123     062  RPTMSD: .ASCIZ  \%S2%D2%S3%D3%S1%T%S1%D5%S2%D5%S3%D5%S2\
    178 107603     045     104     065  RPTMD2: .ASCIZ  \%D5%S2%D5%S1%D5%N\
    198                                          .EVEN
    199
    200 107626                          L10042:
```

```
        107626  104425                          TRAP    C$RPT
```

```
                                .SBTTL  PROTECTION TABLE

                                ;++
                                ; THIS TABLE IS USED BY THE RUNTIME SERVICES
                                ; TO PROTECT THE LOAD MEDIA.
                                ;--

107630                          L$PROT::

107630  177777                          -1                      ;OFFSET INTO P-TABLE FOR CSR ADDRESS
107632  177777                          -1                      ;OFFSET INTO P-TABLE FOR MASSBUS ADDRESS
107634  177777                          -1                      ;OFFSET INTO P-TABLE FOR DRIVE NUMBER
```

```
                        .SBTTL  INITIALIZE SECTION

                        ;++
                        ; THE INITIALIZE SECTION CONTAINS THE CODING THAT IS PERFORMED
                        ; AT THE BEGINNING OF EACH PASS.
                        ;--

                        ;;*************************************************************************************
                        ;       IF HERE FROM START COMMAND
                        ;          THEN
                        ;               SET ISTRT BIT & CLEAR OTHER BITS IN FLAG
                        ;       ENDIF
                        ;       IF HERE FROM RESTART COMMAND
                        ;          THEN
                        ;               SET IREST BIT IN IFLAGS
                        ;       ENDIF
                        ;       IF HERE FROM START OR RESTART COMMAND
                        ;          THEN
                        ;               RESET ALL UNITS
                        ;               ESTABLISH FREE MEMORY
                        ;               CLEAR TNUM
                        ;               INITIALIZE CLOCK
                        ;               BUILD CONTROLLER & DRIVES TABLES IN MEMORY
                        ;               EXIT INIT SECTION
                        ;       ENDIF
                        ;       IF HERE FROM CONTINUE COMMAND
                        ;          THEN
                        ;               SET ICONT BIT IN IFLAGS
                        ;               EXIT INIT SECTION
                        ;       ENDIF
                        ;       IF HERE FROM POWER FAIL RESTART
                        ;          THEN
                        ;               EXIT INIT SECTION
                        ;       ENDIF
                        ;       IF HERE FROM NEW PASS OR SUB-PASS
                        ;          THEN
                        ;               LOOK FOR ANY ADDED OR DROPPED UNITS
                        ;               EXIT INIT SECTION
                        ;       ENDIF
                        ;;*************************************************************************************
```

M3


```
  1 107636                          L$INIT::
  2
  3 107636  012700  000040                MOV     #EF.STA,R0              ;HERE FROM START COMMAND?
    107642  104447                        TRAP    C$REFG
  4
  5 107644  103004                        BCC     1$                      ;BRANCH TO 1$ IF NOT, ELSE
  6 107646  012737  000010  064440        MOV     #ISTRT,IFLAGS           ;SET START BIT IN FLAG.
  7 107654  000531                        BR      INIT1
  8 107656                          1$:
  9 107656  012700  000037                MOV     #EF.RES,R0              ;HERE FROM RESTART COMMAND?
    107662  104447                        TRAP    C$REFG
 10
 11 107664  103004                        BCC     2$                      ;BRANCH TO 2$ IF NOT, ELSE
 12 107666  052737  000004  064440        BIS     #IREST,IFLAGS           ;SET RESTART BIT IN FLAG.
 13 107674  000521                        BR      INIT1
 14 107676                          2$:
 15 107676  012700  000036                MOV     #EF.CON,R0              ;HERE FROM CONTINUE COMMAND?
    107702  104447                        TRAP    C$REFG
 16
 17 107704  103007                        BCC     3$                      ;BRANCH TO 3$ IF NOT, ELSE
 18 107706  042737  000020  064440        BIC     #ISTRTH,IFLAGS          ;CLEAR 1ST TIME THRU TEST 4 FLAG AND
 19 107714  052737  000002  064440        BIS     #ICONT,IFLAGS           ;SET CONTINUE BIT IN FLAG.
 20 107722  000476                        BR      13$
 21 107724                          3$:
 22 107724  012700  000034                MOV     #EF.PWR,R0              ;HERE FROM POWER FAIL?
    107730  104447                        TRAP    C$REFG
 23
 24 107732  103001                        BCC     4$                      ;BRANCH TO 4$ IF NOT, ELSE
 25 107734  000471                        BR      13$
```

```
 1
 2                                          ;MAKE ALL CONTROLLER/DRIVE TABLES NOT AVAILABLE FOR TESTING
 3
 4 107736  013705  064424          4$:     MOV     CTABS,R5                ;GET ADDRESS OF 1ST CONTROLLER TABLE
 5 107742  052765  100000  000002  5$:     BIS     #CT.AVL,C.UNIT(R5)      ;SET CONTROLLER TABLE NOT AVAILABLE
 6 107750  010502                          MOV     R5,R2                   ;GET POINTER TO DRIVE TABLES
 7 107752  062702  000020                  ADD     #C.DRO,R2
 8 107756  012703  000010                  MOV     #8.,R3                  ;GET NUMBER OF DRIVES PER CONTROLLER TABLE
 9 107762  012200                  6$:     MOV     (R2)+,R0                ;SEE IF THIS DRIVES HAS A TABLE,
10 107764  001403                          BEQ     7$                      ;BRANCH IF NOT, ELSE
11 107766  052760  100000  000002          BIS     #DT.AVL,D.UNIT(R0)      ;SET DRIVE TABLE NOT AVAILABLE.
12 107774  005303                  7$:     DEC     R3                      ;LOOK AT NEXT DRIVE IN CONTROLLER TABLE,
13 107776  001371                          BNE     6$                      ;BRANCH IF NO DRIVES, ELSE
14 110000  062705  000046                  ADD     #C.SIZE,R5              ;LOOK AT NEXT CONTROLLER TABLE.
15 110004  005715                          TST     (R5)                    ;SEE IF THERE IS ANOTHER CONTROLLER TABLE,
16 110006  001012                          BNE     9$                      ;BRANCH IF SO, ELSE
17 110010  062705  000046                  ADD     #C.SIZE,R5              ;MOVE TO NEXT CONTROLLER TABLE
18 110014  005715                          TST     (R5)                    ;IS THERE A NEXT ONE?
19 110016  001351                          BNE     5$                      ;IF SO, CLEAR THE BITS THERE
20
21                                          ;NOW GET EACH P-TABLE AND MAKE THE APPROPRIATE CONTROLLER/DRIVE
22                                          ;TABLES AVAILABLE FOR TESTING.
23
24 110020  005003                          CLR     R3                      ;START WITH LOGICAL UNIT 0
25 110022                          8$:                                     ;GET POINTER TO IT'S P-TABLE
26 110022  010300                          MOV     R3,R0
   110024  104442                          TRAP    C$GPHRD
27
28 110026  103030                          BCC     12$                     ;BRANCH TO 12$ IF NOT AVAILABLE
29 110030  013705  064424                  MOV     CTABS,R5                ;GET ADDRESS OF 1ST CONTROLLER TABLE
30 110034  021015                  9$:     CMP     (R0),(R5)               ;SEE IF UDA ADDRESSES ARE THE SAME,
31 110036  001411                          BEQ     11$                     ;BRANCH IF SO, ELSE
32 110040  062705  000046                  ADD     #C.SIZE,R5              ;LOOK AT NEXT CONTROLLER TABLE.
33 110044  005715                          TST     (R5)                    ;SEE IF THERE IS ANOTHER CONTROLLER TABLE,
34 110046  001372                          BNE     9$                      ;BRANCH IF SO, ELSE
35 110050                          10$:                                    ;REPORT TABLE CONSISTANCY ERROR.
36 110050  104454                          TRAP    C$ERSF
   110052  000006                          .WORD   6
   110054  000000                          .WORD   0
   110056  074400                          .WORD   ERR006
37                                                                        ;DO CLEAN-UP TRAP
38 110060  104444                          TRAP    C$DCLN
39
40 110062  016001  000010          11$:    MOV     H.DRV(R0),R1            ;GET DRIVE NUMBER FROM P-TABLE
41 110066  004737  102274                  CALL    GTDRVT                  ;FIND THE DRIVE TABLE ADDRESS
42 110072  001366                          BNE     10$                     ;BRANCH IF NOT FOUND, ELSE
43 110074  042765  100000  000002          BIC     #CT.AVL,C.UNIT(R5)      ;CLEAR AVAILABLE BIT IN CONTROLLER AND
44 110102  042764  100000  000002          BIC     #DT.AVL,D.UNIT(R4)      ;THE DRIVE TABLES.
45 110110  005203                  12$:    INC     R3                      ;INCREMENT TO NEXT UNIT IN P-TABLE
46 110112  020337  002012                  CMP     R3,L$UNIT               ;SEE IF ALL P-TABLES CHECKED,
47 110116  103741                          BLT     8$                      ;BRANCH IF NOT, ELSE
48 110120  012701  064632          13$:    MOV     #TIME,R1                ;AT 15 MINUTES FROM NOW
52 110124  012700  001604                  MOV     #15.*60.,R0             ;SET TIME FOR NEXT REPORT
53 110130  004737  104530                  CALL    SETTO
55 110134  000137  111170                  JMP     IMTYCX                  ;EXIT THE INITIALIZE SECTION.
```

```
                                ;INITIALIZE KW11 CLOCK, FREE MEMORY AND IP ADDRESS TABLE
                                ;DURING START OR RESTART COMMAND ONLY

110140  005037  064626  INIT1:  CLR     KW.EL                   ;CLEAR ELAPSED TIME
110144  005037  064630          CLR     KW.EL+2
110150  012700  000114          MOV     #'L,R0
110154  104462                  TRAP    C$CLCK
110156  103413                  BCS     1$
110160  012700  000120          MOV     #'P,R0
110164  104462                  TRAP    C$CLCK
110166  103407                  BCS     1$
110170  005037  064616          CLR     KW.CSR                  ;IF NEITHER, CLEAR CSR STORAGE WORD
110174  004137  075664          JSR     R1,LPNTF                ;CALL   LPNTF PRINT ROUTINE
110200  066466                  .WORD   NOCLOCK                 ;ADDRESS OF ASCIZ STRING
110202  000000                  .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
110204  000434                  BR      2$

110206  012037  064616  1$:     MOV     (R0)+,KW.CSR            ;STORE DATA RETURNED
110212  012037  064620          MOV     (R0)+,KW.BRL
110216  012037  064622          MOV     (R0)+,KW.VEC
110222  012037  064624          MOV     (R0)+,KW.HZ

                                ;SETUP KW11 VECTOR ADDRESS
110226  012746  000340          MOV     #PRI07,-(SP)
110232  012746  106230          MOV     #KW1$I,-(SP)
110236  013746  064622          MOV     KW.VEC,-(SP)
110242  012746  000003          MOV     #3,-(SP)
110246  104437                  TRAP    C$SVEC
110250  062706  000010          ADD     #10,SP
110254  012777  000105  154534  MOV     #KW.OUT,@KW.CSR         ;START THE CLOCK
110262  012701  064632          MOV     #STIME,R1               ;AT 15 MINUTES FROM NOW
110266  012700  001604          MOV     #15.*60.,R0             ;SET TIME FOR NEXT REPORT
110272  004737  104530          CALL    SETTO
110276  004737  106260  2$:     CALL    RESET                   ;RESET ALL UDA'S
110302  104431                  TRAP    C$MEM
110304  010037  064412          MOV     R0,FFREE
110310  017737  154076  064414  MOV     @FFREE,FSIZE            ;RESET SIZE OF FREE MEMORY
110316  005037  064444          CLR     TNUM                    ;INITIALIZE TEST NUMBER TO NO TEST RUNNING
110322  005037  064442          CLR     FNUM                    ;INITIALIZE FILE NUMBER TO NO FILE IN MEMORY
```

```
                                        ;ALLOCATE DRIVE TABLES TO MEMORY
                                        ;
110326  013737  064412  064422  INIT2:  MOV     FFREE,DTABS             ;STORE START OF DRIVE TABLES AND
110334  005077  154062                  CLR     @DTABS                  ;MARK ZERO END.
110340  013700  002012                  MOV     L$UNIT,R0               ;GET NUMBER OF LOGICAL UNITS TO RUN.
110344  012701  000001                  MOV     #1,R1                   ;GET INITIAL SIZE OF DRIVE TABLE AND
110350  062701  000105          1$:     ADD     #<0.SIZE>/2,R1          ;ACCUMULATE DRIVE TABLE SIZE.
110354  005300                          DEC     R0                      ;SEE IF ANY MORE LOGICAL UNITS.
110356  001374                          BNE     1$                      ;BRANCH IF NOT, ELSE
110360  004737  075422                  CALL    ALOCM                   ;ALLOCATE ALL DRIVE TABLES TO MEMORY.
                                                                        ; R1 POINTS TO 1ST WORD IN DRIVE TABLE
                                        ;
                                        ;INITIALIZE CONTROLLER TABLE STORAGE WITH A WORD OF ZEROS
                                        ;
110364  013737  064412  064424  INIT3:  MOV FFREE,CTABS                 ;STORE START OF CONTROLLER TABLES AND
110372  005077  154026                  CLR     @CTABS                  ;MARK ZEROS END.
110376  005037  064426                  CLR     CTRLRS                  ;CLEAR CONTROLLER COUNT
110402  012701  064534                  MOV     #IPADRS,R1              ; R1 -> IP ADDRESS
110406  012702  000010                  MOV     #8.,R2                  ; R2 IS A COUNTER
110412  005021          1$:     CLR     (R1)+                           ; CLEAR ENTRY
110414  005302                  DEC     R2                              ; DONE?
110416  001375                  BNE     1$                              ; IF NOT, BRANCH
```

```
                                        ;BUILD CONTROLLER TABLES

110420  005005                  INIT4:  CLR     R5              ;CLEAR CUSTOMER DATA FLAG
110422  005002                          CLR     R2              ;START WITH LOGICAL UNIT 0
110424                          1$:                             ;GET POINTER TO IT'S P-TABLE
110424  010200                          MOV     R2,R0
110426  104442                          TRAP    C$GPHRD

                                                                ;BRANCH TO 16$ IF NOT AVAILABLE
110430  103156                          BCC     16$
110432  013703  064424                  MOV     CTABS,R3        ;GET ADDRESS OF 1ST CONTROLLER TABLE
110436  005713                  2$:     TST     (R3)            ;CHECK IF ANY MORE TABLES
110440  001435                          BEQ     6$              ;BUILD NEW TABLE IF FOUND ZERO WORD
110442  021013                          CMP     (R0),(R3)       ;CHECK IF SAME UNIBUS ADDRESS,
110444  001017                          BNE     4$              ;BRANCH IF NOT, ELSE
                                                                ;CHECK THAT OTHER PARAMETERS MATCH.
110446  016004  000004                  MOV     H.BRL(R0),R4    ;GET BR LEVEL FROM P-TABLE
110452  000304                          SWAB    R4              ;SWAP TO HIGH BYTE
110454  006104                          ROL     R4              ;SHIFT ONE MORE TO LEFT
110456  056004  000002                  BIS     H.VEC(R0),R4    ;ADD VECTOR ADDRESS
110462  020463  000004                  CMP     R4,C.VEC(R3)    ;COMPARE VECTOR AND BR LEVELS,
110466  001004                          BNE     3$              ;BRANCH IF DIFFERENT, ELSE
110470  026063  000006  000006          CMP     H.BST(R0),C.BST(R3)     ;COMPARE BURST RATES,
110476  001461                          BEQ     11$             ;BRANCH IF SAME, ELSE
110500  000137  111212          3$:     JMP     CTABER          ;FOUND SAME UDA WITH DIFFERENT
                                                                ;BR LEVEL, VECTOR ADDRS OR BURST RATE.
110504  016304  000004          4$:     MOV     C.VEC(R3),R4    ;GET VECTOR FROM CONTROLLER TABLE
110510  042704  177000                  BIC     #^C<CT.VEC>,R4  ;AND
110514  026004  000002                  CMP     H.VEC(R0),R4    ;COMPARE VECTOR ADDRESSES,
110520  001002                          BNE     5$              ;BRANCH IF DIFFERENT, ELSE
110522  000137  111262                  JMP     SAMVEC          ;FOUND TWO UDA'S WITH SAME VECTOR ADDRESS,

110526  062703  000046          5$:     ADD     #C,SIZE,R3      ;POINT TO BEGINNING OF NEXT CONTROLLER
110532  000741                          BR      2$              ;TABLE IN MEMORY.
```

```
                                        ;BUILD NEW CONTROLLER TABLE

110534  012704  064534          6$:     MOV     #IPADRS,R4              ;GET BEGINNING OF IP ADDRESS TABLE
110540  020427  064554          7$:     CMP     R4,#IPADRS+16.          ;SEE IF END OF IP ADDRESS TABLE.
110544  101004                          BHI     9$                      ;BRANCH IF SO, ELSE
110546  005724                          TST     (R4)+                   ;DID WE FIND AN OPEN ENTRY ?
110550  001401                          BEQ     8$                      ;BRANCH IF SO, ELSE
110552  000772                          BR      7$                      ;LOOK AGAIN.

110554  011044                  8$:     MOV     (R0),-(R4)              ;TAKE UNIBUS ADDRESS FROM P-TABLE
                                                                        ;AND STORE IT IN THE IP ADDRESS TABLE.
110556  012701  000023          9$:     MOV     #<C.SIZE>/2,R1          ;GET # OF ENTRIES IN CONTROLLER TABLE
110562  004737  075422                  CALL    ALOCM                   ;AND ALLOCATE A TABLE TO MEMORY.
                                                                        ; R0 POINTS TO 1ST WORD P-TABLE
                                                                        ; R1 POINTS TO 1ST WORD IN CONTROLLER TABLE
110566  011021                          MOV     (R0),(R1)+              ;STORE UDA IP ADDRESS AND
110570  010221                          MOV     R2,(R1)+                ;LOGICAL UNIT NUMBER IN THE CONTROLLER TABLE.
110572  016004  000004                  MOV     H.BRL(R0),R4            ;GET THE BR LEVEL,
110576  000304                          SWAB    R4                      ;SWAP TO HIGH BYTE,
110600  006104                          ROL     R4                      ;SHIFT ONE MORE TO LEFT,
110602  056004  000002                  BIS     H.VEC(R0),R4            ;ADD VECTOR ADDRESS AND
110606  010421                          MOV     R4,(R1)+                ;STORE IT IN THE CONTROLLER TABLE.
110610  016021  000006                  MOV     H.BST(R0),(R1)+         ;STORE THE BURST RATE,
110614  012721  004037                  MOV     #4037,(R1)+             ;THE 'JSR R0' INSTRUCTION AND
110620  012721  104520                  MOV     #UDASRV,(R1)+           ;THE ADDRESS OF THE INTERRUPT SERVICE
                                                                        ;ROUTINE IN THE CONTROLLER TABLE.
110624  012704  000015                  MOV     #<C.SIZE-C.FLG>/2,R4    ;GET # OF ENTRIES TO END OF TABLE,
110630  005021                  10$:     CLR     (R1)+                   ;CLEAR REST OF TABLE AND
110632  005304                          DEC     R4                      ;ADD ZERO WORD AT END.
110634  002375                          BGE     10$                     ;LOOP TIL ALL CLEARED
110636  005237  064426                  INC     CTRLRS                  ;KEEP TRACK OF CONTROLLER COUNT
```

```
                                        ;BUILD DRIVE TABLES
                        064422          11$:    MOV     DTABS,R1        ;GET ADDRESS OF CURRENT DRIVE TABLE
                        000020                  ADD     #C.DRO,R3       ;INDEX TO 1ST DRIVE IN CONTROLLER TABLE
                        000010                  MOV     #8.,R4          ;GET MAXIMUM # OF DRIVES PER CONTROLLER
                                        12$:    TST     (R3)            ;ANY ENTRY TO DRIVE TABLE.
                                                BEQ     14$             ;BRANCH IF NOT, ELSE
                        000010                  CMP     H.DRV(R0),0(R3)+ ;COMPARE DRIVE NUMBER IN DRIVE TABLE.
                                                BNE     13$             ;BRANCH IF DIFFERNENT, ELSE
                        111226                  JMP     MLDRER          ;FOUND TWO P-TABLES WITH SAME DRIVE.

                                        13$:    DEC     R4              ;COUNT DRIVES
                                                BNE     12$             ;IF EIGHT DRIVE TABLES EXIST,
                        111244                  JMP     TOOMER          ;   THEN REPORT ERROR

                                        14$:    MOV     R1,(R3)         ;STORE ADDRESS OF DRIVE TABLE IN
                                                                        ;CONTROLLER TABLE.
                        000010                  MOV     H.DRV(R0),(R1)+ ;STORE DRIVE NUMBER AND
                                                MOV     R2,(R1)+        ;LOGICAL UNIT NUMBER IN DRIVE TABLE.
                        000012                  MOV     H.FRM(R0),(R1)  ;GET TEST AREA BIT
                                                BIS     (R1),R5         ;SAVE "OR" OF BIT FROM ALL DRIVES
                                                COM     (R1)            ;COMPLIMENT IT
                        157777                  BIC     #^C<M.YL>,(R1)
                        011012                  BIS     #DDEF,(R1)+     ;LOAD DEFAULT PARAMETER BITS
                        000100                  MOV     #<D.SIZE/2>-3,R4 ;CLEAR REST OF TABLE
                                        15$:    CLR     (R1)+
                                                DEC     R4
                                                BGT     15$
                        177777  177754          MOV     #-1,<D.ECYL*2-D.SIZE>(R1) ;MARK CYLINDERS AT TEST ALL

                        000206  064422          ADD     #D.SIZE,DTABS   ;NEXT DRIVE TABLE ADDRESS AND
                        153434                  CLR     @DTABS          ;MARK ZERO END.
                                        16$:    INC     R2              ;INCREMENT LOGICAL UNIT NUMBER
                        002012                  CMP     R2,#L$UNIT      ;CHECK IF GOT ALL TABLES
                                                BLT     1$              ;IF NOT, GO BACK FOR NEXT, ELSE
                        000001                  MOV     #1,R1           ;GET 1 WORD TO TERMINATE ALL CONTROLLER
                        075422                  CALL    ALOCM           ;TABLES AND ALLOCATE IT TO MEMORY.
```

```
                                        ;CHECK FOR CUSTOMER WARNING MESSAGE
111006  032705  020000          INIT5:  BIT     #HM.CYL,R5              ;CHECK IF BIT EVER SET
111012  001460                          BEQ     5$                      ;BYPASS IF NOT
111014  004137  075664                  JSR     R1,LPNTF                ;CALL   LPNTF PRINT ROUTINE
111020  065454                          .WORD   INITWA                  ;ADDRESS OF ASCIZ STRING
111022  000000                          .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
111024  013705  064424                  MOV     CTABS,R5                ;GET ADDRESS 1ST CONTROLLER TABLE
111030  010504                  1$:     MOV     R5,R4                   ;GET ADDRESS OF POINTER TO DRIVE TABLE
111032  062704  000020                  ADD     #C.DRO,R4
111036  012701  000010                  MOV     #8.,R1                  ;GET COUNT OF DRIVE TABLES
111042  012403                  2$:     MOV     (R4)+,R3                ;GET ADDRESS OF DRIVE TABLE
111044  001422                          BEQ     4$
111046  032763  020000  000004          BIT     #D.DCY,D.PRM(R3)        ;CHECK IF CUSTOMER DATA SELECTED
111054  001014                          BNE     3$
111056  011346                          MOV     (R3),-(SP)
111060  011546                          MOV     (R5),-(SP)
111062  016346  000002                  MOV     D.UNIT(R3),-(SP)
111066  012746  065560                  MOV     #INITWB,-(SP)
111072  012746  000004                  MOV     #4,-(SP)
111076  010600                          MOV     SP,R0
111100  104417                          TRAP    C$PNTF
111102  062706  000012                  ADD     #12,SP
111106  005301                  3$:     DEC     R1                              ;COUNT THE DRIVE TABLES
111110  001354                          BNE     2$                      ;LOOK AT ALL OF THEM
111112  062705  000046          4$:     ADD     #C.SIZE,R5              ;MOVE TO NEXT CONTROLLER TABLE
111116  005715                          TST     (R5)                    ;SEE IF ANOTHER TABLE AND
111120  001343                          BNE     1$                      ; LOOK AT IT

                                        ;GET CONFIRMATION TO PROCEED

111122  104450                          TRAP    C$MANI
111124  103013                          BCC     5$
111126  104443                          TRAP    C$GMAN
111130  000404                          BR      10000$
111132  064476                          .WORD   TEMP
111134  000120                          .WORD   T$CODE
111136  064763                          .WORD   INITWC
111140  000001                          .WORD   1
111142                          10000$:
111142  032737  000001  064476          BIT     #1,TEMP                 ;LOOK AT RESPONSE
111150  001001                          BNE     5$                      ;BRANCH IF YES WAS ANSWER
                                                                        ;DO CLEAN-UP TRAP
111152  104444                          TRAP    C$DCLN

                                        ;SAVE CURRENT PARAMETERS TO FREE MEMORY SO EACH TEST CAN USE ALL OF IT

111154  013737  064412  064416  5$:     MOV     FFREE,FMEM              ;SAVE START ADDRESS
111162  013737  064414  064420          MOV     FSIZE,FMEMS             ;SAVE SIZE
```

```
                                ;EXIT INITIALIZE SECTION

111170                          INITXX:
111170  012700  000000                  MOV     #PRI00,R0
111174  104441                          TRAP    C$SPRI
111176  005037  064656                  CLR     DLL             ;ERASE DOWNLINE LOAD DATA
111202  004737  105612                  CALL    CLOSEF          ;MAKE SURE DATA FILE IS CLOSED

111206  104432                          TRAP    C$EXIT
111210  000066                          .WORD   L10044-.
```

```
                                .SBTTL  INITIALIZE ERRORS

                                ;DIFFERENT VECTORS, BR LEVELS OR BURST RATES FOR ONE CONTROLLER

111212  010305          CTABER: MOV     R3,R5                   ;GET CONTROLLER ADDRESS
111214  104454                  TRAP    C$ERSF
111216  000001                  .WORD   1
111220  000000                  .WORD   0
111222  074252                  .WORD   ERR001
                                                                ;DO CLEAN-UP TRAP
111224  104444                  TRAP    C$DCLN

                                ;TWO P-TABLES FOR SAME DRIVE

111226  013705  064476  MLDRER: MOV     TEMP,R5                 ;GET CONTROLLER ADDRESS
111232  104454                  TRAP    C$ERSF
111234  000002                  .WORD   2
111236  000000                  .WORD   0
111240  074270                  .WORD   ERR002
                                                                ;DO CLEAN-UP TRAP
111242  104444                  TRAP    C$DCLN

                                ;MORE THAN EIGHT DRIVES SELECTED ON ONE CONTROLLER

111244  013705  064476  TOOMER: MOV     TEMP,R5                 ;GET CONTROLLER ADDRESS
111250  104454                  TRAP    C$ERSF
111252  000003                  .WORD   3
111254  000000                  .WORD   0
111256  074306                  .WORD   ERR003
                                                                ;DO CLEAN-UP TRAP
111260  104444                  TRAP    C$DCLN

                                ;TWO UDA'S USE THE SAME VECTOR

111262  010305          SAMVEC: MOV     R3,R5                   ;GET CONTROLLER ADDRESS
111264  104454                  TRAP    C$ERSF
111266  000010                  .WORD   8
111270  000000                  .WORD   0
111272  074412                  .WORD   ERR008
                                                                ;DO CLEAN-UP TRAP
111274  104444                  TRAP    C$DCLN
                                .EVEN

111276                  L10044:
111276  104411                  TRAP    C$INIT
```

```
                                .SBTTL  AUTODROP SECTION

                                ;++
                                ; THIS CODE IS EXECUTED IMMEDIATELY AFTER THE INITIALIZE CODE IF
                                ; T[illegible] "ADR" FLAG  WAS SET.  THE UNIT(S) UNDER TEST ARE CHECKED TO
                                ; SEE IF THEY WILL RESPOND.  THOSE THAT DON'T ARE IMMEDIATELY
                                ; DROPPED FROM TESTING.
                                ;--

111300                          L$AUTO::

                                L10045:
111300  104461                          TRAP    C$AUTO
```

```
                                .SBTTL  CLEANUP CODING SECTION

                                ;++
                                ; THE CLEANUP CODING SECTION CONTAINS THE CODING THAT IS PERFORMED
                                ; AFTER THE HARDWARE TESTS HAVE BEEN PERFORMED.
                                ;--

111302                          L$CLEAN::

111302  004737  105612                  CALL    CLOSEF                  ;CLOSE DATA FILE
111306  022737  000004  064444          CMP     #4,TNUM                 ;ARE WE DOING TEST 4 ?
111314  001402                          BEQ     1$                      ;BRANCH IF SO, DON'T RESET BUS
111316  004737  106250                  CALL    RESET                   ;RESET ALL UDA'S
111322                          1$:

111322  104432                          TRAP    C$EXIT
111324  000002                          .WORD   L10046-.

                                        .EVEN

111326                          L10046:
111326  104412                          TRAP    C$CLEAN
```

```
                                .SBTTL  DROP UNIT SECTION

                                ;++
                                ; THE DROP-UNIT SECTION CONTAINS THE CODING THAT CAUSES A DEVICE
                                ; TO NO LONGER BE TESTED.
                                ;--

111330                          L$DU::

                                        .WORD   J$JMP
                                        .WORD   L10047-2-.

                                        .EVEN

111334                          L10047:
111334  104453                          TRAP    C$DU
```

```
                                .SBTTL  ADD     UNIT SECTION

                                ;++
                                ; THE ADD-UNIT SECTION CONTAINS ANY CODE THE PROGRAMMER WISHES
                                ;  TO BE EXECUTED IN CONJUNCTION WITH THE ADDING OF A UNIT BACK
                                ;  TO THE TEST CYCLE.
                                ;--

111336                          L$AU::

                                        .WORD   J$JMP
111336  000167                  .WORD   L10050-2-.
111340  000000

                                        .EVEN

111342                          L10050:
111342  104452                          TRAP    C$AU
```

```
 2                                      .SBTTL  HARDWARE TESTS
14                                      .SBTTL  TEST 1: UNIBUS ADDRESSING TEST
51
54 111344                               T1::
59 111344  012701  000001                       MOV     #1,R1                   ;INITIALIZE TEST PARAMETERS
60 111350  004737  076336                       CALL    TINIT
61 111354  013737  064424  064430               MOV     CTABS,TSTTAB            ;GET ADDRESS OF 1ST CONTROLLER TABLE
62 111362  013705  064430               T1NEXT: MOV     TSTTAB,R5               ; GET CONTROLLER TABLE ADDRESS
63 111366  116537  000002  002074               MOVB    C.UNIT(R5),L$LUN        ; CHECK IF UNIT AVAILABLE FOR TESTING
64 111374  005765  000002                       TST     C.UNIT(R5)
65 111400  100010                               BPL     T1NOW                   ; TEST IF AVAILABLE
67 111402  062737  000046  064430       T1SKIP: ADD     #C.SIZE,TSTTAB          ; MOVE TO NEXT CONTROLLER
68 111410  005777  153014                       TST     @TSTTAB                 ; CHECK IF ANOTHER CONTROLLER TABLE
69 111414  001362                               BNE     T1NEXT
70 111416  104432                               TRAP    C$EXIT
   111420  000776                               .WORD   L10051-.
71
72 111422  004737  106260               T1NOW:  CALL    RESET                   ;RESET ALL UDA'S
```

```
                                        T1.1:
111426                                          TRAP    C$BSUB
111426  104402
111430  005037  064636                          CLR     NXMAD           ;CLEAR MEMORY ERROR FLAG
                                                                        ;SETUP TIMEOUT ERROR VECTOR
111434  012746  000340                          MOV     @PRI07,-(SP)
111440  012746  104510                          MOV     @NXMI,-(SP)
111444  012746  000004                          MOV     @ERRVEC,-(SP)
111450  012746  000003                          MOV     #3,-(SP)
111454  104437                                  TRAP    C$SVEC
111456  062706  000010                          ADD     #10,SP
111462  011504                                  MOV     (R5),R4         ;GET ADDRESS OF UDAIP REGISTER
111464  005714                                  TST     (R4)            ;READ UDAIP
111466  005764  000002                          TST     2(R4)           ;READ UDASA
                                                                        ;RETURN TIMEOUT ERROR VECTOR
111472  012700  000004                          MOV     @ERRVEC,R0
111476  104436                                  TRAP    C$CVEC
111500  005737  064636                          TST     NXMAD           ;CHECK FLAG
111504  001406                                  BEQ     T1GOOD
111506  104455                                  TRAP    C$ERDF
111510  000046                                  .WORD   38
111512  000000                                  .WORD   0
111514  075044                                  .WORD   ERR038
111516  104406                                  TRAP    C$CLP1
111520  000730                                  BR      T1SKIP          ;END TEST NOW
111522                                  T1GOOD:
111522                                  L10052:
111522  104403                                  TRAP    C$ESUB
```

```
                                        ;
                                        ;       MAKE SURE UDA PASSES INTERNAL DIAGNOSTIC
                                        ;       MAKE SURE UDA CAN SENSE STEP 1 AND 2
                                        ;

111524                                  T1.2:
111524  104402                                  TRAP    C$BSUB
111526  005014                                  CLR     (R4)                    ; INIT UDA
111530  012737  004000  105546                  MOV     #SA.S1,UDARSD           ; STEP 1 ASSERTED?
111536  004737  105410                          CALL    UDARSP                  ; WAIT FOR RESPONSE
111542  103410                                  BCS     1$                      ; IF FAIL, EXIT
111544  012764  100000  000002                  MOV     #SA.STP.2(R4)           ; SEND STEP 1
111552  012737  010000  105546                  MOV     #SA.S2,UDARSD           ; STEP 2 ASSERTED?
111560  004737  105410                          CALL    UDARSP
111564                                  1$:
111564                                  L10053:
111564  104403                                  TRAP    C$ESUB
```

```
                                        ;
                                        ;       TEST THE DIAGNOSTIC LOOP MODE OF ALL UDA'S ON THE SYSTEM
                                        ;

111566                          T1.3:
111566  104402                          TRAP    C$BSUB
111570  011504                          MOV     (R5),R4                 ; R4 POINTS TO UDAIP REGISTER
111572  005014                          CLR     (R4)                    ; INITIALIZE THE UDA
111574  012737  004000  105546          MOV     #SA.S1,UDARSD           ; LOOK FOR STEP 1
111602  004737  105410                  CALL    UDARSP                  ; WAIT FOR RESPONSE
111606  103444                          BCS     5$                      ; IF ERROR, BRANCH
111610  016437  000002  106650          MOV     2(R4),WCHNGD            ; MOVE OLD PORT CONTENTS TO STORAGE
111616  012764  140000  000002          MOV     #<SA.STP+SA.WRP>,2(R4)  ; INITIALIZE FOR PORT WRAP
111624  004737  106554                  CALL    WCHNG                   ; WAIT FOR THE PORT TO CHANGE
111630  001433                          BEQ     5$                      ; IF ERROR, BRANCH
111632  022764  140000  000002          CMP     #<SA.STP+SA.WRP>,2(R4)  ; COMPARE WITH DATA WRITTEN
111640  001017                          BNE     3$
111642  012702  000001          1$:     MOV     #1,R2                   ; SET UP FOR SHIFTING '1'
111646  012703  000020                  MOV     #16.,R3                 ; SET UP LOOP COUNT
111652  016437  000002  106650  2$:     MOV     2(R4),WCHNGD            ; SAVE OLD PORT CONTENTS
111660  010264  000002                  MOV     R2,2(R4)                ; WRITE PATTERN TO UDASA FOR LOOP
111664  004737  106554                  CALL    WCHNG                   ; WAIT FOR UDASA TO CHANGE
111670  001413                          BEQ     5$                      ; IF ERROR, BRANCH
111672  020264  000002                  CMP     R2,2(R4)                ; COMPARE R0 WITH WHAT WAS ECHOED
111676  001405                          BEQ     4$                      ; IF MATCH, BRANCH
111700                          3$:
111700  104455                          TRAP    C$ERDF
111702  000032                          .WORD   26
111704  000000                          .WORD   0
111706  074634                          .WORD   ERR026
111710  000403                          BR      5$                      ; BRANCH
111712  006302                  4$:     ASL     R2                      ; MOVE THE SHIFTING ONE LEFT BY 1
111714  005303                          DEC     R3                      ; DECREMENT COUNT
111716  001355                          BNE     2$                      ; IF LOOP INCOMPLETE, BRANCH
111720                          5$:
111720                          L10054:
111720  104403                          TRAP    C$ESUB
```

```
 1
 2                                          ;
 3                                          ;       TEST THE INTERRUPTS VECTOR AND BR LEVEL
 4                                          ;
 5
 6 111722                                   T1.4:
   111722  104402                                   TRAP    C$BSUB
 7 111724  011504                                   MOV     (R5),R4                 ; R4 POINTS TO UDAIP REGISTER
 9 111726  016503  000004                         MOV     C.VEC(R5),R3            ; GET VECTOR AND BRANCH LEVEL
10 111732  010302                                 MOV     R3,R2                   ; COPY TO R2 FOR BR LEVEL
11 111734  042703  177000                         BIC     #^CCT.VEC,R3            ; CLEAR UNUSED VECTOR BITS
12 111740  042702  170777                         BIC     #^CCT.BRL,R2            ; CLEAR UNUSED BRANCH LEVEL BITS
13 111744  012701  000011                         MOV     #9.,R1                  ; SET UP TO SHIFT BR LEVEL
14 111750  006202                          1$:    ASR     R2                      ; SHIFT BY ONE BIT
15 111752  005301                                 DEC     R1                      ; COUNT SHIFTS
16 111754  001375                                 BNE     1$                      ; IF INCOMPLETE, BRANCH
17 111756  010237  106652                         MOV     R2,BRLEV                ; SAVE THE BRANCH LEVEL
18 111762  010346                                 MOV     R3,-(SP)                ;PUSH R3 ON STACK
   111764  011546                                 MOV     (R5),-(SP)              ;PUSH (R5) ON STACK
   111766  004137  075704                         JSR     R1,LPNTX                ;CALL   LPNTX PRINT ROUTINE
   111772  065342                                 .WORD   INTSTO                  ;ADDRESS OF ASCIZ STRING
   111774  000004                                 .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
20                                                                               ; SETUP INTERRUPT VECTOR ADDRESS
21 111776  012746  000000                         MOV     #PRI00,-(SP)
   112002  012746  106252                         MOV     #INTSRV,-(SP)
   112006  010346                                 MOV     R3,-(SP)
   112010  012746  000003                         MOV     #3,-(SP)
   112014  104437                                 TRAP    C$SVEC
   112016  062706  000010                         ADD     #10,SP
22 112022  012700  000000                         MOV     #PRI00,R0
   112026  104441                                 TRAP    C$SPRI
23 112030  006203                                 ASR     R3                      ; DIVIDE VECTOR BY 4 FOR UDA INITIALIZATION
24 112032  006203                                 ASR     R3                      ; DIVIDE VECTOR BY 4 FOR UDA INITIALIZATION
25 112034  052703  100200                         BIS     #<SA.STP+SA.INT>,R3     ; SET OTHER BITS FOR UDA INITIALIZATION
26 112040  005037  064454                         CLR     INTRCV                  ; FLAG AS NO INTERRUPTS RECEIVED
27 112044  005014                                 CLR     (R4)                    ; INIT UDA
28 112046  012737  004000  105546                 MOV     #SA.S1,UDARSD           ; LOOK FOR STEP 1 COMPLETION
29 112054  004737  105410                         CALL    UDARSP                  ; WAIT FOR COMPLETION
30 112060  010364  000002                         MOV     R3,2(R4)                ; MOVE STEP 1 DATA TO UDA
31 112064  012700  000012                         MOV     #10.,R0                 ;SET UP TIMEOUT OF 10 SECONDS
32 112070  010501                                 MOV     R5,R1
33 112072  062701  000040                         ADD     #C.TO,R1                ;POINT TO CONTROLLER TABLE
34 112076  004737  104530                         CALL    SETTO
35 112102  005737  064454                  2$:    TST     INTRCV                  ; SEE IF INTERRUPTED
36 112106  001016                                 BNE     3$                      ; IF SO, EVERYTHING'S OK, SO BRANCH
37                                                                               ;>>>>>>>>>>BREAK BACK TO MONITOR<<<<<<<<<<
38 112110  104422                                 TRAP    C$BRK
39
40 112112  005737  064616                         TST     KW.CSR                  ;SEE IF CLOCK ON SYSTEM
41 112116  001771                                 BEQ     2$
42 112120  023765  064630  000042                 CMP     KW.EL+2,C.TOH(R5)       ;SEE IF TIME ELAPSED
43 112126  101041                                 BHI     7$
44 112130  001364                                 BNE     2$
45 112132  023765  064626  000040                 CMP     KW.EL,C.TO(R5)
46 112140  103760                                 BLO     2$
47 112142  000433                                 BR      7$                      ; BRANCH
48 112144  005037  064454                  3$:    CLR     INTRCV                  ; FLAG AS NO INTERRUPTS RECEIVED
```

```
     49 112150  012700  000340                MOV     #PRI07,R0
        112154  104441                        TRAP    C$SPRI
     50 112156  005064  000002                CLR     2(R4)           ; WRITE SECOND STEP TO UDA
     51 112162  012702  000144                MOV     #100.,R2        ; SET UP DELAY SO WE KNOW WE'RE INTERRUPTED
     52 112166  005302                4$:     DEC     R2              ; DECREMENT COUNT
     53 112170  001376                        BNE     4$              ; IF INCOMPLETE, BRANCH
     54 112172  012701  000007                MOV     #7.,R1          ; R1 IS PROCESS PRIORITY LEVEL
     55 112176                        5$:
        112176  010146                        MOV     R1,-(SP)        ;;PUSH R1 ON STACK
     56 112200  012702  000005                MOV     #5.,R2          ; SET UP FOR SHIFTING PRIORITY
     57 112204  006301                6$:     ASL     R1              ; SHIFT PRIORITY
     58 112206  005302                        DEC     R2              ; DECREMENT SHIFT COUNT
     59 112210  001375                        BNE     6$              ; IF INCOMPLETE, BRANCH
     60 112212  010100                        MOV     R1,R0
        112214  104441                        TRAP    C$SPRI
     61 112216  012601                        MOV     (SP)+,R1        ;;POP STACK INTO R1
     62 112220  005737  064454                TST     INTRCV          ; SEE IF INTERRUPT RECEIVED
     63 112224  001007                        BNE     8$              ; IF SO, BRANCH
     64 112226  005301                        DEC     R1              ; DECREMENT PRIORITY LEVEL
     65 112230  100362                        BPL     5$              ; IF ALL LEVELS UNTESTED, BRANCH
     66 112232                        7$:
        112232  104455                        TRAP    C$ERDF
        112234  000034                        .WORD   28
        112236  000000                        .WORD   0
        112240  074672                        .WORD   ERR028
     67 112242  000420                        BR      10$             ; BRANCH
     68
     69 112244                        8$:
        112244  012700  000000                MOV     #PRI00,R0
        112250  104441                        TRAP    C$SPRI
     70 112252  005201                        INC     R1              ; SO PRIORITY = BR LEVEL
     71 112254  023701  106652                CMP     BRLEV,R1        ; SEE IF BR LEVEL MATCHES PRIORITY
     72 112260  001405                        BEQ     9$              ; IF SO, BRANCH
     73 112262  104455                        TRAP    C$ERDF
        112264  000035                        .WORD   29
        112266  000000                        .WORD   0
        112270  074704                        .WORD   ERR029
     74 112272  000404                        BR      10$             ; BRANCH
     75 112274                        9$:
        112274  004137  075704                JSR     R1,LPNTX        ;CALL   LPNTX PRINT ROUTINE
        112300  065437                        .WORD   INTST1          ;ADDRESS OF ASCIZ STRING
        112302  000000                        .WORD   ARG.CT          ;ARGUMENT COUNT * 2
     76 112304  016503  000004        10$:    MOV     C.VEC(R5),R3    ; GET VECTOR ADDRESS
     77 112310  042703  177000                BIC     #^C<CCT.VEC>,R3 ; CLEAR UNUSED BITS
     78 112314  010300                        MOV     R3,R0
        112316  104436                        TRAP    C$CVEC
     79 112320                        L10055:
        112320  104405                        TRAP    C$ESUB
```

```
      1
      2 112322                          T1.5:
        112322  104402                          TRAP    C$BSUB
      3 112324  005004                          CLR     R4              ; INITIALIZE UDA WITH SMALLEST
      4 112326  004737  104612                  CALL    UDAINT          ; RING BUFFER AND INTERRUPTS DISABLED
      5 112332                          L10056:
        112332  104403                          TRAP    C$ESUB
```

```
      1
      2 112334                          T1.6:
        112334  104402                          TRAP    C$BSUB
      3 112336  012704  126400                  MOV     @<SA.STP+<5*SA.MS1>+<5*SA.CM1>>,R4 ;INITIALIZE UDA WITH RING BUFFER
      4 112342  004737  104612                  CALL    UDAINT                             ;LARGE ENOUGH TO COVER NORMAL
      5                                                                                    ;HOST COMM AREA PACKET AND BUFFER
      6                                                                                    ;SPACE (A 5 IN MESSAGE LENGTH AND
      7                                                                                    ;A 5 IN COMMAND LENGTH)
      8 112346                          L10057:
        112346  104403                          TRAP    C$ESUB
```

```
                                        T1.7:
                                                TRAP    C$BSUB
                                                MOV     FFREE,-(SP)             ;;PUSH FFREE ON STACK
                                                MOV     FSIZE,-(SP)             ;;PUSH FSIZE ON STACK
                                                MOV     #1,R1                   ; RUN DM PROGRAM IN
                                                CALL    RUNDM                   ; ONE CONTROLLER ONLY
                                                BEQ     1$
                                                CALL    RESPDM
                                        1$:
                                                MOV     (SP)+,FSIZE             ;;POP STACK INTO FSIZE
                                                MOV     (SP)+,FFREE             ;;POP STACK INTO FFREE
                                        L10060:
                                                TRAP    C$ESUB
                                                JMP     T1SKIP
                                                .EVEN

                                        L10051:
                                                TRAP    C$ETST
```

```
                                        .SBTTL  TEST 2: DISK RESIDENT DIAGNOSTIC TEST

112420                                  T2::
112420  012701  000002                          MOV     #2,R1                   ;INITIALIZE TEST PARAMETERS
112424  004737  076336                          CALL    TINIT
112430  013737  064424  064430                  MOV     CTABS,TSTTAB            ;GET ADDRESS TO 1ST CONTROLLER TABLE

112436  004737  106260                  1$:     CALL    RESET                   ;RESET ALL UDA'S
112442  013746  064412                          MOV     FFREE,-(SP)             ;;PUSH FFREE ON STACK
112446  013746  064414                          MOV     FSIZE,-(SP)             ;;PUSH FSIZE ON STACK
112452  012701  000001                          MOV     #1,R1                   ;RUN DM PROGRAM IN
112456  004737  076532                          CALL    RUNDM                   ; ONE CONTROLLER ONLY
112462  001402                                  BEQ     2$
112464  004737  076626                          CALL    RESPDM
112470                                  2$:
112470  012637  064414                          MOV     (SP)+,FSIZE             ;;POP STACK INTO FSIZE
112474  012637  064412                          MOV     (SP)+,FFREE             ;;POP STACK INTO FFREE
112500  062737  000046  064430                  ADD     #C.SIZE,TSTTAB          ;MOVE TO NEXT CONTROLLER
112506  005777  151716                          TST     @TSTTAB                 ;CHECK IF ANY MORE CONTROLLER TABLES
112512  001351                                  BNE     1$
                                                .EVEN

112514                                  L10061:
112514  104401                                  TRAP    C$ETST
```

```
                                        .SBTTL  TEST 3: DISK FUNCTION TEST

112516                                  T3::
112516  012701  000003                            MOV     #3,R1                   ;INITIALIZE TEST PARAMETERS
112522  004737  076336                            CALL    TINIT
112526  013737  064424  064430                    MOV     CTABS,TSTTAB            ;GET ADDRESS OF 1ST TABLE ADDRESS
112534  013701  064426                            MOV     CTRLRS,R1               ;RUN DM PROGRAM ON ALL CONTROLLERS
112540  004737  076532                            CALL    RUNDM                   ;  AT ONCE
112544  001402                                    BEQ     1$
112546  004737  076626                            CALL    RESPDM
112552                                  1$:
                                                .EVEN

112552                                  L10062:
112552  104401                                  TRAP    C$ETST
```

```
                                        .SBTTL  TEST 4: DISK EXERCISER

112554                                  T4::
112554  022737  000004  064444                CMP     #4,TNUM                 ;CHECK IF TEST 4 WAS IN PROGRESS
112562  001053                                BNE     T4STRT                  ;BRANCH IF NOT
112564  022737  000002  064440                CMP     #ICONT,IFLAGS           ;CHECK IF HERE BY CONTINUE COMMAND
112572  001047                                BNE     T4STRT                  ;BRANCH IF NOT
112574  005037  064440                        CLR     IFLAGS                  ;CLEAR FLAGS FOR NEXT TIME HERE
112600  013704  064650                        MOV     LBUFS,R4                ;GET LOG BUFFER POINTER
112604  001423                                BEQ     LOGCHK                  ;   IF ZERO, NONE EXISTS
112606  004137  075664                        JSR     R1,LPNTF                ;CALL   LPNTF PRINT ROUTINE
112612  066543                                .WORD   LOGM1                   ;ADDRESS OF ASCIZ STRING
112614  000000                                .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
112616  005037  064650                        CLR     LBUFS                   ;CLEAR START ADDRESS TO ERASE BUFFER
112622  012405                        LOGOUT: MOV     (R4)+,R5                ;GET CONTROLLER TABLE ADDRESS
112624  004737  103250                        CALL    PNTERR                  ;PRINT ERROR REPORT
112630  062704  000104                        ADD     #<HC.BSZ-2>,R4          ;BUMP POINTER TO NEXT ENTRY
112634  020437  064652                        CMP     R4,LBUFN                ;CHECK IF AT END
112640  103770                                BLO LOGOUT                      ;PRINT ALL ENTRIES
112642  004137  075664                        JSR     R1,LPNTF                ;CALL   LPNTF PRINT ROUTINE
112646  066575                                .WORD   LOGM2                   ;ADDRESS OF ASCIZ STRING
112650  000000                                .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
112652  000410                                BR      T4CON

112654  032737  001000  064400        LOGCHK: BIT     #SM.LOG,SFPTBL+SO.BIT   ;CHECK IF LOG ENABLED
112662  001404                                BEQ     T4CON
112664  004137  075664                        JSR     R1,LPNTF                ;CALL   LPNTF PRINT ROUTINE
112670  066622                                .WORD   LOGM3                   ;ADDRESS OF ASCIZ STRING
112672  000000                                .WORD   ARG.C1                  ;ARGUMENT COUNT * 2
112674  005737  064450                T4CON:  TST     URNING                  ;CHECK IF ANY CONTROLLERS STILL RUNNING
112700  001404                                BEQ     T4STRT                  ;RESTART IF NOT
112702  004737  076626                        CALL    RESPDM                  ;CONTINUE BY RESPONDING TO REQUESTS
112706  000137  113240                        JMP     T4WAIT                  ;END OF TEST WHEN DONE
```

```
 1
 2                                          ;       START TEST
 3
10 112712  012701  000004          T4STRT: MOV     #4,R1                   ;INITIALIZE TEST PARAMETERS
12 112716  004737  076336                  CALL    TINIT
13 112722  032737  000014  064440          BIT     #ISTRT!IREST,IFLAGS     ;HERE FROM OPERATOR COMMAND?
14 112730  001521                          BEQ     T4RUN                   ;RUN WITH PREVIOUS PARAMETERS IF NEW PASS
15 112732  032737  000200  064400          BIT     #SM.MAN,SFPTBL+SO.BIT   ;MANUAL INTERVENTION MODE?
16 112740  001463                          BEQ     T4DEF                   ;IF NOT, SET UP DEFAULT PARAMETERS
17 112742  104450                          TRAP    C$MANI
18 112744  103055                          BCC     T4DEFW
20 112746  012701  000004                  MOV     #4,R1                   ; R1 = T4QUEST FILE NUMBER
21 112752  020137  064442                  CMP     R1,FNUM                 ; IS IT ALREADY LOADED?
22 112756  001406                          BEQ     1$                      ; IF SO, BRANCH
23 112760  005005                          CLR     R5                      ; ELSE R5 = ADJUSTED ADDRESS
24 112762  004737  105630                  CALL    RDREC                   ; READ IN FILE
25 112766  103002                          BCC     1$                      ; IF OK, BRANCH
26 112770  000137  076424                  JMP     TINITE                  ; ELSE, ERROR
28
29                                         ;INPUT PARAMETERS
30
31 112774  005037  064452          1$:     CLR     UCNT                    ;CLEAR COUNT OF UNITS USING PATTERN 16
32 113000  013705  064424                  MOV     CTABS,R5                ;GET ADDRESS OF 1ST CONTROLLER TABLE
33 113004  012702  000010          T4PRM1: MOV     #8.,R2                  ;GET COUNT OF DRIVE TABLES
34 113010  010504                          MOV     R5,R4                   ;GET FIRST DRIVE TABLE POINTER
35 113012  062704  000020                  ADD     #C.DRO,R4
36 113016  012403                  T4PRM2: MOV     (R4)+,R3                ;GET DRIVE TABLE ADDRESS
37 113020  001416                          BEQ     T4PRM4                  ;GO TO NEXT CONTROLLER IF NONE
38 113022  032763  100000  000002          BIT     #DT.AVL,D.UNIT(R3)      ;SEE IF TO BE TESTED
39 113030  001010                          BNE     T4PRM3
41 113032  004737  002122                  CALL    STORAG                  ;ASK QUESTIONS
45 113036  022763  000020  000006          CMP     #16.,D.PAT(R3)
46 113044  001002                          BNE     T4PRM3
47 113046  005237  064452                  INC     UCNT
48 113052  005302                  T4PRM3: DEC     R2                      ;COUNT DRIVE TABLES
49 113054  001360                          BNE     T4PRM2                  ;GO LOOK AT NEXT
50 113056  062705  000046          T4PRM4: ADD     #C.SIZE,R5              ;GO TO NEXT CONTROLLER
51 113062  005715                          TST     (R5)                    ;   IF THERE IS ONE
52 113064  001347                          BNE     T4PRM1
53 113066  012701  064554                  MOV     #PAT16C,R1              ; R1 -> PAT16C FOR INPUT
55 113072  004737  002124                  CALL    STORAG+2                ; ASK LAST QUESTIONS
60 113076  000436                          BR      T4RUN
```

```
      1
      2                                 ;       NOW GET DATA PATTERN 16 IF SELECTED BY ANY DRIVE
      3                                 ;       GIVE WARNING MANUAL INTERVENTION NOT ALLOWED
      4
      5 113100                          T4DEFW:
        113100  004137  075664                   JSR     R1,LPNTF                ;CALL   LPNTF PRINT ROUTINE
        113104  065605                           .WORD   T4WARN                  ;ADDRESS OF ASCIZ STRING
        113106  000000                           .WORD   ARG.CT                  ;ARGUMENT COUNT * 2
```

```
                                        ;       SET UP DEFAULT PARAMETERS
                                        T4DEF:  MOV     CTABS,R5                ;GET ADDRESS OF 1ST CONTROLLER TABLE
                                        T4DEFA: MOV     #8.,R2                  ;GET COUNT OF DRIVE TABLES
                                                MOV     R5,R4                   ;GET FIRST DRIVE TABLE POINTER
                                                ADD     #C.DRO,R4
                                        T4DEFB: MOV     (R4)+,R3                ;GET DRIVE TABLE ADDRESS
                                                BEQ     T4DEFE                  ;GO TO NEXT CONTROLLER IF NONE
                                                ADD     #D.PRM,R3
                                                BIC     #^C<D.DCY>,(R3)
                                                BIS     #ODEF,(R3)+
                                                MOV     #55.,R0
                                        T4DEFC: CLR     (R3)+
                                                DEC     R0
                                                BNE     T4DEFC
                                        T4DEFD: DEC     R2                      ;COUNT DRIVE TABLES
                                                BNE     T4DEFB                  ;GO LOOK AT NEXT
                                        T4DEFE: ADD     #C.SIZE,R5              ;GO TO NEXT CONTROLLER
                                                TST     (R5)                    ;  IF THERE IS ONE
                                                BNE     T4DEFA

                                                ;START TEST

                                        T4RUN:  ROL     IFLAGS                  ;CLEAR FLAGS FOR NEXT TIME HERE
                                                BIC     #^C<ISTRTH>,IFLAGS
                                                MOV     CTABS,TSTTAB            ;GET ADDRESS OF 1ST CONTROLLER TABLE
                                                MOV     CTRLRS,R1               ;RUN DM PROGRAM ON ALL CONTROLLERS
                                                CALL    RNT4DM                  ;  AT ONCE
                                                BEQ     T4WAIT
                                                MOV     CTABS,TSTTAB            ; MAKE SURE TSTTAB HAS CONTROLLER INFO
                                                CALL    RESPDM
                                        T4WAIT: BIT     #SM.LOG,SFPTBL+SO.BIT   ;CHECK IF LOG IS ENABLED
                                                BEQ     T4EXIT                  ;EXIT IF NOT
                                                                                ;>>>>>>>>>>BREAK BACK TO MONITOR<<<<<<<<<<
                                                TRAP    C$BRK
                                                BR      T4WAIT                  ;WAIT TILL STOPPED BY CONTROL C
                                        T4EXIT:                                 ;PRINT A STATISTICAL REPORT
                                                TRAP    C$DRPT
                                                TRAP    C$EXIT
                                                .WORD   L10063-.
                                                .EVEN

                                        L10063:
                                                TRAP    C$ETST
```

```
 2                                      .TITLE PARAMETER CODING
13
14                                      .SBTTL  HARDWARE PARAMETER CODING SECTION
42
44                                      ;++
45                                      ; THE HARDWARE PARAMETER CODING SECTION CONTAINS MACROS
46                                      ; THAT ARE USED BY THE SUPERVISOR TO BUILD P-TABLES.  THE
47                                      ; MACROS ARE NOT EXECUTED AS MACHINE INSTRUCTIONS BUT ARE
48                                      ; INTERPRETED BY THE SUPERVISOR AS DATA STRUCTURES.  THE
49                                      ; MACROS ALLOW THE SUPERVISOR TO ESTABLISH COMMUNICATIONS
50                                      ; WITH THE OPERATOR.
51                                      ;--
52
53 113264  000032                               .WORD L10064-L$HARD/2
   113266                               L$HARD::
55          000000                      H.UBA   = 0                     ;UNIBUS ADDRESS
56          000002                      H.VEC   = 2                     ;UDA VECTOR
57          000004                      H.BRL   = 4                     ;BR LEVEL
58          000006                      H.BST   = 6                     ;BURST RATE
59          000010                      H.DRV   = 10                    ;DRIVE NUMBER
60          000012                      H.PRM   = 12                    ;PROGRAM PARAMETERS
61
62          020000                      HM.CYL  == BIT13                ;TEST CUSTOMER DATA AREA
64                                                                      ;PRINT 'UNIBUS ADDRESS OF UDA?'
65 113266  000031                               .WORD   T$CODE
   113270  113352                               .WORD   MSGUBA
   113272  160000                               .WORD   T$LOLIM
   113274  177774                               .WORD   T$HILIM
66                                                                      ;PRINT 'VECTOR?'
67 113276  001031                               .WORD   T$CODE
   113300  113400                               .WORD   MSGVEC
   113302  000004                               .WORD   T$LOLIM
   113304  000774                               .WORD   T$HILIM
68                                                                      ;PRINT 'BR LEVEL?'
69 113306  002052                               .WORD   T$CODE
   113310  113407                               .WORD   MSGBRL
   113312  177777                               .WORD   -1
   113314  000004                               .WORD   T$LOLIM
   113316  000007                               .WORD   T$HILIM
70                                                                      ;PRINT 'UNIBUS BURST RATE?'
71 113320  003052                               .WORD   T$CODE
   113322  113420                               .WORD   MSGBST
   113324  177777                               .WORD   -1
   113326  000000                               .WORD   T$LOLIM
   113330  000077                               .WORD   T$HILIM
72                                                                      ;PRINT 'DRIVE #?'
73 113332  004052                               .WORD   T$CODE
   113334  113442                               .WORD   MSGLDR
   113336  177777                               .WORD   -1
   113340  000000                               .WORD   T$LOLIM
   113342  000377                               .WORD   T$HILIM
75
76                                                                      ;PRINT 'EXERCISE ON CUSTOMER DATA AREA
77 113344  005130                               .WORD   T$CODE                ;       IN TEST 4?'
   113346  113452                               .WORD   MSGCST
   113350  020000                               .WORD   HM.CYL
79                                      .EVEN
```

```
                113352                          L10064:
 80
 84 113352      125     116     111    MSGUBA: .ASCIZ  \UNIBUS ADDRESS OF UDA\
 85 113400      126     105     103    MSGVEC: .ASCIZ  \VECTOR\
 86 113407      102     122     040    MSGBRL: .ASCIZ  \BR LEVEL\
 87 113420      125     116     111    MSGBST: .ASCIZ  \UNIBUS BURST RATE\
 88 113442      104     122     111    MSGLDR: .ASCIZ  \DRIVE #\
 90 113452      105     130     105    MSGCST: .ASCIZ  \EXERCISE ON CUSTOMER DATA AREA IN TEST 4\
 92                                             .EVEN
 96
106
```

```
                                .SBTTL  SOFTWARE PARAMETER CODING SECTION

                                ;++
                                ; THE SOFTWARE PARAMETER CODING SECTION CONTAINS MACROS
                                ; THAT ARE USED BY THE SUPERVISOR TO BUILD P-TABLES.  THE
                                ; MACROS ARE NOT EXECUTED AS MACHINE INSTRUCTIONS BUT ARE
                                ; INTERPRETED BY THE SUPERVISOR AS DATA STRUCTURES.  THE
                                ; MACROS ALLOW THE SUPERVISOR TO ESTABLISH COMMUNICATIONS
                                ; WITH THE OPERATOR.
                                ;--

113524  000030                          .WORD L10065-L$SOFT/2
113526                          L$SOFT::
        000000                  SO.EL   = 0                     ;ERROR LIMIT
        000002                  SO.XL   = 2                     ;DATA TRANSFER LIMIT (MEGABITS)
        000004                  SO.BIT  = 4                     ;SINGLE BIT ANSWERS

        000200                  SM.MAN  == BIT07                ;  MANUAL INTERVENTION MODE
        000400                  SM.SSF  == BIT08                ;  SUPPRESS SOFT ERRORS
        001000                  SM.LOG  == BIT09                ;  ERROR LOG ENABLED
        040000                  SM.IW   == BIT14                ;  INITIAL WRITE
```

F6


```
                                                                ;PRINT 'ENTER MANUAL INTERVENTION MODE
                                                                ;       FOR SPECIAL DIAGNOSIS?'

                                                                ;PRINT 'REMAINING SOFTWARE QUESTIONS
                                                                ;       APPLY TO TEST 4 ONLY'

                                                                ;PRINT 'ERROR LIMIT?'

                                                                ;PRINT 'READ TRANSFER LIMIT IN MEGABYTES
                                                                ;       - 0 FOR NO LIMIT?'

                                                                ;PRINT 'SUPPRESS PRINTING SOFT ERRORS?'

                                                                ;PRINT 'DO INITIAL WRITE ON START?'

                                                                ;PRINT 'ENABLE ERROR LOG?'

113526  002130                  .WORD   T$CODE
113530  113606                  .WORD   S.MAN
113532  000200                  .WORD   SM.MAN

113534  000003                  .WORD   T$CODE
113536  113673                  .WORD   S.MES

113540  000052                  .WORD   T$CODE
113542  113756                  .WORD   S.EL
113544  177777                  .WORD   -1
113546  000001                  .WORD   T$LOLIM
113550  177777                  .WORD   T$HILIM

113552  001052                  .WORD   T$CODE
113554  113772                  .WORD   S.XL
113556  177777                  .WORD   -1
113560  000000                  .WORD   T$LOLIM
113562  177777                  .WORD   T$HILIM

113564  002130                  .WORD   T$CODE
113566  114054                  .WORD   S.SSF
113570  000400                  .WORD   SM.SSF

113572  002130                  .WORD   T$CODE
113574  114112                  .WORD   S.IW
113576  040000                  .WORD   SM.IW

113600  002130                  .WORD   T$CODE
113602  114144                  .WORD   S.LOG
113604  001000                  .WORD   SM.LOG
                                .EVEN
113606                  L10065:

113606      105     116     124 S.MAN:  .ASCIZ  \ENTER MANUAL INTERVENTION MODE FOR SPECIAL DIAGNOSIS\
113673      122     105     115 S.MES:  .ASCIZ  \REMAINING SOFTWARE QUESTIONS APPLY TO TEST 4 ONLY\
113755      000                 .BYTE 0
113756      105     122     122 S.EL:   .ASCIZ  \ERROR LIMIT\
113772      122     105     101 S.XL:   .ASCIZ  \READ TRANSFER LIMIT IN MEGABYTES - 0 FOR NO LIMIT\
114054      123     125     120 S.SSF:  .ASCIZ  \SUPPRESS PRINTING SOFT ERRORS\
114112      104     117     040 S.IW:   .ASCIZ  \DO INITIAL WRITE ON START\
114144      105     116     101 S.LOG:  .ASCIZ  \ENABLE ERROR LOG\
                                .EVEN

114166                  $PATCH::
            000050              .REPT 40.
                                .EVEN
114306  114332                  .WORD T$FREE
114310  000010                  .WORD T$SIZE
114312                  L$LAST::
```

```
 1
14
16 114312  000000                        .WORD   0
   114314  000006                        .WORD   L10070 ./2-1
   114316                      L10066:
17 114316  172150                        .WORD   172150          ; UNIBUS ADDRESS
18 114320  000154                        .WORD   154             ; VECTOR ADDRESS
19 114322  000005                        .WORD   5.              ; BR LEVEL
20 114324  000077                        .WORD   63.             ; UNIBUS BURST RATE
21 114326  000000                        .WORD   0.              ; DRIVE NUMBER
22 114330  000000                        .WORD   0.              ; COSTUMER DATA AREA
23 114332                      L10070:
25         000001                      .END
```

H6

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Symbol table

SFQ 0279

```
ADR    = 000020 G      CALR5   102142      C$DU   = 000053      C.UNIT= 000002      D.DC   = 000002
ALOCM    075422        CALR6   102220      C$EDIT= 000003      C.VEC  = 000004      D.DCA  = 000001
APRINT   104472        CALR7   102234      C$ERDF= 000055      DDEF   = 011012      D.DCY  = 020000
APRIZ    104506        CALR8   102252      C$ERHR= 000056      DFPTBL   064356 G    D.DRV  = 000000
ARG.CT= 000000         CALR9   102270      C$ERRO= 000060      DIAG   = 177777      D.ECC  = 010000
ASS    = 100000        CF.ATN= 000200      C$ERSF= 000054      DIAGMC= 000000       D.ECCC= 000176
ASSEMB= 000010         CF.MSC= 000100      C$ERSO= 000057      DIVIDE   102704      D.ECYL= 000160
A1     = 000001        CF.OTH= 000040      C$ESCA= 000010      DIV10    102742      D.END1= 000120
A2     = 000002        CF.SHO= 000002      C$ESEG= 000005      DLL      064656      D.END2= 000130
A3     = 000020        CF.THS= 000020      C$ESUB= 000003      DLLADR   064666      D.END3= 000140
A4     = 000040        CF.576= 000001      C$ETST= 000001      DLLDR    064660      D.END4= 000150
BAS      067047        CLOG    105550      C$EXIT= 000032      DLLNAM   064674      D.HERR= 000170
BASLN    067050        CLOSEF  105612      C$GETD= 000026      DLLR     064664      D.IW   = 040000
BASL1    066775        CLRBFL  104304      C$GETW= 000027      DLLSIZ   064672      D.PAT  = 000006
BASL2    067013        CLRBUF  104256      C$GMAN= 000043      DLLV     064662      D.PRM  = 000004
BASL3    067032        CON.A   076062      C$GPHR= 000042      DMFRST= 001000       D.RET  = 001000
BASN0    066651        CON.A1  076066      C$GPLO= 000030      DMMAIN= 000040       D.RO   = 004000
BASN1    066670        CON.A2  076110      C$GPRI= 000040      DMOVRL= 000004       D.SEEK= 000174
BASN2    066714        CON.D   076112      C$INIT= 000011      DMPROG   064432      D.SEQ  = 000100
BASN3    066734        CON.H   076124      C$INLP= 000020      DMTRLN= 000000       D.SERN= 000200
BASN4    066754        CON.N   076150      C$MANI= 000050      DONE     101722      D.SERR= 000172
BELL   = 000007 G      CON.N1  076154      C$MEM  = 000031     DSPSIZ= 000017       D.SIZE= 000206
BIT0   = 000001 G      CON.O   076136      C$MSG  = 000023     DTABS    064422 G    D.TR   = 000020
BIT00  = 000001 G      CON.QU  076042      C$OPEN= 000034      DT.AVL= 100000       D.UNIT= 000002
BIT01  = 000002 G      CON.QX  076060      C$PNTB= 000014      DT.UNT= 000077       D.WC   = 000010
BIT02  = 000004 G      CON.R   076172      C$PNTF= 000017      DUP    = 001000      D.WCA  = 000004
BIT03  = 000010 G      CON.R1  076214      C$PNTS= 000016      DU.DFL= 020000       D.WO   = 002000
BIT04  = 000020 G      CON.S   076230      C$PNTX= 000015      DU.FTL= 050000       D.XFRR= 000166
BIT05  = 000040 G      CON.S1  076234      C$QIO  = 000377     DU.INF= 030000       D.XFRW= 000164
BIT06  = 000100 G      CR     = 000015 G   C$RDBU= 000007      DU.QUE= 010000       D.ZERO= 140200
BIT07  = 000200 G      CRLF     065042     C$REFG= 000047      DU.SPC= 060000       EF.BBR= 000200
BIT08  = 000400 G      CTABER   111212     C$RESE= 000033      DU.TER= 040000       EF.BBU= 000100
BIT09  = 001000 G      CTABS    064424 G   C$REVI= 000003      D.BB   = 000010      EF.CON= 000036 G
BIT1   = 000002 G      CTRLRS   064426     C$RFLA= 000021      D.BB01= 000012       EF.LOG= 000040
BIT10  = 002000 G      CT.AVL= 100000      C$RPT  = 000025     D.BB02= 000016       EF.NEW= 000035 G
BIT11  = 004000 G      CT.BRL= 007000      C$SEFG= 000046      D.BB03= 000022       EF.PWR= 000034 G
BIT12  = 010000 G      CT.CMD= 000004      C$SPRI= 000041      D.BB04= 000026       EF.RES= 000037 G
BIT13  = 020000 G      CT.MSG= 000010      C$SVEC= 000037      D.BB05= 000032       EF.SEX= 000020
BIT14  = 040000 G      CT.REQ= 000020      C$TPRI= 000013      D.BB06= 000036       EF.STA= 000040 G
BIT15  = 100000 G      CT.RN  = 000002     C.BST  = 000006     D.BB07= 000042       EN     = 040000
BIT2   = 000004 G      CT.UNT= 000077      C.DR0  = 000020     D.BB08= 000046       EO     = 140000
BIT3   = 000010 G      CT.U50= 000040      C.DR1  = 000022     D.BB09= 000052       ERRBLK   064410 G
BIT4   = 000020 G      CT.VEC= 000777      C.DR2  = 000024     D.BB10= 000056       ERRC     076304
BIT5   = 000040 G      C$AU   = 000052     C.DR3  = 000026     D.BB11= 000062       ERRD     076316
BIT6   = 000100 G      C$AUTO= 000061      C.DR4  = 000030     D.BB12= 000066       ERRLIM   065245
BIT7   = 000200 G      C$BRK  = 000022     C.DR5  = 000032     D.BB13= 000072       ERRMC    101470
BIT8   = 000400 G      C$BSEG= 000004      C.DR6  = 000034     D.BB14= 000076       ERRMES   101250
BIT9   = 001000 G      C$BSUB= 000002      C.DR7  = 000036     D.BB15= 000102       ERRME1   065101
BLDCMD   104124        C$CEFG= 000045      C.FLG  = 000014     D.BB16= 000106       ERRMSG   064406 G
BLDC0    104164        C$CLCK= 000062      C.HCOM= 000016      D.BCYL= 000154       ERRMSL   101356
BLDC1    104172        C$CLEA= 000012      C.JAD  = 000012     D.BE   = 000040      ERRMSX   101464
BOE    = 000400 G      C$CLOS= 000035      C.JSR  = 000010     D.BEC  = 000112      ERRNBR   064404 G
BRLEV    106652        C$CLP1= 000006      C.REF  = 000044     D.BGN1= 000114       ERRTYP   064402 G
CALR1    101726        C$CVEC= 000036      C.SIZE= 000046      D.BGN2= 000124       ERRVEC= 000004 G
CALR2    101754        C$DCLN= 000044      C.TO   = 000040     D.BGN3= 000134       ERR.SZ= 000011
CALR3    102052        C$DODU= 000051      C.TOH  = 000042     D.BGN4= 000144       ERR.TB   076252
CALR4    102066        C$DRPT= 000024      C.UADR= 000000      D.CYL  = 000400      ERR.TN   075250 G
```

```
ERR001  074252 G        F$PROT= 000021        H.DRV  = 000010        KW11I   106230 G        L$HPCP  002016 G
ERR002  074270 G        F$PWR  = 000017        H.PRM  = 000012        LBUFE   064654          L$HPTP  002022 G
ERR003  074306 G        F$RPT  = 000012        H.UBA  = 000000        LBUFN   064652          L$HW    064356 G
ERR004  074324 G        F$SEG  = 000003        H.VEC  = 000002        LBUFS   064650          L$ICP   002104 G
ERR005  074336 G        F$SOFT= 000005        IBE    = 010000 G      LDDM    076554          L$INIT  107636 G
ERR006  074400 G        F$SRV  = 000010        ICONT  = 000002 G      LDNEXT  076606          L$LADP  002026 G
ERR007  074350 G        F$SUB  = 000002        IDU    = 000040 G      LF      = 000012 G      L$LAST  114312 G
ERR008  074412 G        F$SW   = 000014        IER    = 020000 G      LOAD    104006          L$LOAD  002100 G
ERR014  074362 G        F$TEST= 000001        IFLAGS  064440 G        LOADB   103600          L$LUN   002074 G
ERR021  074430 G        GETCDN  102430        INITBL  105276          LOADDM  103410          L$MREV  002050 G
ERR022  074470 G        GETCNT  102364        INITWA  065454          LOADER  104120          L$NAME  002000 G
ERR023  074516 G        GETCNX  102370        INITWB  065560          LOADE1  104110          L$PRIO  002042 G
ERR024  074602 G        GETCXX  102436        INITWC  064763          LOADT1  103674          L$PROT  107630 G
ERR025  074615 G        GTDRVT  102274        INITXX  111170          LOE     = 040000 G      L$PRT   002112 G
ERR026  074634 G        GTT452  076500        INIT1   110140          LOG     = 000001        L$REPP  002062 G
ERR027  074654 G        G$CNTO= 000200        INIT2   110326          LOGCHK  112654          L$REV   002010 G
ERR028  074672 G        G$DELM= 000372        INIT3   110364          LOGM1   066543          L$RPT   106654 G
ERR029  074704 G        G$DISP= 000003        INIT4   110420          LOGM2   066575          L$SOFT  113526 G
ERR030  074720 G        G$EXCP= 000400        INIT5   111006          LOGM3   066622          L$SPC   002056 G
ERR031  074734 G        G$HILI= 000002        INTRCV  064454          LOGOUT  112622          L$SPCP  002020 G
ERR032  074746 G        G$LOLI= 000001        INTSRV  106252 G        LOT     = 000010 G      L$SPTP  002024 G
ERR033  074764 G        G$NO   = 000000        INTSTO  065342          LPNT    075722          L$STA   002030 G
ERR034  074772 G        G$OFFS= 000400        INTST1  065437          LPNTB   075674          L$SW    064374 G
ERR035  075000 G        G$OFSI= 000376        IPADRS  064534          LPNTF   075664          L$TEST  002114 G
ERR036  075016 G        G$PRMA= 000001        IREST  = 000004 G       LPNTS   075714          L$TIML  002014 G
ERR037  075030 G        G$PRMD= 000002        ISR    = 000100 G       LPNTX   075704          L$UNIT  002012 G
ERR038  075044 G        G$PRML= 000000        ISTRT  = 000010 G       LT1L1   103716          L10000  064372
ERR23A  074536          G$RADA= 000140        ISTRTH= 000020 G        LT1L2   103744          L10001  064402
ERR23B  074562          G$RADB= 000000        IXE    = 004000 G       LT11    103730          L10002  074266
ERR23C  074570          G$RADD= 000040        I$AU   = 000041         L$ACP   002110 G        L10003  074304
EVL     = 000004 G      G$RADL= 000120        I$AUTO= 000041         L$APT   002036 G        L10004  074322
E$END  = 002100         G$RADO= 000020        I$CLN  = 000041         L$AU    111336 G        L10005  074334
E$LOAD= 000035          G$XFER= 000004        I$DU   = 000041         L$AUT   002070 G        L10006  074346
FDATA   064472          G$YES  = 000010        I$HRD  = 000041         L$AUTO  111300 G        L10007  074360
FFREE   064412 G        HCOMM   075446        I$INIT= 000041         L$CCP   002106 G        L10010  074376
FILOPN  064474          HC.BF1= 000100        I$MOD  = 000041         L$CLEA  111302 G        L10011  074410
FMEM    064416          HC.BF2= 000206        I$MSG  = 000041         L$CO    002032 G        L10012  074426
FMEMS   064420          HC.BSZ= 000106        I$PROT= 000040         L$DEPO  002011 G        L10013  074466
FMERR   075410          HC.CCT= 000012        I$PTAB= 000041         L$DESC  064724 G        L10014  074514
FNAME   064456          HC.CEV= 000014        I$PWR  = 000041         L$DESP  002076 G        L10015  074600
FNUM    064442          HC.CMD= 000010        I$RPT  = 000041         L$DEVP  002060 G        L10016  074614
FRMTT   065037          HC.CPK= 000020        I$SEG  = 000041         L$DISP  064344 G        L10017  074632
FS      = 100000        HC.ESZ= 000004        I$SETU= 000041         L$DLY   002116 G        L10020  074652
FSIZE   064414 G        HC.INT= 000000        I$SFT  = 000041         L$DTP   002040 G        L10021  074670
FWORD   106150          HC.ISZ= 000004        I$SRV  = 000041         L$DTYP  002034 G        L10022  074702
F$AU   = 000015         HC.MCT= 000006        I$SUB  = 000041         L$DU    111330 G        L10023  074716
F$AUTO= 000020         HC.MEV= 000014        I$TST  = 000041         L$DUT   002072 G        L10024  074732
F$BGN  = 000040         HC.MPK= 000020        J$JMP  = 000167         L$DVTY  064700 G        L10025  074744
F$CLEA= 000007         HC.MSG= 000004        KTBASA  064434          L$EF    002052 G        L10026  074762
F$DU   = 000016         HC.PSZ= 000060        KTBASO  064436          L$ENVI  002044 G        L10027  074770
F$END  = 000041         HC.RSZ= 000004        KTMEM   064640          L$ERRT  064402 G        L10030  074776
F$HARD= 000004         HC.SIZ= 000314        KW.BRL  064620          L$ETP   002102 G        L10031  075014
F$HW   = 000013         HELP   = 000000        KW.CSR  064616          L$EXP1  002046 G        L10032  075026
F$INIT= 000006         HM.CYL= 020000 G      KW.EL   064626          L$EXP4  002064 G        L10033  075042
F$JMP  = 000050         HOE    = 100000 G      KW.HZ   064624          L$EXP5  002066 G        L10034  075054
F$MOD  = 000000         H.BRL  = 000004        KW.OUT= 000105 G        L$HARD  113266 G        L10035  075406
F$MSG  = 000011         H.BST  = 000006        KW.VEC  064622          L$HIME  002120 G        L10036  104516
```

J6

PARAMETER CODING MACRO V05.00 Wednesday 04-Jan-84 16:12 Page 221-3 SFQ 0281
Symbol table

```
L10037  104526          MSGPKT  075150          PAT16C  064554          P.SHST= 000042          RSP.CK  105366
L10040  106250          MSGUBA  113352          PAT16W  064556          P.SHUN= 000040          RSP.S1  105314
L10041  106256          MSGVEC  113400          PB      075566          P.STS = 000012          RSP.S2  105322
L10042  107626          MX    = 000252          PF      075542          P.TIME= 000C24          RSP.S3  105342
L10044  111276          MXFERE  101142          PNT   = 001000 G        P.TRKS= 000044          RSP.S4  105360
L10045  111300          MXFERP  065170          PNTERR  103250          P.UADR= 000020          RUNDM   076532
L10046  111326          MXFERX  101140          PNTNUM  102442          P.UNFL= 000016          RWORDT  106110
L10047  111334          M1    = 000004          PNTNUS  102450          P.UNIT= 000004          RWRDE1  106216
L10050  111342          M2    = 000010          PNTPKL  075106          P.UNSZ= 000044          SAMVEC  111262
L10051  112416          M3    = 000100          PNTPKT  075056          P.UNTI= 000024          SA.A2 = 001000
L10052  111522          M4    = 000200          PRI   = 002000 G        P.USEF= 000022          SA.BST= 000374
L10053  111564          NCON    075374          PRINTC  075506          P.VRSN= 000014          SA.CMD= 034000
L10054  111720          NCONF   076024          PRI00 = 000000 G        P.VSER= 000050          SA.CME= 000070
L10055  112320          NCONS   076002          PRI01 = 000040 G        RDDAT   106004          SA.CM1= 001000
L10056  112332          NOCLOC  066466          PRI02 = 000100 G        RDDLL   105570          SA.CNT= 000360
L10057  112346          NXMAD   064636          PRI03 = 000140 G        RDERR   106172          SA.CTP= 003400
L10060  112410          NXMI    104510 G        PRI04 = 000200 G        RDREC   105630          SA.DI = 000400
L10061  112514          ONEFIL= 000001          PRI05 = 000240 G        RDST    105672          SA.ERC= 003777
L10062  112552          OP.ABO= 000001          PRI06 = 000300 G        RDSTS   105670          SA.ERR= 100000
L10063  113262          OP.ACC= 000020          PRI07 = 000340 G        RESET   106260          SA.GO = 000001
L10064  113352          OP.AVA= 000100          PS      075636          RESPCT  076640          SA.INE= 000200
L10065  113606          OP.AVL= 000010          PTYPE   075770          RESPDM  076626          SA.INT= 000200
L10066  114316          OP.CCD= 000021          PX      075612          RG.FLG= 040000          SA.LFC= 000002
L10070  114332          OP.CMP= 000040          P.BCNT= 000014          RG.OWN= 100000          SA.MCV= 000017
MC    = 000314          OP.DUP= 000101          P.BUFF= 000020          RNTIM   065045          SA.MSE= 000007
MD    = 000125          OP.ELP= 000003          P.CMST= 000020          RNTIME  106362          SA.MSG= 003400
MD.CMP= 040000          OP.END= 000200          P.CNCL= 000022          RNTIMX  106542          SA.MS1= 000400
MD.CWB= 000010          OP.ERS= 000022          P.CNTF= 000016          RNTIM1  065070          SA.NV = 002000
MD.ERR= 010000          OP.ESP= 000002          P.CNTI= 000024          RNTIM2  065076          SA.NVE= 000400
MD.EXP= 100000          OP.FLU= 000023          P.CPSP= 000042          RNT4DM  076436          SA.PRG= 000001
MD.FEU= 000001          OP.GCS= 000002          P.CRF = 000000          RPTCT   106764          SA.STE= 000200
MD.IMF= 000002          OP.GSS= 000001          P.CTMO= 000020          RPTCTN  107232          SA.STP= 100000
MD.NXU= 000001          OP.GUS= 000003          P.CYLS= 000050          RPTDT   107004          SA.S1 = 004000
MD.PRI= 000001          OP.MRD= 000030          P.DEXT= 000014          RPTDTN  107226          SA.S2 = 010000
MD.RIP= 000001          OP.MWR= 000031          P.DFLG= 000017          RPTMD2  107603          SA.S3 = 020000
MD.SCH= 004000          OP.ONL= 000011          P.DMDT= 000024          RPTMSD  107534          SA.S4 = 040000
MD.SCL= 002000          OP.RD = 000041          P.DPRG= 000020          RPTMSG  107262          SA.TST= 100000
MD.SEC= 000100          OP.RLC= 000103          P.DTMO= 000024          RPTMSH  107316          SA.VCE= 000177
MD.SEQ= 000020          OP.RPL= 000024          P.ELGF= 000034          RPTXX   107242          SA.VEC= 000177
MD.SER= 000400          OP.RSD= 000005          P.FBBK= 000034          RSPDRP  077036          SA.WRP= 040000
MD.SPD= 000001          OP.SCC= 000004          P.FLGS= 000011          RSPDSP  077360          SEKERE  101000
MD.SSH= 000200          OP.SEX= 000007          P.GRPS= 000046          RSPERR  077122          SETOO   104542
MD.SWP= 000004          OP.SHC= 000102          P.HSTI= 000020          RSPIN   077054          SETO1   104550
MD.VOL= 000002          OP.SSD= 000004          P.HTMO= 000020          RSPMWR  077074          SETO2   104556
MD.WBN= 000100          OP.SUC= 000012          P.LBN = 000034          RSPNRP  077022          SETTO   104530
MD.WBV= 000400          OP.WR = 000042          P.MEDI= 000034          RSPNTO  076766          SFPTBL  064374 G
MEMFIL  077426          OSTRE   076040          P.MLUN= 000014          RSPNXT  076770          SM.IW = 040000 G
MESSAG  101610          OSTRNG  075772          P.MOD = 000012          RSPOU   077142          SM.LOG= 001000 G
MESSG   065713          O$APTC= 000000          P.OPCD= 000010          RSPOUT  077256          SM.MAN= 000200 G
MLDRER  111226          O$AU  = 000000          P.OTRF= 000014          RSPOU2  077324          SM.SSF= 000400 G
MM    = 000377          O$BGNR= 000001          P.OVRL= 000034          RSPOU3  077332          SNDCMD  104210
MSCP  = 000000          O$BGNS= 000001          P.RBN = 000014          RSPPTW  077134          SND.S1  105300
MSGBRL  113407          O$DU  = 000000          P.RBNS= 000056          RSPPT2  077144          SND.S2  105304
MSGBST  113420          O$ERRT= 000001          P.RCTC= 000057          RSPPT3  077214          SND.S3  105310
MSGCST  113452          O$GNSW= 000001          P.RCTS= 000054          RSPRPT  077020          SO.BIT= 000004
MSGLDR  113442          O$POIN= 000001          P.RGID= 000034          RSPTM   076724          SO.EL = 000000
MSGPKL  075174          O$SETU= 000001          P.RGOF= 000040          RSPTMO  076754          SO.XL = 000002
```

K6


```
SSTEP4  105406          T$CODE= 002130          T1GOOD  111522          T4BB2   100704          UTOT2   101214
STIME   064632          T$ERRN= 000035          T1MSIZ  077416          T4BB2E  100732          UTOT3   101236
STLDDM  076542          T$EXCP= 000000          T1NEXT  111362          T4CON   112674          UTOT4   101244
STORAG  002122          T$FLAG= 000040          T1NOW   111422          T4DEF   113110          U52EXT  064526
STOSIZ= 062220          T$FREE= 114332          T1SKIP  111402          T4DEFA  113114          WAITMS  104320
ST.ABO= 000002          T$GMAN= 000000          T1.1    111426          T4DEFB  113126          WCHNG   106554
ST.AOL= 000400          T$HILI= 177777          T1.2    111524          T4DEFC  113152          WCHNGD  106650
ST.AVL= 000004          T$LAST= 000001          T1.3    111566          T4DEFD  113160          XFRU    074215
ST.CMD= 000001          T$LOLI= 000000          T1.4    111722          T4DEFE  113164          XMSG1   073543
ST.CMP= 000007          T$LSYM= 010000          T1.5    112322          T4DEFW  113100          XMSG2   073577
ST.CNT= 000012          T$LTNO= 000004          T1.6    112334          T4EXIT  113254          XPKT1   073644
ST.DAT= 000010          T$NEST= 177777          T1.7    112350          T4MPRM  100352          XPKT2   074135
ST.DIA= 000037          T$NS0 = 000000          T2      112420 G        T4MXFR  101002          XSA     074164
ST.DRV= 000013          T$NS1 = 000005          T2CMD   077702          T4OPT7  064760          X$ALWA= 000000
ST.HST= 000011          T$NS2 = 000002          T2CMDE  100340          T4PRM1  113004          X$FALS= 000040
ST.MFE= 000005          T$PCNT= 000000          T2CMDM  077716          T4PRM2  113016          X$OFFS= 000400
ST.MSK= 000037          T$PTAB= 010067          T2CMDN  100262          T4PRM3  113052          X$TRUE= 000020
ST.OFL= 000003          T$PTHV= 000001          T2CMDQ  100074          T4PRM4  113056          X1      067160
ST.SUB= 000040          T$PTNU= 000001          T2CMDR  100236          T4RUN   113174          X1A     067061
ST.SUC= 000000          T$SAVL= 177777          T2CMDV  100162          T4SEEK  100762          X14     070061
ST.WPR= 000006          T$SEGL= 177777          T2CMDW  100312          T4SOFT  100734          X2      067254
SVCGBL= 000000          T$SIZE= 000010          T2CMDX  100334          T4STRT  112712          X2A     067061
SVCINS= 000000          T$SUBN= 000000          T2CMDO  077736          T4UPRM  100374          X21     070650
SVCSUB= 000000          T$TAGL= 177777          T2CMD2  100010          T4UPRX  100652          X22     070765
SVCTAG= 000000          T$TAGN= 010071          T2CMD3  100172          T4WAIT  113240          X23A    071123
SVCTST= 000000          T$TEMP= 000000          T2CMD9  077722          T4WARN  065605          X23B    071431
S$LSYM= 010000          T$TEST= 000004          T2CMS1  066056          UAM   = 000200 G        X24     071445
S.EL    113756          T$TSTM= 177777          T2CMS5  066445          UCNT    064452          X25     071635
S.IW    114112          T$TSTS= 000001          T2DLL   077536          UDAINT  104612          X26     072006
S.LOG   114144          T$$AU = 010050          T2DR    064646          UDAIST  105070          X27     072174
S.MAN   113606          T$$AUT= 010045          T2GND1  103142          UDARSD  105546          X28     072321
S.MES   113673          T$$CLE= 010046          T2GND2  103144          UDARSP  105410          X29     072371
S.SSF   114054          T$$DAT= 010070          T2GND3  103204          UDASRV  104520 G        X3      067323
S.XL    113772          T$$DU = 010047          T2GNE   103240          UF.CMR= 000001          X3A     067061
TEMP    064476          T$$HAR= 010061          T2GNUM  103122          UF.CMW= 000002          X30     072662
TIEXIT  076422          T$$HW = 010000          T2GNX   103234          UF.INA= 040000          X31     072775
TINDEX= 000006          T$$INI= 010044          T2PNT   103050          UF.RPL= 100000          X32     073117
TINIT   076336          T$$MSG= 010035          T2PNTB  103040          UF.SCH= 004000          X35     073230
TINITE  076424          T$$PC = 000001          T2PNTD  103112          UF.SCL= 002000          X36     073310
TNAMES  076274          T$$PRO= 010043          T2PNTO  103070          UF.WBN= 000100          X37     073426
TNUM    064444          T$$PTA= 010067          T2PNTW  103010          UF.WPH= 020000          X38     070460
TOOMER  111244          T$$RPT= 010042          T2WARN  065757          UF.WPS= 001000          X4      067406
TSTTAB  064430          T$$SOF= 010065          T2WRO   064644          UF.576= 000004          X5      067725
TTYOUT  075662          T$$SRV= 010041          T2WRR   064642          URNING  064450          X6      067573
TYPCNT  064532          T$$SUB= 010060          T3      112516 G        URUN    064446          X7      067775
TY.U50= 000002          T$$SW = 010001          T4      112554 G        UTOTST  101144          X8      067660
TY.U52= 000001          T$$TES= 010063          T4BB1   100654          UTOT1   101156          X8A     067061
T$ARGC= 000004          T1      111344 G        T4BB1E  100702          UTOT1A  101210          $PATCH  114166 G

. ABS.  114332    000   (RW,I,GBL,ABS,OVR)
        000000    001   (RW,I,LCL,REL,CON)
Errors detected:  0

*** Assembler statistics
```

L6

Work file reads: 396
Work file writes: 367
Size of work file: 29429 Words (115 Pages)
Size of core pool: 17152 Words (67 Pages)
Operating system: RT-11 (Under RSTS/E)

Elapsed time: 00:04:35.08
ZUDCE0,ZUDCE0/C=SVC34R.MLB/P:1,ZUDCE0.DOC,ZUDCE0

M6

N6


```
BIT05    88-57    88-57#
BIT06    88-57    88-57#
BIT07    88-57    88-57#  219-26
BIT08    88-57    88-57#  219-27
BIT09    88-57    88-57#  219-28
BIT1     88-57#   97-23    98-25   100-25   101-22
BIT10    88-57#   98-17
BIT11    88-57#   98-16
BIT12    88-57#   98-15
BIT13    88-57#   98-14   218-62
BIT14    88-57#   98-13   219-29
BIT15    88-57#   97-14    98-12    98-32   120-32   138-25   138-26   138-53   139-26   139-35   140-52   142-56   156-30   161-26
        162-56   186-7.   186-91   203-66
BIT2     88-57#   97-24    98-24   100-26
BIT3     88-57#   97-21    98-23   100-27
BIT4     88-57#   97-19    98-22   100-28
BIT5     88-57#   97-18    98-21
BIT6     88-57#   98-20
BIT7     88-57#   98-32   147-11
BIT8     88-57#   98-19
BIT9     88-57#   98-18
BLDC0   166-23   166-25#
BLDC1   166-27#  166-29
BLDCMD  124-16   124-35   162-69   164-18   166-16#
BOE      88-57#
BRLEV   184-26#  207-17*  207-71
C$AU     83-3740 202-35
C$AUTO   83-3740 199-18
C$BRK    83-3740 121-50   169-33   175-15   176-29   180-29   184 13   207-38   216-50
C$BSEG   83-3740
C$BSUB   83-3740 204-2    205-7    206-6    207-6    208-2    209-2    210-2
C$CEFG   83-3740
C$CLCK   83-3740 1.1-7    191-9
C$CLEA   83-3740 200-43
C$CLOS   83-3740 179-14
C$CLP1   83-3740 204-14
C$CVEC   83-3740 175-32   204-10   207-78
C$DCLN   83-3740 107-9    117-32   180-120  190-38   196-31   198-8    198-15   198-22   198-29
C$DODU   83-3740
C$DRPT   83-3740 122-12   216-53
C$DU     83-3740 201-34
C$EDIT   83-3740  83-427
C$ERDF   83-3740 121-24   121-46   123-22   124-12   154-25   162-57   162-61   165-4    169-41   169-50   174-63   174-86   175-35
        175-105  176-38   176-45   184-21   204-13   206-27   207-66   207-73
C$ERHR   83-3740
C$ERRO   83-3740 161-45
C$ERSF   83-3740 107-7    117-30   180-118  190-36   198-6    198-13   198-20   198-27
C$ERSO   83-3740
C$ESCA   83-3740
C$ESEG   83-3740
C$ESUB   83-3740 204-17   205-16   206-33   207-79   208-5    209-8    210-9
C$ETST   83-3740 210-29   211-40   212-34   216-73
C$EXIT   83-3740 197-31   200-28   203-70   216-54
C$GETB   83-3740 180-31   180-37   180-48   180-77   180-85   180-92   180-104  180-108
C$GETW   83 3740
C$GMAN   83-3740 130-64   196-27
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C$GPHN  83-374# 190-26  193-7
C$GPLO  83-374#
C$GPRI  83-374#
C$INIT  83-374# 198-43
C$INLP  83-374#
C$MANI  83-374# 130-34  196-25  214-17
C$MEM   83-374# 191-30
C$MSG   83-374# 106-28  106-32  106-36  106-40  106 45  106-49  106-54  106-58  106-62  106-84  106-89  106-103 106-107
       106-111  106-116 106-120 106-124 106-128 106-133 106-137 106-142 106-146 106-150 106-155 106-159 106-163 106-167
       106-214
C$OPEN  83-374# 180-25
C$PNTB  83-374# 110-20
C$PNTF  83-374# 110-18  196-15
C$PNTS  83-374# 110-24  186-119 186-121
C$PNTX  83-374# 110-22
C$QIO   83-374#
C$ROBU  83-374#
C$REFG  83-374# 189-3   189-9   189-15  189-22
C$RESE  83-374#  83-374#
C$REVI  83-374#  83-427
C$RFLA  83-374# 138-50  140-38  142-45
C$RPT   83-374# 186-200
C$SEFG  83-374#
C$SPRI  83-374# 197-4   207-22  207-49  207-60  207-69
C$SVEC  83-374# 162-36  175-28  182-15  191-20  204-5   207-21
C$TPRI  83-374#
C.BST   97-30#  174-100 193-24
C.DR0   97-35#  139-20  154-16  186-84  190-7   195-5   196-9   214-35  216-7
C.DR1   97-36#
C.DR2   97-37#
C.DR3   97-38#
C.DR4   97-39#
C.DR5   97-40#
C.DR6   97-41#
C.DR7   97-42#
C.FLG   97-33#  120-37* 121-10  121-13  121-15  122-23* 123-7   123-27  124-30* 124-31  124-38* 124-41* 138-54* 140-60*
       143-19*  162-86* 162-87* 164-28* 167-21* 169-18  169-46* 194-28
C.HCOM  97-34#  106-184 109-18* 121-9   166-17  167-15
C.JAD   97-32#
C.JSR   97-31#  162-35
C.REF   97-45#  123-20  167-16* 167-17
C.SIZE  97-47#  120-36  122-16  186-148 190-16  190-17  190-32  193-34  194-7   194-28  196-18  203-67  211-19  214-50
       216-19
C.TO    97-43#  121-44  124-46  169-15  169-39  176-23  176-35  184-8   184-19  207-33  207-85
C.TOH   97-44#  121-41  169-36  176-32  184-16  207-42
C.UADR  97-27#  106-201 175-25  193-16  206-8   207-8   207-19
C.UNIT  97-28#  120-29  120-30  121-12  161-18  162-56* 186-74  190-5*  190-[illegible]  203-63  203-64
C.VEC   97-29#  162-32  193-22  193-28  207-9   207-76
CALR1   115-4   145-70  147-12
CALR2   115-5   146-60
CALR3   115 6   147-110
CALR4   115 7   148-70
CALR5   115-8   149-70
CALR6   115-9   150-60
CALR7   115 10  151-60
CALR8   115-11  152-60
```

```
CALR9   115-12   153-6#
CF.576   93-42#
CF.ATN   93-37#
CF.MSC   93-38#
CF.OTH   93-39#
CF.SHO   93-41#
CF.THS   93-40#
CLOG    174-30   174-38   177-11#
CLOSEF  178-19   179-12#  180-113  197-6    200-10
CLRBFL  168-23#  168-25
CLRBUF  124-18   124-37   168-17#
CON.A   113-15#  116-31
CON.A1  113-16#  113-18   146-21
CON.A2  113-20   113-22#
CON.D   113-26#  116-31
CON.H   113-32#  116-31
CON.N   114-10#  116-31
CON.N1  114-11#  114-13
CON.O   114-4#   116-31
CON.QU  113-5#   113-9    116-31
CON.QX  113-7    113-10#
CON.R   114-19#  116-31
CON.R1  114-21   114-26#
CON.S   114-32#  116-31
CON.S1  114-33#  114-35
CR       88-58   106-203  110-11   114-11   130-60   146-14   146-22   148-9    149-9    186-52
CRLF    103-55#  110-13
CT.AVL   97-14#  120-32   186-77   190-5    190-43   203-66
CT.BRL   97-12#  207-12
CT.CMD   97-24#  121-15   162-86   164-28   167-21
CT.MSG   97-21#  121-13   122-23   124-30   138-54   140-60   143-19   169-18   169-46   172-20
CT.REQ   97-19#  123-7    123-27   124-31   124-38   124-41   162-86
CT.RN    97-23#  121-10   122-23   162-87
CT.USO   97-18#
CT.UNT   97-10#
CT.VEC   97-11#  162-33   193-29   207-11   207-77
CTABER  193-26   198-5#
CTABS   100-15#  186-72   190-4    190-29   192-16+  192-17+  193-10   196-7    203-61   211-10   212-10   214-32   216-4    216-36
        216-41
CTRLRS  100-16#  192-18+  194-32+  212-11   216-37
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D.BB02   98-41#
D.BB03   98-42#
D.BB04   98-43#
D.BB05   98-44#
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D.BB07   98-46#
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D.BB11   98-50#
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D.BCYL   99-11#  133-45    133-63
D.BE     98-21#  133-23    133-59    133-71
D.BEC    99-2#   133-30    133-41    133-51
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D.BGN3   99-7#
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D.CYL    98-19#  133-36
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D.DCA    98-26#
D.DCY    98-14#  196-13    216-11
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D.ECCC   99-18#  136-22*   186-121
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D.UNIT   98-36#  130-45    138-23    138-55    139-24    142-55    143-24    143-26    154-31    161-24    186-88    186-119   190-11*   190-44*
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D.WCA    98-24#
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F$BGN   83-374#  83-401   87-31    88-51   106-26   106-30   106-34   106-38   106-43   106-47   106-52   106-56   106-60   106-75
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       205-16   206-6    206-6    206-33   207-6    207-6    207-79   208-2    208-2    208-5    209-2    209-2    209-8    210-2
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F$DU    83-374# 201-8    201-34
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       207-6    207-79   207-79   208-2    208-2    208-5    208-5    209-2    209-2    209-8    209-8    210-2    210-2    210-9
       210-9    210-29   210-29   211-3    211-3    211-3    211-40   211-40   212-3    212-3    212-3    212-34   212-34   213-5
       213-5    213-5    216-54   216-73   216-73   217-2    218-43   218-79   220-32   220-101  221-15   221-16   221-23   221-24
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F$INIT  83-374# 189-1    198-43
F$JMP   83-374# 186-169  186-169  197-31   200-28   201-19   201-19   202-20   202-20   203-70   216-54
F$MOD   83-374#  83-401   87-31    88-51   185-1    186-41   202-36   203-52   217-2    218-43   220-101
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F$RPT   83-374# 186-47   186-200
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G$CNTO   83-374#
G$DELM   83-374#
G$DISP   83-374# 220-9
G$EXCP   83-374#
G$HILI   83-374#
G$LOLI   83-374#
G$NO     83-374# 130-64  196-27
G$OFFS   83-374# 130-64  196-27  218-65  218-67  218-69  218-71  218-73  218-77  220-4   220-12  220-15  220-17  220-19
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G$OFSI   83-374# 130-64  196-27  218-65  218-67  218-69  218-71  218-73  218-77  220-4   220-12  220-15  220-17  220-19
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G$PRMA   83-374# 218-65  218-67
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G$PRML   83-374# 196-27  218-77  220-4   220-17  220-19  220-21
G$RADA   83-374# 130-64
G$RADB   83-374#
G$RADD   83-374# 218-69  218-71  218-73  220-12  220-15
G$RADL   83-374# 196-27  218-77  220-4   220-17  220-19  220-21
G$RADO   83-374# 218-65  218-67
G$XFER   83-374#
G$YES    83-374# 218-65  218-67  218-69  218-71  218-73  218-77  220-4   220-12  220-15  220-17  220-19  220-21
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GETCNT   113-15  114-10  114-19  114-32  155-14#  156-16
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H.BST    193-24  194-24  218-58#  218-71  218-71  218-71
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H.PRM    195-21  218-60# 218-77  218-77  218-77
H.UBA    193-15  218-55# 218-65  218-65  218-65
H.VEC    193-21  193-30  194-22  218-56#  218-67  218-67  218-67
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HC.BF2    90-45# 90-47   106-185 124-4   124-8*  124-9   124-36
HC.BSZ    90-24# 90-45   90-47   124-20  141-13  141-17  163-11  163-17  168-20  168-22  213-25
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P.FBBK   95-12#
P.FLGS   95-9#
P.GRPS   95-31#
P.HSTI   94-24#   95-25#   95-43#
P.HTMO   94-39#
P.LBN    94-13#
P.MEDI   95-27#   95-45#
P.MLUN   95-23#   95-41#
P.MOD    94-9#
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P.RBNS   95-34#
P.RCTC   95-35#
P.RCTS   95-33#
P.RGID   94-46#   164-22*
P.RGOF   94-47#   164-21*
P.SHST   95-29#   95-47#
P.SHUN   94-26#   95-28#   95-46#
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P.TRKS   95-30#
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P.UNIT   94-7#    95-7#
P.UNSZ   95-48#
P.UNTI   95-26#   95-44#
P.USEF   94-40#
P.VRSN   94-57#   95-54#
P.VSER   95-49#
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PNTNUS   146-13   156-17#
PNTPKL   106-176# 106-180
PNTPKT   106-145  106-149  106-169#
PRI      88-57#
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PRI02    88-57#
PRI03    88-57#
PRI04    88-57#
PRI05    88-57#
PRI06    88-57#
PRI07    83-427   88-57#   162-36   175-28   182-15   191-20   204-5    207-49
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RDDLL   129-53   178-16#
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RG.OWN   90-5#   167-18   167-19
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RNTIM2  103-58#  183-34
RNTIME  100-202  138-56   143-27   148-8    149-8    183-14#  186-51
RNTIMX  183-15   183-36#
RPTCT   186-74#  186-154
RPTCTN  186-76   186-87   186-148#
RPTDT   186-86#  186-147
RPTDTN  186-90   186-146#
RPTMD2  186-121  186-178#
RPTMSD  186-119  186-177#
RPTMSG  186-50   186-174#
RPTMSH  186-71   186-175#
RPTXX   186-69   186-156#
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RSP.S2  175-64   175-79#
RSP.S3  175-66   175-88#
RSP.S4  175-68   175-96#
RSPURP  121-25   121-47   122-23#  123-23   124-13   124-25
RSPDSP  124-24   125-4#   125-20
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RSPIN   121-14   123-6#
RSPNUR  123-8    123-10#
RSPNRP  122-5    122-8    122-10   122-16#
RSPNTO  121-40   121-43   121-45   121-46#
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RSPPTW  123-21   123-27#
RSPRPT  122-7    122-11#
RSPTM   121-22   121-29#
RSPTMO  121-42   121-46#
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RWRDEI  180-35   180-51   180-89   180-95   180-118#
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        106-163#  106-167#  106-214#  130-64   130-64   130-64   130-64#  171-13#  172-22#  181-10#  181-14#  186-200#  196-27   196-2?
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ST.AOL	96-18#													
ST.AVL	96-9#													
ST.CMD	96-6#													
ST.CMP	96-12#													
ST.CNT	96-15#													
ST.DAT	96-13#													
ST.DIA	96-17#													
ST.DRV	96-16#													
ST.HST	96-14#													
ST.MFE	96-10#													
ST.MSK	96-3#	123-15	162-84	164-26										
ST.OFL	96-8#													
ST.SUB	96-4#													
ST.SUC	96-5#													
ST.WPR	96-11#													
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STLDDM	118-38	120-21#												
STORAG	84-8#	117-24	117-25	118-19	119-7	180-70	180-73	214-41	214-55					
STOSIZ	84-5#	84-8	180-73											
SVCGBL	83-374#	83-383#	83-427	83-427	83-427	83-427	83-427	83-427	83-427	83-427	83-427	83-427	83-427	83-427
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	87-10	87-10	87-10	87-10	87-10	100-8	100-8	100-8	103-14	103-14	103-14	103-25	103-25	103-25
	106-16#	106-26	106-26	106-26	106-30	106-30	106-30	106-34	106-34	106-34	106-38	106-38	106-38	106-43
	106-43	106-43	106-47	106-47	106-47	106-52	106-52	106-52	106-56	106-56	106-56	106-60	106-60	106-60
	106-75	106-75	106-75	106-86	106-86	106-86	106-91	106-91	106-91	106-105	106-105	106-105	106-109	106-109
	106-109	106-114	106-114	106-114	106-118	106-118	106-118	106-122	106-122	106-122	106-126	106-126	106-126	106-131
	106-131	106-131	106-135	106-135	106-135	106-139	106-139	106-139	106-144	106-144	106-144	106-148	106-148	106-148
	106-152	106-152	106-152	106-157	106-157	106-157	106-161	106-161	106-161	106-165	106-165	106-165	106-193	106-193
	106-193	106-224#	171-11	171-11	171-11	172-19	172-19	172-19	181-6	181-6	181-6	181-12	181-12	181-12
	186-47	186-47	186-47	187-9	187-9	187-9	189-1	189-1	189-1	199-10	199-10	199-10	200-8	200-8
	200-8	201-8	201-8	201-8	202-9	202-9	202-9	218-53	218-53	218-53	219-12	219-12	219-12	220-100
	220-100	220-100	220-100#											
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	103-14	103-14	103-25	103-25	103-25	103-25	106-13#	106-28	106-28	106-32	106-32	106-36	106-36	106-40
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	106-89	106-103	106-103	106-107	106-107	106-111	106-111	106-116	106-116	106-120	106-120	106-124	106-124	106-128
	106-128	106-133	106-133	106-137	106-137	106-142	106-142	106-146	106-146	106-150	106-150	106-155	106-155	106-159

Cross reference table (CREF V05.00)

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        220-15   220-15#
T$FLAG  186-169  186-169#  186-169#  197-31   197-31   197-31#  197-31#  200-28   200-28   200-28#  200-28#  201-19   201-19#  201-19#
        202-20   202-20#  202-20#  203-70   203-70   203-70#  203-70#  216-54   216-54   216-54#  216-54#
T$FREE  220-100  221-24#
T$GMAN   83-374#  130-64   130-64#  130-64#
T$HILI  130-64   130-64#  218-65   218-65#  218-67   218-67#  218-69   218-69#  218-71   218-71#  218-73   218-73#  220-12   220-12#
        220-15   220-15#
T$LAST   83-374#  220-100#  221-15
T$LOLI  130-64   130-64#  218-65   218-65#  218-67   218-67#  218-69   218-69#  218-71   218-71#  218-73   218-73#  220-12   220-12#
        220-15   220-15#
T$LSYM   83-374   83-374#  86-27    87-30    106-28   106-32   106-36   106-40   106-45   106-49   106-54   106-58   106-62   106-84
        106-89   106-103  106-107  106-111  106-116  106-120  106-124  106-128  106-133  106-137  106-142  106-146  106-150  106-155
        106-159  106-163  106-167  106-214  171-13   172-22   181-10   181-14   186-200  198-43   199-18   200-43   201-34   202-35
        204-17   205-16   206-33   207-79   208-5    209-8    210-9    210-29   211-40   212-34   216-73   218-79   220-32
T$LTNO  220-100#
T$NEST   83-374#  83-401   83-401   83-401#  86-10    86-10    86-10#   86-27    86-27    86-27    86-27#   87-10    87-10    87-10#
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        106-36   106-36   106-36   106-36#  106-38   106-38   106-38#  106-40   106-40   106-40   106-40#  106-43   106-43   106-43#
        106-45   106-45   106-45   106-45#  106-47   106-47   106-47#  106-49   106-49   106-49   106-49#  106-52   106-52   106-52#
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        106-62   106-62   106-62   106-62#  106-75   106-75   106-75#  106-84   106-84   106-84   106-84#  106-86   106-86   106-86#
        106-89   106-89   106-89   106-89#  106-91   106-91   106-91#  106-103  106-103  106-103  106-103#  106-105  106-105  106-105#
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        106-124  106-124  106-124  106-124#  106-126  106-126  106-126#  106-128  106-128  106-128  106-128#  106-131  106-131  106-131#
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        106-142  106-142  106-142  106-142#  106-144  106-144  106-144#  106-146  106-146  106-146  106-146#  106-148  106-148  106-148#
        106-150  106-150  106-150  106-150#  106-152  106-152  106-152#  106-155  106-155  106-155  106-155#  106-157  106-157  106-157#
        106-159  106-159  106-159  106-159#  106-161  106-161  106-161#  106-163  106-163  106-163  106-163#  106-165  106-165  106-165#
        106-167  106-167  106-167  106-167#  106-193  106
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