Micro Fiche Scan

Name of device(s) tested:
    RA60/80/81/82,UDA50A,KDA50-Q
Test description:
    UDA50/KDA50 FORMATTER
MAINDEC Number or Package Identifier (after SEP 1977):
    CZUDKB0
Fiche Document Part Number:
    AH-T939B-MC
Fiche preparation date unknown, using copyright year:
    1985
Image resolution:
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IDENTIFICATION

PRODUCT CODF: AC T938B-MC

PRODUCT NAME: CZUDKBO RA SERIES DISK DRIVE FORMATTER

PRODUCT DATE: 23-DEC-1985

MAINTAINER: RON BOWSER

AUTHOR: RON BOWSER

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```
                                  .TITLE  CZUDKO UDA50A/KDA50-Q FORMATTER
        .REM
```

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1.0 GENERAL INFORMATION

1.1 PROGRAM ABSTRACT

This program will format any disk drive connected to a UDA50A or KDA50-Q disk controller. At the time of this writing, there are three such drives in existance -- the RA60, RA80 and RA81. No changes to this program will be needed to format new disk drives as they become available.

There are three ways to format a disk with this program:

1. Reformat - Format the disk with the bad sector information that was written onto the disk at the factory. This is the normal way to format a disk.

2. Reconstruct - Format the disk without using any bad sector information. This should be used only when the bad sector information has been destroyed or for some reason can no longer be ead from the disk. This method may also be specified in the disk drive's maintenance manual for special cases (eg. changing an RM/RA80 spare HDA from RM80 format to RA80 format).

3. Restore - Format the disk using bad sector information obtained from a disk file on the XXDP+ system load device. This method is provided for use by manufacturing. No files are provided, nor any method of obtaining the files, at this time.

The format operation is performed by a Diagnostic Utilities and Protocol (DUP) program loaded into the disk controller. The host program simply downline loads the DUP program into the controller and monitors its execution. The DUP program obtains parameters from the host program (eg. drive number and format mode) and requests the host program to print error and summary messages. The DUP program is also commonly called a "diagnostic machine" (DM) program.

This program can only format in one mode at a time. In RESTORE mode, only one disk may be selected in the hardware questions or an error message will result and the program will stop.

In REFORMAT and RECONSTRUCT modes, any number of disk drives may be selected. A controller can only format one disk at a time, so each disk on a controller are connected to different controllers, all controllers will be run simultaneously. For example, lets assume three units are selected for formatting in the hardware questions, units 1 and 2 are connected to one controller and unit 3 is connected to a different controller. This program will automatically start format operations on units 1 and 3. When unit 1 finishes (or errors), unit 2 will be started. After units 2 and 3 are finished, the program stops.

This program will stop after each pass (all units formatted once). There is no need to specify a PASS switch on the command line to the Diagnostic Runtime Services (eg. START/PASS:1).

Special provisions have been made to allow this program to run under an APT system in manufacturing. This system does not allow questions to be asked of an operator. Such a condition also exists under XXDP+ when the UAM flag is set. In this condition, only reformat mode can be selected. Selecting RECONSTRUCT or RESTORE will result in an error. Also, a date of 1-JAN-70 will be written on the disk.

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. The initial version will require the following:

PDP-11 Unibus or Q-bus processor
28K words of memory (minimum)
Console terminal
XXDP+ load media containing this program
One or more UDA50A or KDA50-Q subsystems.

A system clock - either type L or P - will be used to time the DUP program and report runtime, if available. If no system clock is available, this program cannot detect a hung DUP program.

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+ Mon'tor (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	'ype the state of all flags (see section 2.3)
ZFLAGS	Clear all flags (see section 2.3)

A command can be recognized by the f'rst 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 appended 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, 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*	Inhibic 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)
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 QUESTICNS

When the formatter is STARTed, the Runtime Serv ces will prompt the user for hardware informatior 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.

CSR ADDRESS (O) 172150 ?

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

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 number 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 controller at a time.

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. You may change the default values with the SETUP utility.

REFORMAT USING EXISTING BAD SECTOR INFORMATION (L) Y ?

If this question is answered "YES", then the user wants the REFORMAT mode format operation. REFORMAT mode will use the bad sector information that is already on the disk. Any other mode will destroy this information. If this question is answered "NO", the following will be asked to be sure the user knows what he is doing.

NOT USING EXISTING INFORMATION WILL DESTROY THE FACTORY BAD SECTOR INFORMATION ON THE DISK.
AGAIN - REFORMAT USING EXISTING BAD SECTOR INFORMATION (L) Y ?

This is asked to verify that the user does want to destroy the bad sector information on the disk and run another format mode. If this is answered "YES", then the user wants the REFORMAT mode format operation and use the existing bad block information. If again answered "NO", the following question will be asked.

RECONSTRUCT BAD SECTOR INFORMATION (L) Y ?

A "YES" answer will cause a reconstruct mode format operation. If answered "NO", the following will be asked to verify the user really wants the restore mode format.

DO YOU HAVE A FILE ON THE SYSTEM LOAD DEVICE
CONTAINING BAD SECTOR INFORMATION (L) N ?

Note that such a file will not be provided with the formatter and this mode is not recommended. The format will begin only on a "YES" answer. Otherwise the following message will be printed and the program will abort.

YOU CANNOT PROCEED WITHOUT SUCH A FILE.
RESTART PROGRAM AND SELECT TO REFORMAT OR RECONSTRUCT DISK.

2.6 MANUAL INTERVENTION QUESTIONS

When the program starts a warning message is printed to warn of improper use of this formatter.

```
WARNING:
      THIS FORMATTER PROGRAM SHOULD NOT BE USED AS A DIAGNOSTIC
      TOOL.  RUN THIS PROGRAM ONLY AS INSTRUCTED IN THE DISK
      DRIVE'S SERVICE MANUAL.
WARNING:
      THIS PROGRAM WILL TAKE APPROXIMATELY 45 MINUTES ON
      A RA60, 30 MINUTES ON A RA80, 60 MINUTES ON A RA81, AND
      120 MINUTES ON A RA82.
```

```
ARE YOU SURE YOU WANT TO RUN THIS FORMATTER (L) N ?
```

You must answer "YES" or the program will abort immediately. This family of disk drives uses a powerful bad block revectoring mechanism to replace blocks that fall on defective areas of the disk media. As a disk is used and defective blocks are detected, DEC operating systems replace the blocks with other blocks on the disk (reserved for this purpose and otherwise inaccessable) so that the disk constantly appears to have its full storage capacity of error free disk blocks. Formatting a disk of this type destroys this history information and is absolutely not recommended except in the cases specifically described in the disk drive's service manual. These disks are fully formatted when shipped from the factory, therefore there is no reason to run this formatter program at installation.

Upon answering "YES" to the above question, the date will be asked for in the format used by the XXDP+ system.

```
ENTER DATE AS DD-MMM-YY (A) 1-JAN-70 ?
```

The default is provided so the user need not supply the date. The date question will normally only be asked one time. If an improper answer is typed, "INPUT ERROR" is printed and the question is asked again. A two or four digit year may be typed. A four digit year must be 1900 or greater (eg. 14-APR-1982). If only two digits are typed, the year is determined as follows:

1. If the number typed is 70 or greater, a 19 is prefixed. Eg., 1-JAN-70 translates to year 1970 and 25-DEC-99 translates to year 1999.

2. If the number typed is less than 70, a 20 is prefixed. Eg., 1 APR-21 is translated to year 2021.

If RECONSTRUCT mode is selected, the following question will be asked for each disk before the format operation begins.

```
SERIAL NUMBER FOR UNIT xx CONTROLLER AT xxxxxx DRIVE xxx
 (A) ?
```

```
                        A decimal number in the range of 0 to 18446744073709551615
                        must be entered (no default).
```

If RESTORE mode is selected, the following question will be asked.

```
NAME OF FILE CONTAINING BAD SECTOR INFORMATION FOR
DISK TO BE FORMATTED (A) ?
```

If the file named does not exist on the system load device, the program will abort back to the XXDP+ prompt after printing an error message.

2.7 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 (D) ?  8<CR>

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

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

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

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

UNIT 5
CSR ADDRESS (O) ?  160000<CR>
SUB-DEVICE # (O) ?  4<CR>
Q-FACTOR (O) 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 (0)  160000<CR>
                SUB-DEVICE # (0) ?  7<CR>
                Q-FACTOR (0) 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 (0) ?  8<CR>

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

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

                UNIT 7
                CSR ADDRESS (0) ?  160000<CR>
                SUB-DEVICE # (0) ?  6,7<CR>
                Q-FACTOR (0) 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-devices 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 'n one pass as shown below.

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

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

2.8 QUICK START-UP PROCEDURE

To start-up th's program:

1. Boot XXDP+
2. Give the date and answer the LSI and 50HZ (if there is a clock) questions
3. Type "R ZUDKAO"
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"
8. Answer "Y" to the "ARE YOU SURE ..." question following the warning. Please read the disk drive's service manual before answering this question.
9. Type today's date.

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 controller:

```
DR>STA

CHANGE HW (L)  ? Y

# UNITS (D)  ? 2

UNIT 0
CSR ADDRESS (O)  172150 ?
VECTOR (O)  154 ?
DRIVE NUMBER (D)  0 ? 0,1

CHANGE SW (L)  ? N

WARNING:
      THIS FORMATTER PROGRAM SHOULD NOT BE USED AS A DIAGNOSTIC
      TOOL.  RUN THIS PROGRAM ONLY AS INSTRUCTED IN THE DISK
      DRIVE'S SERVICE MANUAL.
WARNING:
      THIS PROGRAM WILL TAKE APPROXIMATELY 45 MINUTES ON
      A RA60, 30 MINUTES ON A RA80, 60 MINUTES ON A RA81, AND
      120 MINUTES ON A RA82.

ARE YOU SURE YOU WANT TO RUN THIS FORMATTER (L) N ? Y

ENTER DATE AS DD-MMM-YY (A) 1-JAN-70 ? 14-APR-82

UNIT 0 CONTROLLER AT 172150 DRIVE 0   RUNTIME 0:00:20
Format begun Version 11
STOPPING THIS FORMAT AFTER THIS POINT WILL MAKE THE DISK
UNUSABLE, AND WILL CAUSE THE DISK TO BE SPUN DOWN WHEN
BROUGHT ONLINE.

UNIT 1 CONTROLLER AT 172150 DRIVE 1   RUNTIME 0:00:23
Format begun Version 11
STOPPING THIS FORMAT AFTER THIS POINT WILL MAKE THE DISK
UNUSABLE, AND WILL CAUSE THE DISK TO BE SPUN DOWN WHEN
BROUGHT ONLINE.

UNIT 0 CONTROLLER AT 172150 DRIVE 0   RUNTIME 0:42:20
Format completed
     2 Revectored LBNS
     2 Primary revectored LBNS
     0 Secondary/tertiary revectored LBNS
     0 Bad RBNS
     0 Bad blocks in the RCT area due to data errors
     0 Bad blocks in the DBN area due to data errors
     0 Bad blocks in the XBN area due to data errors
     2 Blocks retried on the check pass
FCT used successfully
```

```
UNIT 1 CONTROLLER AT 172150 DRIVE 1   RUNTIME 1:25:18
Format completed
   131 Revectored LBNS
   131 Primary revectored LBNS
     0 Secondary/tertiary revectored LBNS
     0 Bad RBNS
     1 Bad blocks in the RCT area due to data errors
     0 Bad blocks in the DBN area due to data errors
     0 Bad blocks in the XBN area due to data errors
   249 Blocks retried on the check pass
FCT used successfully

CZUDK EOP    1
    0 CUMULATIVE ERRORS
DR>
```

Sample of terminal dialogue going through software questions.
Only one disk is being tested.

```
DR>STA

CHANGE HW (L)  ? N

CHANGE SW (L)  ? Y

REFORMAT USING EXISTING BAD SECTOR INFORMATION (L) Y ? Y

WARNING:
      THIS FORMATTER PROGRAM SHOULD NOT BE USED AS A DIAGNOSTIC
      TOOL.  RUN THIS PROGRAM ONLY AS INSTRUCTED IN THE DISK
      DRIVE'S SERVICE MANUAL.
WARNING:
      THIS PROGRAM WILL TAKE APPROXIMATELY 45 MINUTES ON
      A RA60, 30 MINUTES ON A RA80, 60 MINUTES ON A RA81, AND
      120 MINUTES ON A RA82.

ARE YOU SURE YOU WANT TO RUN THIS FORMATTER (L) N ? Y

ENTER DATA AS DD-MMM-YY (A) 1-JAN-70 ? 14-APR-82

  RUNTIME 0:00:20
Format begun Version 8
STOPPING THIS FORMAT AFTER THIS POINT WILL MAKE THE DISK
UNUSABLE, AND WILL CAUSE THE DISK TO BE SPUN DOWN WHEN
BROUGHT ONLINE.

  RUNTIME 1:33:45
Format completed
     2 Revectored LBNS
     2 Primary revectored LBNS
     0 Secondary/tertiary revectored LBNS
     0 Bad RBNS
     0 Bad blocks in the RCT area due to data errors
     0 Bad blocks in the DBN area due to data errors
     0 Bad blocks in the XBN area due to data errors
     2 Blocks retried on the check pass
FCT used successfully
```

```
CZUDK EOP     1
    0 CUMULATIVE ERRORS
DR>
```

3.0 ERROR INFORMATION

3.1 TYPES OF ERROR MESSAGES

There are three levels of error messages that may be issued by the formatter: 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 = formatter name
        TYPE = error type (SYS FTL ERR, DEV FTL 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 formatter program. The formatter 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 the controller or disk drive). Testing stops on that device for the remainder of the current test.

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 formatter are always one line each. The basic message defines what program detected the error, the controller being used and the time of the error:

```
HOST  PROGRAM CONTROLLER AT xxxxxx  RUNTIME hhh:mm:ss
```

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

Sample error message:

```
CZUDK DVC FTL ERR  00021 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx      -  general message
HOST PROGRAM  CONTROLLER AT 172150  RUNTIME 0:00:12                 -  basic message
CONTROLLER RESIDENT DIAGNOSTICS DETECTED FAILURE                   \
  SA CONTAINS 104041                                                }-  extended message
REPLACE CONTROLLER PROCESSOR MODULE                                /
```

The DUP program may also print error messages. They are printed exactly as presented by the DUP program and cannot be suppressed by any flags.

3.2 SPECIFIC ERROR MESSAGES

3.2.1 HOST PROGRAM ERROR MESSAGES

Following is a list of the error messages that may be printed by the formatter 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, controller address and data in registers are filled with sample numbers. Additional information about the error may follow the error message.

```
00001   CZUDK SYS FTL ERR  00001 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
        HOST PROGRAM  CONTROLLER AT 172150  RUNTIME x:xx:xx
        INVALID ANSWERS GIVEN TO HARDWARE QUESTIONS
        CONTROLLER HAS MORE THAN ONE VECTOR, BR LEVEL OR BURST RATE
```

When the hardware questions were answered, two units were selected with the same CSR address but with a different vector, BR level or burst rate. A single controller can have only one vector, BR level or burst rate. The program is aborted and returns to the Runtime Services prompt so that the hardware questions may be changed.

```
00002   CZUDK SYS FTL ERR  00002 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
        HOST PROGRAM  CONTROLLER AT 172150  RUNTIME x:xx:xx
        INVALID ANSWERS GIVEN TO HARDWARE QUESTIONS
        MULTIPLE 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 the hardware questions may be changed.

```
00003   CZUDK SYS FTL ERR  00003 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
        HOST PROGRAM  CONTROLLER AT 172150  RUNTIME x:xx:xx
        INVALID ANSWERS GIVEN TO HARDWARE QUESTIONS
        MORE THAN EIGHT DRIVES SELECTED ON THIS CONTROLLER
```

Up to four physical disk drives can be attached to a UDA50A or KDA50-Q 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 formatter program. Even though more than eight logical disk drives can be attached to one UDA50A or KDA50-Q, the controller only supports eight. The program is aborted and returns to the Runtime Services prompt so that the hardware questions may be changed.

```
00004   CZUDK SYS FTL ERR  00004 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
        HOST PROGRAM  RUNTIME x:xx:xx
        NOT ENOUGH ROOM IN MEMORY TO FORMAT THE UNITS SELECTED
        PLEASE START PROGRAM OVER AND FORMAT 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. The number of units that are testable at one time has been exceeded. Start program over and select fewer units.

```
00008   CZUDK SYS FTL ERR  00008 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
        HOST PROGRAM  CONTROLLER AT 172150  RUNTIME x:xx:xx
        INVALID ANSWERS GIVEN TO HARDWARE QUESTIONS
        TWO CONTROLLERS USE THE SAME VECTOR
```

The hardware questions for two units specified different CSR addresses but identical vector addresses. The program is aborted and returns to the Runtime Services prompt so that the hardware questions may be changed.

```
00009   CZUDK DVC FTL ERR  00009 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
        HOST PROGRAM  RUNTIME x:xx:xx
        ONLY ONE DISK CAN BE SELECTED IN HW QUESTIONS IN RESTORE MODE.
        PLEASE START PROGRAM OVER AND SELECT ONLY ONE DISK.
```

If the operator chooses to run the formatter in RESTORE mode, then only one disk can be selected in the hardware questions. RESTORE mode is run in this way because a file containing the bad block information is used and that information matches only one drive.

```
00010   CZUDK DVC FTL ERR  00010 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
        HOST PROGRAM  RUNTIME x:xx:xx
        THIS PROGRAM CAN ONLY REFORMAT A DISK IN UNATTENDED MODE
```

This program needs to ask questions of the operator. It refuses to run in RECONSTRUCT and RESTORE modes because the questions obtain data that is absolutely necessary. REFORMAT mode is allowed to run because only a date is needed. The default date of 1-JAN-70 's used.

```
00014   CZUDK DVC FTL ERR  00014 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
        HOST PROGRAM  CONTROLLER AT 172150  RUNTIME x:xx:xx
        CONTROLLER IS NOT SUPPORTED BY THIS FORMATTER PROGRAM.  THIS
        PROGRAM REQUIRES A UDA50-A (MODEL 6) OR A KDA50-Q (MODEL 13)
        CONTROLLER.  CONTROLLER REPORTED MODEL CODE xx.
```

All UDA50-0's (modules M7161-2) are not supported by this formatter. The module sets M7485-6 and M????-? are the only ones that can be used by this formatter. If the controller is a UDA50-0 (M7161-2) it will not be tested. If the controller consists of the M7161-2 modules, install one with M7485-6 modules. Replace both modules, mixing the module sets will not work.

```
00020   CZUDK DVC FTL ERR  00020 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
        HOST PROGRAM  CONTROLLER AT 172150  RUNTIME x:xx:xx
        MEMORY ERROR TRYING TO READ CONTROLLER REGISTERS
        CHECK CSR SELECTION SWITCHES ON CONTROLLER PROCESSOR MODULE OR BUS
        OR REPLACE CONTROLLER PROCESSOR MODULE
```

A non-existant memory error occurred when the host program tried to access the IP and SA registers. The controller is at another address (check the CSR selection switches) or the BUS or the controller processor module is broken.

```
00021   CZUDK DVC FTL ERR 00021 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
        HOST PROGRAM  CONTROLLER AT 172150  RUNTIME x:xx:xx
        CONTROLLER RESIDENT DIAGNOSTICS DETECTED FAILURE
          SA CONTAINS  105154
        REPLACE CONTROLLER SDI MODULE
```

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

104000	-	Fatal sequencer 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 in the last line of the error message.

```
00022   CZUDK DVC FTL ERR  00022 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
        HOST PROGRAM  CONTROLLER AT 172150  RUNTIME x:xx:xx
        STEP BIT DID NOT SET IN SA REGISTER DURING INITIALIZATION
        STEP BIT EXPECTED 004000
          SA CONTAINS  000000
        REPLACE CONTROLLER PROCESSOR MODULE

                The controller did not respond as expected during the
                initialization sequence which communicates using data
                in the SA register. A normal response from the controller
                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
                Neither the expected step bit nor the error bit set within
                the expected time.

00023   CZUDK DVC FTL ERR  00023 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
        HOST PROGRAM  CONTROLLER AT 172150  RUNTIME x:xx:xx
        CONTROLLER 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 CONTROLLER PROCESSOR MODULE

                The controller is to clear the ring structure (a communications
                area used by the controller to talk to the host) in host memory
                before Step 4 of initialization.  If the controller 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 controller
                to clear each word indicates a fault in the address
                interface to the Unibus or Q-bus.

00024   CZUDK DVC FTL ERR  00024 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
        HOST PROGRAM  CONTROLLER AT 172150  RUNTIME x:xx:xx
        SA REGISTER DID NOT GO TO ZERO AFTER STEP 3 WRITE OF INITIALIZATION
        PURGE/POLE DIAGNOSTICS WERE REQUESTED
          SA CONTAINS 004400
        REPLACE CONTROLLER PROCESSOR MODULE

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

```
00025   CZUDK DVC FTL ERR  00025 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
        HOST PROGRAM  CONTROLLER AT 172150  RUNTIME x:xx:xx
        CONTROLLER DID NOT RETURN CORRECT DATA IN SA REGISTER DURING
        INITIALIZATION
          SA EXPECTED  004400
          SA CONTAINS  004000
        REPLACE CONTROLLER PROCESSOR MODULE

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

00030   CZUDK DVC FTL ERR  00030 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
        HOST PROGRAM  CONTROLLER AT 172150  RUNTIME x:xx:xx
        CONTROLLER REPORTED FATAL ERROR IN SA REGISTER WHILE RUNNING FORMATTER
          SA CONTAINS  100004

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

                        004400 - Controller has been inited by either a bus
                                 init or by writing into the IP.
                        100001 - BUS envelope/packet read error (parity or timeout)
                        100002 - BUS envelope/packet write error (parity or timeout)
                        100003 - Controller ROM and RAM parity error
                        100004 - Controller RAM parity error
                        100005 - Controller ROM parity error
                        100006 - BUS ring read error
                        100007 - BUS ring write error
                        100010 - BUS interrupt master failure
                        100011 - Host access timeout error
                        100012 - Host exceeded credit limit
                        100013 - Controller 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 BUS

00031   CZUDK DVC FTL ERR  00031 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
        HOST PROGRAM  CONTROLLER AT 172150  RUNTIME x:xx:xx
        FORMATTER 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   CZUDK DVC FTL ERR  00032 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
        HOST PROGRAM  CONTROLLER AT 172150  RUNTIME x:xx:xx
        MESSAGE BUFFER RECEIVED FROM FORMATTER 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 BUS or either one of the controller 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   CZUDK DVC FTL ERR  00033 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
00034   HOST PROGRAM  CONTROLLER AT 172150  RUNTIME x:xx:xx
        RESPONSE PACKET FROM CONTROLLER DOES NOT CONTAIN EXPECTED DATA
        EITHER CONTROLLER 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 000000              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 the controller. 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 controller and the host program. If 2 occurred, check the error code in the MSCP specification for further information. The packets are displayed two long words per line, low order word and byte to the right (corresponding to the MSCP long-word entity).

```
00036   CZUDK DVC FTL ERR  00036 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
        HOST PROGRAM  CONTROLLER AT 172150  RUNTIME x:xx:xx
        NO INTERRUPT RECEIVED FROM CONTROLLER FOR 30 SECONDS
        WHILE LOADING FORMATTER

                After a DM program has been sent to the controller, 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   CZUDK DVC FTL ERR  00037 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
        HOST PROGRAM  CONTROLLER AT 172150  RUNTIME x:xx:xx
        CONTROLLER REPORTED FATAL ERROR IN SA REGISTER WHILE LOADING FORMATTER
          SA CONTAINS  100004
        REPLACE CONTROLLER PROCESSOR MODULE

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

00100   CZUDK DVC FTL ERR  00100 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
        HOST PROGRAM  CONTROLLER AT 172150  RUNTIME x:xx:xx
        FORMATTER ASKED UNEXPECTED QUESTION (25)

                The formatter sends a value that corresponds to
                a specific question or message.  If this value does not
                fit into the range of questions, then this error appears.

00101   CZUDK DVC FTL ERR  00101 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
        HOST PROGRAM  CONTROLLER AT 172150  RUNTIME x:xx:xx
        FORMATTER REJECTED ANSWER TO DATE OR SERIAL NUMBER QUESTION

                After the operator inputs the date/serial number, the
                formatter will ask the host program for them.  If for
                some reason the date/serial number was unacceptable to
                the formatter, this error message will appear.  Retry
                the program and if this error appears again, get out
                of the diagnostic runtime services and back to the
                XXDP+ prompt and reload the program.
```

3.2.2 DUP PROGRAM ERROR MESSAGES

Error messages returned by the formatter are as follows:

GET STATUS failure

This could be caused by a number of reasons. Examples: the RUN/STOP switch is out, the WRITE PROTECT switch is in, or the DIAGNOSTIC REQUEST bit is set by the drive.

SDI send error

An attempt to send an SDI command failed. The signal RECEIVER READY was not asserted.

Unsuccessful SDI command

The response from an SDI command was unsuccessful and all commands should be successful for the formatter to work. There may be a cable problem, drive receiver problem or controller transmitter problem.

SDI receive error

This message is presented for several reasons. The drive timed out, the first word from the drive was not a start frame, there was a framing error on the SDI level 0 read (cable/receiver/transmitter problem), checksum error, or the buffer size given by the formatter wasn't large enough for the controller. Again, there may be a cable/receiver/transmitter problem.

BUS read error

This is caused by one of two problems. While trying to read an overlay into the controller buffer memory, the formatter came across a nonexistent memory error. Or, there was a failure while downline loading the bad block information. There may be something wrong with the BUS or the controller processor module.

Formatter initialization error

For this error to occur, the controller must be processing the DM code improperly.

Non-existant unit number

The desired disk drive wasn't attached to the controller.

DBN/XBN format error (drive FORMAT command failed)

All attempts and retries to format a track failed. There may have been a timeout of drive signals, the drive dropped the READ/WRITE READY signal during the format operation or the drive clock timed out (which indicates cable/transmitter/receiver failures).

FCT does not have enough good copies of each block

There must be at least two good copies of every block in the FCT. For this error to occur, the media is badly corrupted or the read/write logic is failing.

SEEK error

After a seek command completed successfully, the READ/WRITE READY signal was never set or the ATTENTION signal was set.

RCT does not have enough good copies of each block

There must be at least two good copies of every block in the RCT. For this error to occur, the media is badly corrupted or the read/write logic is failing.

LBN format error (drive FORMAT command failed)

All attempts and retries to format a track failed. There may have been a timeout of drive signals, the drive dropped the READ/WRITE READY signal during the format operation or the drive clock timed out (which indicates cable/transmitter/receiver failures).

FCT write error

A particular block failed to be written into every copy of the FCT. There is either terribly bad media or a write logic failure.

RCT read error

The formatter could not read at least one good copy of a particular block in the RCT area.

RCT write error

A particular block failed to be written into every copy of the RCT. There is either terribly bad media or a write logic failure.

RCT full

There were so many bad blocks on the media that the RCT area was filled and could not hold any more. There could be read/wr te logic failure or bad cable connection.

FCT read error

The formatter could not read at least one good copy of a particular block in the FCT area.

FCT downline-load error

The formatter was led to believe that a bad block 'nformation file was larger than it really was. There may be a BUS or controller processor module problem.

Drive init timeout

After the drive was inited, the RECEIVER READY signal never asserted.

Illegal response to start-up question

An overflow occurred when the serial number went over 64 bits.

FCT corrupted - Format Invalid

A problem was detected while using the data in the FCT. Either the data was not written properly or it has been c)rrupted since the last format. The format on the disk is no good and the disk will not be usable by any DEC operating system. Running the 'ormatter again may have a slight chance of succeeding. Otherwise, replace the disk or HDA. If you do not have a spare disk or HDA you may try to format the disk in RECONSTRUCT mode. If the disk is not an RA80, order a replacement disk or HDA immediately.

```
DRIVE ERROR ENCOUNTERED - STATUS RESPONSE:
STATUS (R TO L):  1AF1  0304  E100  8B00  0080  0013  1000
LAST BLOCK ACCESSED (16-BIT OCTAL): 000000  000000
```

The disk drive reported an error. You may see the drive's fault light come on. The formatter will attempt to clear the error in the drive and continue. This error does not mean that anything is necessarily wrong unless this error is printed many times. If you see many of these errors, you may wish to stop the format and run diagnostics on the disk drive. But remember, if you stop the formatter the disk will not be usable and the diagnostics will report that the format is bad. The drive's status is presented in hexidecimal in the same format as the diagnostic programs. The last block accessed is a representation of the last block header written onto the disk.

```
MORE THAN 12.5% OF TRACK IS BAD
```

The formatter found more than one eighth of the blocks on a single track bad. This error does not mean that anything is necessarily wrong unless this error is printed many times. If you see many of these errors, you may wish to stop the format and run diagnostics on the disk drive. But remember, if you stop the formatter the disk will not be usable and the diagnostics will report that the format is bad.

An example of how the errors are presented is below:

```
  RUNTIME  0:00:18
Non-existant unit number
```

4.0 PERFORMANCE AND PROGRESS REPORTS

There is no statistical report that can be printed using the Diagnostic Runtime Services PRINT command.

The DUP program issues the following messages upon normal completion:

Format completed

n Revectored LBNS

Where n is the number of LBNs revectored in the user data area.

n Primary revectored LBNS

Where n is the number of LBNs which were primary revectors.

n Secondary/tertiary revectored LBNS

Where n is the number of the LBNs which were secondary or tertiary revectors.

n Bad RBNS

Where n is the number of RBNs which were bad.

n Bad blocks in the RCT area due to data errors

Where n is the number of blocks in the total RCT area which were bad.

n Bad blocks in the DBN area due to data errors

Where n is the number of blocks in the total DBN area which were bad.

n Bad blocks in the XBN area due to data errors

Where n is the number of blocks in the total XBN area which were bad.

n Blocks retried on the check pass

Where n is the number of blocks which had an error on the first read attempt after formatting.

FCT used successfully or
FCT was not used

Depending on the answers to the software questions and the availability of the bad sector information (FCT), one of these messages will be printed.

An example of how the messages are presented is below.

```
  RUNTIME 1:24:57
Format completed
     5 Revectored LBNS
     5 Primary revectored LBNS
     0 Secondary/tertiary revectored LBNS
     0 Bad RBNS
     0 Bad blocks in the RCT area due to data errors
     0 Bad blocks in the DBN area due to data errors
     0 Bad blocks in the XBN area due to data errors
     5 Blocks retried on the check pass
FCT was not used
```

5.0 TEST SUMMARIES

There is only one test in this program - Test #1. Its only purpose is to load and run the format program in a UDA50A or KDA50-Q.

```
     1                                          .SBTTL  PROGRAM
    25
    26 002000                                          BGNMOD
    27                                          ;++
    28                                          ; THE PROGRAM HEADER IS THE INTERFACE BETWEEN
    29                                          ; THE DIAGNOSTIC PROGRAM AND THE SUPERVISOR.
    30                                          ;--
    31
    32 002000                                          POINTER BGNSW, BGNSFT, BGNSETUP
    33
    34 002000                                          HEADER  CZUDK,B,0,7200.,1,PRI07
       002000                                                                               L$NAME::
       002000       103                                                                             .ASCII /C/
       002001       132                                                                             .ASCII /Z/
       002002       125                                                                             .ASCII /U/
       002003       104                                                                             .ASCII /D/
       002004       113                                                                             .ASCII /K/
       002005       000                                                                             .BYTE   0
       002006       000                                                                             .BYTE   0
       002007       000                                                                             .BYTE   0
       002010                                                                               L$REV::
       002010       102                                                                             .ASCII  /B/
       002011                                                                               L$DEPO::
       002011       060                                                                             .ASCII  /0/
       002012                                                                               L$UNIT::
       002012    000001                                                                             .WORD   T$PTHV
       002014                                                                               L$TIML::
       002014    016040                                                                             .WORD   7200.
       002016                                                                               L$HPCP::
       002016    023234                                                                             .WORD   L$HARD
       002020                                                                               L$SPCP::
       002020    023312                                                                             .WORD   L$SOFT
       002022                                                                               L$HPTP::
       002022    002130                                                                             .WORD   L$HW
       002024                                                                               L$SPTP::
       002024    002136                                                                             .WORD   L$SW
       002026                                                                               L$LADP::
       002026    000124'                                                                            .WORD   L$LAST
       002030                                                                               L$STA::
       002030    000000                                                                             .WORD   0
       002032                                                                               L$CO::
       002032    000000                                                                             .WORD   0
       002034                                                                               L$DTYP::
       002034    000001                                                                             .WORD   1
       002036                                                                               L$APT::
       002036    000000                                                                             .WORD   0
       002040                                                                               L$DTP::
       002040    002124                                                                             .WORD   L$DISPATCH
       002042                                                                               L$PRIO::
       002042    000340                                                                             .WORD   PRI07
       002044                                                                               L$ENVI::
       002044    000000                                                                             .WORD   0
       002046                                                                               L$EXP1::
       002046    000000                                                                             .WORD   0
       002050                                                                               L$MREV::
       002050       003                                                                             .BYTE   C$REVISION
       002051       003                                                                             .BYTE   C$EDIT
```

H3

```
        002052                                  L$EF::
        002052  000000                                  .WORD   0
        002054  000000                                  .WORD   0
        002056                                  L$SPC::
        002056  000000                                  .WORD   0
        002060                                  L$DEVP::
        002060  003454                                  .WORD   L$DVTYP
        002062                                  L$REPP::
        002062  000000                                  .WORD   0
        002064                                  L$EXP4::
        002064  000000                                  .WORD   0
        002066                                  L$EXP5::
        002066  000000                                  .WORD   0
        002070                                  L$AUT::
        002070  000000                                  .WORD   0
        002072                                  L$DUT::
        002072  000000                                  .WORD   0
        002074                                  L$LUN::
        002074  000000                                  .WORD   0
        002076                                  L$DESP::
        002076  003502                                  .WORD   L$DESC
        002100                                  L$LOAD::
        002100  104035                                  EMT     E$LOAD
        002102                                  L$ETP::
        002102  000000                                  .WORD   0
        002104                                  L$ICP::
        002104  021512                                  .WORD   L$INIT
        002106                                  L$CCP::
        002106  022450                                  .WORD   L$CLEAN
        002110                                  L$ACP::
        002110  022446                                  .WORD   L$AUTO
        002112                                  L$PRT::
        002112  021504                                  .WORD   L$PROT
        002114                                  L$TEST::
        002114  000000                                  .WORD   0
        002116                                  L$DLY::
        002116  000000                                  .WORD   0
        002120                                  L$HIME::
        002120  000000                                  .WORD   0
```

```
                                    .SBTTL  DISPATCH TABLE

                                    ;++
                                    ; THE DISPATCH TABLE CONTAINS THE STARTING ADDRESS OF EACH TEST.
                                    ; IT IS USED BY THE SUPERVISOR TO DISPATCH TO EACH TEST.
                                    ;--

002122                              DISPATCH 1
002122  000001                                                                  .WORD   1
002124                                                                  L$DISPATCH::
002124  022534                                                                  .WORD   T1
```

J3

```
                                        .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.
                                        ;--

   002126                                       BGNHW   DFPTBL
   002126  000002                                                                               .WORD   L10000-L$HW/2
   002130                                                                               L$HW::
   002130                                                                               DFPTBL::

   002130  172150                               .WORD   172150                  ; UNIBUS ADDRESS
   002132  000000                               .WORD   0.                      ; LOGICAL DRIVE NUMBER
   002134                                       ENDHW
   002134                                                                               L10000:
```

C3

```
                                         .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.
                                         ;--

        002134                                   BGNSW   SFPTBL
        002134  000001                                                                                .WORD   L10001-L$SW/2
        002136                                                                                L$SW::
        002136                                                                                SFPTBL::

                                                                                 ;OFFSET          USE
        002136  000007                           .WORD   7                       ; 0.    YES/NO ANSWERS
        002140                                   ENDSW
        002140                                                                                L10001:

        002140                                   ENDMOD
```

```
      1                                 .SBTTL  GLOBAL EQUATES SECTION
      2
      3 002140                                  BGNMOD
      4
      5                                 ;++
      6                                 ; THE GLOBAL EQUATES SECTION CONTAINS PROGRAM EQUATES THAT
      7                                 ; ARE USED IN MORE THAN ONE TEST.
      8                                 ;--
      9
     10 002140                                  EQUALS
                                        ;
                                        ; 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
                                        ;
                001000                  BIT9==  BIT09
                000400                  BIT3==  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
```

M3

```
        000140                  PRIO3== 140
        000100                  PRIO2== 100
        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

        000C15                  CR=     15                          ;VALUE TO PASS TO PRINT MACRO TO END LINE
```

```
;MACRO DEFINITIONS FOR GLOBAL EQUATES

;THESE MACROS ARE USED TO DEFINE INDEXES INTO A TABLE
;
;CALLING SEQUENCE MUST BE
;
;       TABLE
;       ITEM    NAME    BYTES
;       ITEM    NAME    BYTES
;       ITEM    NAME    BYTES
;       END     SIZE
;
;TABLE DEFINES THAT A TABLE IS ABOUT TO BE DEFINED AND END TERMINATES THE DEFINITION.
;ANY NUMBER OF ITEM LINES CAN APPEAR. NAME IS THE NAME OF THE SYMBOL BEING EQUATED TO
;THE INDEX. THE INDEX ALWAYS STARTS AT ZERO. BYTES SPECIFIES THE SIZE OF THE VALUE TO BE
;STORED AT THAT INDEX IN BYTES. THE SIZE ARGUMENT TO THE END STATEMENT IS OPTIONAL, IT
;BE EQUATED TO THE SIZE OF THE TABLE IN BYTES. THE SYMBOL TINDEX IS USED TO KEEP TRACK
;OF THE INDEX VALUE AND WILL BE EQUAL TO THE SIZE OF THE TABLE AFTER THE END STATEMENT.

.MACRO TABLE
        TINDEX=0
.ENDM

.MACRO ITEM NAME BYTES
        NAME=TINDEX
        TINDEX=TINDEX+BYTES
.ENDM

.MACRO END SIZE
        .IF NB SIZE
        SIZE=TINDEX
        .ENDC
.ENDM
```

```
                                ;UDA BIT DEFINITIONS

                                ;UDASA REGISTER UNIVERSAL READ BITS

        004000                  SA.S1=  004000                  ;STEP 1 STATUS BIT
        010000                  SA.S2=  010000                  ;STEP 2 STATUS BIT
        020000                  SA.S3=  020000                  ;STEP 3 STATUS BIT
        040000                  SA.S4=  040000                  ;STEP 4 STATUS BIT
        100000                  SA.ERR= 100000                  ;ERROR INDICATOR
        001000                  SA.QB=  1000                    ;QB BIT MASK
        000100                  SA.MP=  100                     ;MP BIT MASK
        000040                  SA.SM=  40                      ;SA BIT MASK

                                ;UDASA REGISTER ERROR STATUS BITS

        003777                  SA.ERC= 003777                  ;ERROR CODE

                                ;UDASA REGISTER STEP ONE READ 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 ONE WRITE 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 TWO READ 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 TWO WRITE BITS

        000001                  SA.PRG= 000001                  ;ENABLE VAX UNIBUS ADAPTER PURGE INTERRUPT
                                ;       177776                  ;LOW ORDER MESSAGE RING BYTE ADDRESS
                                ;UDASA REGISTER STEP THREE READ 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 THREE WRITE BITS

                                ;       077777                          ;HIGH ORDER MESSAGE RING BYTE ADDRESS
        100000                  SA.TST= 100000                          ;PURGE POLE TEST ENABLE

                                ;UDASA REGISTER STEP FOUR READ BITS

        000017                  SA.MCV= 000017                          ;UDA MICROCODE VERSION
        003760                  SA.CNT= 003760                          ;CONTROLLER MODEL

                                ;UDASA REGISTER STEP FOUR WRITE 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

                                ;INIT ROUTINE FLAGS

        000002                  ICONT   == BIT1                         ;CONTINUE EVENT FLAG
        000004                  IREST   == BIT2                         ;RESTART FLAG
        000010                  ISTRT   == BIT3                         ;START FLAG
        000020                  ISTRTH  == BIT4                         ;START FLAG HOLD FOR DMRQ4 ROUTINE
```

```
                                   ;COMMAND/MESSAGE DESCRIPTOR BIT DEFINITIONS

        100000                     RG.OWN= 100000                      ;SET WHEN UDA OWNS RING
        040000                     RG.FLG= 040000                      ;FLAG BIT

                                   ;OFFSETS INTO HOST COMMUNICATIONS AREA WITH ONE DESCRIPTOR TO EACH RING
                                   ;AND TWO PACKET AND BUFFER AREAS.

        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
        000244                     HC.BSZ= 164.                        ;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               ;MESSAGF PACKET START
        000100                     HC.CEV= HC.MPK+HC.PSZ               ;COMMANL ENVELOPE START
        000104                     HC.CPK= HC.CEV+HC.ESZ               ;COMMAND PACKET START
        000164                     HC.BF1= HC.CPK+HC.PSZ               ;FIRST BUFFER
        000430                     HC.BF2= HC.BF1+HC.BSZ               ;SECOND BUFFER

        000674                     HC.SIZ= HC.BF2+HC.BSZ               ;TOTAL SIZE OF HOST COMM AREA

                                   ;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
```

```
;               +--------------------------------------------------+
;       HC.INT  !       INTERRUPT INDICATORS                       !    4 BYTES
;               !                                                  !
;               +--------------------------------------------------+
;       HC.MSG  !       MESSAGE RING                               !    4 BYTES
;       HC.MCT  !                                                  !
;               +--------------------------------------------------+
;       HC.CMD  !       COMMAND RING                               !    4 BYTES
;       HC.CCT  !                                                  !
;               +--------------------------------------------------+
;       HC.MEV  !       MESSAGE ENVELOPE                           !   52 BYTES
;       HC.MPK  !                                                  !
;               !                                                  !
;               !                                                  !
;               !                                                  !
;               !                                                  !
;               +--------------------------------------------------+
;       HC.CEV  !       COMMAND ENVELOPE                           !   52 BYTES
;       HC.CPK  !                                                  !
;               !                                                  !
;               !                                                  !
;               !                                                  !
;               !                                                  !
;               +--------------------------------------------------+
;       HC.BF1  !       BUFFER # 1 (RESPONSE TO DM PROGRAM)        !   82 BYTES
;               !                                                  !
;               !                                                  !
;               !                                                  !
;               +--------------------------------------------------+
;       HC.BF2  !       BUFFER # 2 (REQUEST FROM DM PROGRAM)       !   82 BYTES
;               !                                                  !
;               !                                                  !
;               !                                                  !
;               +--------------------------------------------------+
                                        ;COMMAND PACKET OPCODES

              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.GDS=   1                         ;DUP GET DUST STATUS
              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 STUD DATA
              000005                    OP.RSD=   5                         ;DUP RECEIVE STUD 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
```

```
                                ;COMMAND MODIFIERS

                                ;      = 020000                      ;CLEAR SERIOUS EXCEPTION
            040000              MD.CMP= 040000                       ;COMPARE
            100000              MD.EXP= 100000                       ;EXPRESS REQUEST
            010000              MD.ERR= 010000                       ;FORCE ERROR
            004000              MD.SCH= 004000                       ;SUPPRESS CACHING (HIGH SPEED)
            002000              MD.SCL= 002000                       ;SUPPRESS CACHING (LOW SPEED)
            000100              MD.SEC= 000100                       ;SUPPRESS ERROR CORRECTION
            000400              MD.SER= 000400                       ;SUPPRESS ERROR RECOVERY
            000200              MD.SSH= 000200                       ;SUPPRESS SHADOWING
            000100              MD.WBN= 000100                       ;WRITE-BACK (NON-VOLATILE)
            000400              MD.WBV= 000400                       ;WRITE BACK (VOLATILE)
            000020              MD.SEQ= 000020                       ;WRITE SHADOW SET ONE UNIT AT A TIME
            000001              MD.SPD= 000001                       ;SPIN-DOWN
            000001              MD.FEU= 000001                       ;FLUSH ENTIRE UNIT
            000002              MD.VOL= 000002                       ;VOLATILE ONLY
            000001              MD.NXU= 000001                       ;NEXT UNIT
            000001              MD.RIP= 000001                       ;ALLOW SELF DESTRUCTION
            000002              MD.IMF= 000002                       ;IGNORE MEDIA FORMAT ERROR
            000004              MD.SWP= 000004                       ;SET WRITE PROTECT
            000010              MD.CWB= 000010                       ;CLEAR WRITE-BACK DATA LOST
            000001              MD.PRI= 000001                       ;PRIMARY REPLACEMENT BLOCK

                                ;END PACKET FLAGS

            000200              EF.BBR= 000200                       ;BAD BLOCK REPORTED
            000100              EF.BBU= 000100                       ;BAD BLOCK UNREPORTED
            000040              EF.LOG= 000040                       ;ERROR LOG GENERATED
            000020              EF.SEX= 000020                       ;SERIOUS EXCEPTION

                                ;CONTROLLER FLAGS

            000200              CF.ATN= 000200                       ;ENABLE ATTENTION MESSAGES
            000100              CF.MSC= 000100                       ;ENABLE MISCELLANEOUS ERROR LOG MESSAGES
            000040              CF.OTH= 000040                       ;ENABLE OTHER HOST'S ERROR LOG MESSAGES
            000020              CF.THS= 000020                       ;ENABLE THIS HOST'S ERROR LOG MESSAGES
            000002              CF.SHD= 000002                       ;SHADOWING
            000001              CF.576= 000001                       ;576 BYTE SECTORS
```

```
                        ;UNIT FLAGS

        000001          UF.CMR= 000001                          ;COMPARE READS
        000002          UF.CMW= 000002                          ;COMPARE WRITES
        100000          UF.RPL= 100000                          ;HOST INITIATED BAD BLOCK REPLACEMENT
        040000          UF.INA= 040000                          ;INACTIVE SHADOW SET UNIT
        004000          UF.SCH= 004000                          ;SUPPRESS CACHING (HIGH SPEED)
        002000          UF.SCL= 002000                          ;SUPPRESS CACHING (LOW SPEED)
        000100          UF.WBN= 000100                          ;WRITE-BACK (NON-VOLATILE)
        020000          UF.WPH= 020000                          ;WRITE PROTECT (HARDWARE)
        001000          UF.WPS= 001000                          ;WRITE PROTECT (SOFTWARE OR VOLUME)
        000004          UF.576= 000004                          ;576 BYTE SECTORS

                        ;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 MAINTENA CE 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
```

```
                                ;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.TRCK= 36.                                     ;TRACK SIZE
        000046                  P.GRP=  38.                                     ;GROUP SIZE
        000050                  P.CYL=  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.UNCL= 36.                                     ;UNIT COMMAND LIMIT
        000050                  P.UNSZ= 40.                                     ;UNIT SIZE
        000054                  P.VSER= 44.                                     ;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
        000024                  P.CNTI= 20.                                     ;CONTROLLER ID

                                ;               GET DUST STATUS END PACKET OFFSETS:
        000014                  P.DEXT= 12.                                     ;DUST PROGRAM EXTENSION
        000017                  P.DFLG= 15.                                     ;STATUS FLAGS
        000020                  P.DPI=  16.                                     ;PROGRESS INDICATOR
        000024                  P.DTO=  20.                                     ;TIMEOUT VALUE
```

```
                        ;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

                        ;GET DUST STATUS FLAGS

        000010          DF.ACT= 010                             ;SET IF THIS DUST CURRENTLY ACTIVE
        000004          DF.NES= 004                             ;SET IF THIS DUST WILL NOT ACCEPT THE EXECUTE
                                                                ;SUPPLIED PROGRAM COMMAND
        000002          DF.LCL= 002                             ;SET IF THIS DUST HAS A LOCAL LOAD MEDIA FOR LOADING
                                                                ;DIAGNOSTICS AND OTHER UTILITIES
        000001          DF.SA=  001                             ;SET IF ANY PROGRAM EXECUTION UNDER THIS DUST
                                                                ;DISABLES THE OPERATION OF ALL OTHER SERVERS IN THE
                                                                ;SAME SYSTEM AS THE DUST

                        ;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

        170000          DU.TYP= 170000                          ;MESSAGE TYPE FIELD

                        ;DM PROGRAM HEADER DEFINITIONS

        000000          DMTRLN= 0                               ;OFFSET TO SIZE OF PROGRAM NEEDING DOWNLINE LOAD
        000004          DMOVRL= 4                               ;OFFSET TO SIZE OF OVERLAY
        000021          DMTMO=  21                              ;TIMEOUT VALUE IN SECONDS (ONE BYTE)
        000040          DMMAIN= 40                              ;OFFSET TO FIRST WORD OF MAIN PROGRAM
        001000          DMFRST= 1000                            ;ADDRESS IN DM FILE CONTAINING FIRST BYTE OF HEADER
```

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```
                                  ;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.

002140                            TABLE                            ;START A TABLE DEFINITION

002140                            ITEM C.UADR     2                ;UNIBUS ADDRESS OF UDAIP REGISTER
002140                            ITEM C.UNIT     2
          000077                          CT.UNT= 000077           ; LOGICAL UNIT NUMBER (FIRST)
          100000                          CT.AVL= BIT15            ; SET WHEN NOT AVAILABLE FOR TESTING
002140                            ITEM C.VEC      2
          000777                          CT.VEC= 000777           ; VECTOR ADDRESS
          007000                          CT.BRL= 007000           ; BR LEVEL
002140                            ITEM C.JSR      2                ;INTERRUPT SERVICE ROUTINE FOR CONTROLLER
002140                            ITEM C.JAD      2                ;  THESE TWO WORDS LOADED WITH [JSR R0,UDASRV]
002140                            ITEM C.FLG      2                ;FLAGS
          000002                          CT.RN=  BIT1             ;DM PROGRAM RUNNING
          000004                          CT.CMD= BIT2             ;COMMAND ISSUED, WAITING FOR RESPONSE
          000010                          CT.MSG= BIT3             ;MESSAGE RESPONSE RECEIVED
                                                                   ;WHENEVER THIS BIT IS SET, CT.CMD IS CLEARED
          000020                          CT.REQ= BIT4             ;BUFFER HAS BEEN GIVEN TO UDA FOR REQUEST
                                                                   ;SET WHENEVER READ STUD DATA COMMAND
                                                                   ;GIVEN TO UDA
          000040                          CT.STA= BIT5             ;GET DUST STATUS COMMAND HAS BEEN SENT
          000100                          CT.TM1= BIT6             ;ONE TIMEOUT PERIOD HAS EXPIRED BETWEEN SEND OR
                                                                   ;RECEIVE DATA RESPONSE
          000200                          CT.TM2= BIT7             ;SECOND TIMEOUT HAS EXPIRED
002140                            ITEM C.RING     2                ;RING BUFFER ADDRESS
002140                            ITEM C.DR0      2                ;POINTER TO DRIVE TABLES
002140                            ITEM C.DR1      2                ;  IF ZERO, NO DRIVE TABLE EXISTS
002140                            ITEM C.DR2      2
002140                            ITEM C.DR3      2
002140                            ITEM C.DR4      2
002140                            ITEM C.DR5      2
002140                            ITEM C.DR6      2
002140                            ITEM C.DR7      2
002140                            ITEM C.TO       2                ;TIMEOUT COUNTER
002140                            ITEM C.TOH      2                ;  (TWO WORDS)
002140                            ITEM C.TOT      2                ;DUP PROGRAM TIMEOUT VALUE IN SECONDS
002140                            ITEM C.PRI      4                ;DUP PROGRAM PROGRESS INDICATOR
002140                            ITEM C.REF      2                ;COMMAND REFERENCE NUMBER

002140                            END C.SIZE                       ;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.

002140                           TABLE                           ;START A TABLE DEFINITION

002140                           ITEM D.DRV      2                       ;DRIVE NUMBER
002140                           ITEM D.UNIT     2
           000077                        DT.UNT= 000077                  ; LOGICAL UNIT NUMBER OF DRIVE
           100000                        DT.AVL= BIT15                   ; SET WHEN NOT AVAILABLE FOR TESTING
002140                           ITEM D.SERN     22.                     ;DISK SERIAL NUMBER

002140                           END D.SIZE                              ;SIZE OF DRIVE TABLE IN BYTES
```

```
;USEFUL INSTRUCTION DEFINITIONS

.MACRO  AND ARG,ADR                     ;LOGICAL AND INSTRUCTION
        .LIST
                                                                BIC #↑C<ARG>,ADR
        .NLIST
.ENDM

.MACRO  OR ARG,ADR                      ;LOGICAL OR INSTRUCTION
        .LIST
                                                                BIS #ARG,ADR
        .NLIST
.ENDM

.MACRO  PUSH ARG                        ;PUSH INSTRUCTION
        .IRP X,<ARG>
        .LIST
                                                                MOV X,-(SP)
        .NLIST
        .ENDM
.ENDM

.MACRO  POP ARG                         ;POP INSTRUCTION
        .IRP X,<ARG>
        .LIST
                                                                MOV (SP)+,X
        .NLIST
        .ENDM
.ENDM

.MACRO  .BR ADR                         ;A BRANCH TO THE NEXT LOCATION
        .IF P2
            .IF NE .-ADR
                .ERROR ;ILLEGAL .BR TO ADR
            .ENDC
        .ENDC
.ENDM

.MACRO  ASSUME FIRST CONDITION SECOND
            .IF CONDITION <FIRST>-<SECOND>
            .IFF
                .ERROR ;BAD ASSUME OF <FIRST> CONDITION <SECOND>
            .ENDC
.ENDM
```

```
;PRINT CHARACTER
;  ARGUMENT MUST BE SOURCE STATEMENT TO MOVE CHARACTER TO PRINT (MOV ARG,R0)
;       EX: "PRINT R1" WILL PRINT THE CHARACTER IN R1
;  SPECIAL CASE: "PRINT #CR" WILL PRINT END OF LINE SEQUENCE
;  THE PRINTING IS DONE AT THE MODE OF THE LAST PRINT LINE CALL
;       IE., PNTX, PNTB, PNTX, PNTS

.MACRO PRINT ARG1
        .IF DIF <ARG1>,R0
                .LIST
                                                                MOVB ARG1,R0
                .NLIST
        .ENDC
        .LIST
                                                                CALL CPNT
        .NLIST
.ENDM

;PROCESSING MACRO FOR NEXT SET OF FORMATTED MESSAGE MACROS

.MACRO PNT... RTN,ADR,ARG1,ARG2,ARG3,ARG4,ARG5,ARG6,ARG7,ARG8
        PNT.CT=0
        .IRP AA,<ARG8,ARG7,ARG6,ARG5,ARG4,ARG3,ARG2,ARG1>
                .IF NB,<AA>
                        .LIST
                                                                MOV AA,-(SP)
                        .NLIST
                        PNT.CT=PNT.CT+2
                .ENDC
        .ENDM
        .LIST
                                                                JSR R1,RTN
                                                                .WORD ADR
                                                                .WORD PNT.CT
        .NLIST
.ENDM
```

```
;PRINT FORMATTED MESSAGE MACROS
;  USE THESE MACROS TO PRINT A FORMATTED MESSAGE
;  FIRST ARGUMENT MUST BE ADDRESS OF FIRST CHARACTER OF MESSAGE STRING
;         TO BE PUT INTO WORD (.WORD ARG)
;  UP TO 8 SOURCE STATEMENTS MAY FOLLOW TO SPECIFY PARAMETERS TO BE
;  USED BY THE FORMAT

.MACRO PNTF ADR ARG1,ARG2,ARG3,ARG4,ARG5,ARG6,ARG7,ARG8
        PNT... LPNTF ADR ARG1,ARG2,ARG3,ARG4,ARG5,ARG6,ARG7,ARG8
.ENDM
.MACRO PNTB ADR ARG1,ARG2,ARG3,ARG4,ARG5,ARG6,ARG7,ARG8
        PNT... LPNTB ADR ARG1,ARG2,ARG3,ARG4,ARG5,ARG6,ARG7,ARG8
.ENDM
.MACRO PNTX ADR ARG1,ARG2,ARG3,ARG4,ARG5,ARG6,ARG7,ARG8
        PNT... LPNTX ADR ARG1,ARG2,ARG3,ARG4,ARG5,ARG6,ARG7,ARG8
.ENDM
.MACRO PNTS ADR ARG1,ARG2,ARG3,ARG4,ARG5,ARG6,ARG7,ARG8
        PNT... LPNTS ADR ARG1,ARG2,ARG3,ARG4,ARG5,ARG6,ARG7,ARG8
.ENDM
.MACRO PNT ADR ARG1,ARG2,ARG3,ARG4,ARG5,ARG6,ARG7,ARG8
        PNT... LPNT ADR ARG1,ARG2,ARG3,ARG4,ARG5,ARG6,ARG7,ARG8
.ENDM
```

```
                                .SBTTL  GLOBAL DATA SECTION

                                ;++
                                ; THE GLOBAL DATA SECTION CONTAINS DATA THAT ARE USED
                                ; IN MORE THAN ONE TEST.
                                ;--

002140                          FFREE:: .BLKW 1                         ;FIRST FREE WORD IN MEMORY
002142                          FSIZE:: .BLKW 1                         ;SIZE OF FREE MEMORY IN WORDS
002144                          FMEM:   .BLKW 1                 ;COPY OF FFREE AT END OF INIT SECTION
002146                          FMEMS:  .BLKW 1                 ;COPY OF FSIZE AT END OF INIT SECTION
002150                          CTABS:: .BLKW 1                         ;START OF CONTROLLER TABLE STORAGE
002152                          CTRLRS: .BLKW 1                         ;COUNT OF UDA CONTROLLERS IN PTABLES
002154                          TSTTAB: .BLKW 1                         ;POINTER TO FIRST CONTROLLER TABLE UNDER TEST
                                        .GLOBL RAFMT
002156  000000G                 DMPROG: .WORD RAFMT                     ;START ADDRESS OF DM PROGRAM
002160                          URUN:   .BLKW 1                         ;NUMBER OF UNITS TO RUN AT ONE TIME
002162                          URNING: .BLKW 1                         ;NUMBER OF UNITS STILL RUNNING
002164                          UCNT:   .BLKW 1                         ;COUNTER OF UNITS UNDER TEST
002166  000000                  FILOPN: .WORD 0                         ; FILE OPEN
002170                          UFREEZ: .BLKW 1                         ;FREEZE ON UNIT WHEN NOT ZERO
002172                          NXMAD:  .BLKW 1                         ;SET TO ALL ONES BY NON-EXISTANT ADDRESS
002174  000000                  FDATA:  .WORD 0
002176                          FCTBUF: .BLKB 512.              ;STORAGE FOR FCT BLOCK
003176                          FCTNUM: .BLKW 1         ;FCT BLOCK NUMBER
003200                          MODE:   .BLKW 1 ;MODE WORD, SAME BIT DEFS AS SO.BIT

                                ;INIT ROUTINE DATA

003202                          DTABS:: .BLKW 1                         ;START OF DRIVE TABLE STORAGE
003204                          IFLAGS::.BLKW 1                         ;FLAGS FROM INIT CODE

                                ;CLOCK CONTROL

003206  000000                  KW.CSR: .WORD 0                         ;CSR OF CLOCK
003210                          KW.BRL: .BLKW 1                         ;BR LEVEL
003212                          KW.VEC: .BLKW 1                         ;VECTOR
003214                          KW.HZ:  .BLKW 1                         ;HERTZ (50. OR 60.)
003216                          KW.EL:  .BLKW 2                         ;ELAPSED TIME

003222  016540                  PTYPE:  .WORD PF                        ;PRINT TYPE
003224     000     000          ERRCHR: .BYTE 0,0                       ;FIRST BYTE LOADED WITH OUTPUT CHARACTER
003226  000000                  NULL:   .WORD 0                         ;USED TO PRINT A NULL CHARACTER
003230                          FNAME:  .BLKB 10.
```

```
003242                           TEMP:    .BLKB 22.                          ;USED TO GET ANSWER FROM GMANID CALL
003270     061      055      112 DATEI:   .ASCIZ\1-JAN-70\                   ;DEFAULT DATE
003301                                    .BLKB 3
003304  000000                   DATEO:   .WORD 0 ;DATE STRING IN FORMATTER FORMAT
003306                                    .BLKB 10.          ;(FIRST WORD ZERO SAYS NO DATE HERE YET)
003320     061      070      064 HIGHEST:.ASCIZ\18446744073709551615\      ;HIGHEST DISK SERIAL NUMBER
003345     104      105      103 MONTHS:  .ASCII\DEC\        ;NAME OF MONTHS
003350     116      117      126          .ASCII\NOV\
003353     117      103      124          .ASCII\OCT\
003356     123      105      120          .ASCII\SEP\
003361     101      125      107          .ASCII\AUG\
003364     112      125      114          .ASCII\JUL\
003367     112      125      116          .ASCII\JUN\
003372     115      101      131          .ASCII\MAY\
003375     101      120      122          .ASCII\APR\
003400     115      101      122          .ASCII\MAR\
003403     106      105      102          .ASCII\FEB\
003406     112      101      116          .ASCII\JAN\
003411     037                   DAYS:    .BYTE 31.          ;NUMBER OF DAYS IN EACH MONTH
003412     035                            .BYTE 29.
003413     037                            .BYTE 31.
003414     036                            .BYTE 30.
003415     037                            .BYTE 31.
003416     036                            .BYTE 30.
003417     037                            .BYTE 31.
003420     037                            .BYTE 31.
003421     036                            .BYTE 30.
003422     037                            .BYTE 31.
003423     036                            .BYTE 30.
003424     037                            .BYTE 31.
003425     061      071      000 YEAR19:  .ASCIZ\19\
003430     062      060      000 YEAR20:  .ASCIZ\20\
                                          .EVEN
003434  000000                   IPADRS:  .WORD 0
003436  000000                            .WORD 0
003440  000000                            .WORD 0
003442  000000                            .WORD 0
003444  000000                            .WORD 0
003446  000000                            .WORD 0
003450  000000                            .WORD 0
003452  000000                            .WORD 0
```

```
      1                                         .SBTTL  GLOBAL TEXT SECTION
      2
      3                                         ;++
      4                                         ; THE GLOBAL TEXT SECTION CONTAINS FORMAT STATEMENTS,
      5                                         ; MESSAGES, AND ASCII INFORMATION THAT ARE USED IN
      6                                         ; MORE THAN ONE TEST.
      7                                         ;--
      8
      9                                         ;
     10                                         ; NAMES OF DEVICES SUPPORTED BY PROGRAM
     11                                         ;
     12 003454                                        DEVTYP <RA SERIES DISK DRIVE>
        003454                                                                            L$DVTYP::
   '    003454      122     101     040                                                          .ASCIZ  /RA SERIES DISK DRIVE
                                                                                                 .EVEN
     13
     14                                         ; TEST DESCRIPTION
     15                                         ;
     16 003502                                        DESCRIPT <CZUDKO UDA50A,KDA50A-Q FORMATTER>
        003502                                                                            L$DESC::
  -Q FORM003502      103     132     125                                                         .ASCIZ  /CZUDKO UDA50A,KDA50A
                                                                                                 .EVEN
```

F5

```
                                         ;UNFORMATTED MESSAGES

  003544     105     116     124  DATEQ:  .ASCIZ\ENTER DATE AS DD-MMM-YY\
  003574     040     106     117  FILNAQ: .ASCIZ\ FOR DISK TO BE FORMATTED\
  003626     040     000          SERNQ:  .ASCIZ\ \
  003630     101     122     105  WNQUES: .ASCIZ\ARE YOU SURE YOU WANT TO RUN THIS FORMATTER\
```

G5

```
                                        ; FORMAT STATEMENTS USED IN PRINT CALLS

003704    045    124    000   ERRONE:  .ASCIZ\%T\
003707    045    116    000   ERRNL:   .ASCIZ\%N\
003712    042    040    040   RNTIM:   .ASCIZ\"  RUNTIME "D16":"\
003735    104    071    042   RNTIM1:  .ASCIZ\D9":"\
003743    104    071    000   RNTIM2:  .ASCIZ\D9\
003746    042    040    040   ERRME1:  .ASCIZ\"  *  *  *  ERROR PROCESSING MESSAGE STRING  *  *  *"N\
004035    116    042    125   MESSG:   .ASCIZ\N"UNIT "D6" CONTROLLER AT "O16" DRIVE "D9S\
004110    042    116    117   NOCLOCK:.ASCIZ\"NO LINE CLOCK AVAILABLE FOR TIMING EVENTS"N\
004165    042    110    117   BASNO:   .ASCIZ\"HOST PROGRAM"\
004204    042    040    040   BASL2:   .ASCIZ\"  CONTROLLER AT "O16\
004232    042    040    040   BASL3:   .ASCIZ\"  DRIVE "D9\
004247    000                 BAS:     .BYTE 0                          ;NULL TO PRINT NOTHING

004250    122    066    122   BASLN:   .ASCIZ\R6R6R6R6\                 ;USED TO PRINT BASIC LINE OF ERROR MESSAGE
004261    116    042    123   SERNUM:  .ASCIZ\N"SERIAL NUMBER FOR UNIT "D6" CONTROLLER AT "O16" DRIVE "D9\
004355    042    123    124   WNSTOP:  .ASCII\"STOPPING THIS FORMAT AFTER THIS POINT WILL MAKE THE DISK"N\
004450    042    125    116            .ASCII\"UNUSABLE, AND WILL CAUSE THE DISK TO BE SPUN DOWN WHEN"N\
004541    042    102    122            .ASCIZ\"BROUGHT ONLINE."NN\
004565    116    042    127   WNSTRT:  .ASCII\N"WARNING:"N\
004601    042    040    040            .ASCII\"       THIS FORMATTER PROGRAM SHOULD NOT BE USED AS A DIAGNOSTIC"N\
004703    042    040    040            .ASCII\"       TOOL.  RUN THIS PROGRAM ONLY AS INSTRUCTED IN THE DISK'N\
005002    042    040    040            .ASCIZ\"       DRIVE'S SERVICE MANUAL."N\
005043    116    042    127   WNTIME:  .ASCII\N"WARNING:"N\
005057    042    040    040            .ASCII\"       THIS PROGRAM WILL TAKE APPROXIMATELY 45 MINUTES ON"N\
005152    042    040    040            .ASCII\"       A RA60, 30 MINUTES ON A RA80, 60 MINUTES ON A RA81, AND "N\
005253    042    040    040            .ASCIZ\"       120 MINUTES ON A RA82."N\
      005313                         X1A:
      005313                         X2A:
      005313                         X3A:
      005313   042     111     116   X8A:     .ASCIZ\"INVALID ANSWERS GIVEN TO HARDWARE QUESTIONS"N\
      005372   122     065     122   X1:      .ASCIZ\R5R6"CONTROLLER HAS MORE THAN ONE VECTOR, BR LEVEL OR BURST RATE"N\
      005475   122     065     122   X2:      .ASCIZ\R5R6"MULTIPLE UNITS SELECT THE SAME DRIVE"N\
      005551   122     065     122   X3:      .ASCIZ\R5R6"MORE THAN EIGHT DRIVES SELECTED ON THIS CONTROLLER"N\
      005643   122     064     042   X4:_     .ASCII\R4"NOT ENOUGH ROOM IN MEMORY TO FORMAT THE UNITS SELECTED"N\
      005736   042     120     114            .ASCIZ\"PLEASE START PROGRAM OVER AND FORMAT FEWER UNITS AT A TIME"N\
      006034   122     065     122   X8:      .ASCIZ\R5R6"TWO CONTROLLERS USE THE SAME VECTOR"N\
      006107   122     064     042   X9:      .ASCII\R4"ONLY ONE DISK CAN BE SELECTED IN HW QUESTIONS IN RESTORE MODE."N\
      006212   042     120     114            .ASCIZ\"PLEASE START PROGRAM OVER AND SELECT ONLY ONE DISK."N\
      006301   122     064     042   X10:     .ASCIZ\R4"THIS PROGRAM CAN ONLY REFORMAT A DISK IN UNATTENDED MODE."N\
      006400   122     065     042   X14:     .ASCII\R5"CONTROLLER IS NOT SUPPORTED BY THIS FORMATTER PROGRAM.  THIS"N\
      006501   042     120     122            .ASCII\"PROGRAM REQUIRES A UDA50-A (MODEL 6) OR A KDA50-Q (MODEL 13)"N\
      006600   042     103     117            .ASCIZ\"CONTROLLER.  CONTROLLER REPORTED MODEL CODE "D4"."N\
      006665   122     065     042   X20:     .ASCII\R5"MEMORY ERROR TRYING TO READ CONTROLLER REGISTERS"N\
      006752   042     103     110            .ASCII\"CHECK CSR SELECTION SWITCHES ON CONTROLLER PROCESSOR MODULE OR BUS"N\
      007057   042     117     122            .ASCIZ\"OR REPLACE CONTROLLER PROCESSOR MODULE"N\
      007131   122     065     042   X21:     .ASCII\R5"CONTROLLER RESIDENT DIAGNOSTICS DETECTED FAILURE"NR8\
      007220   042     122     105            .ASCIZ\"REPLACE CONTROLLER SDI MODULE"N\
      007261   122     065     042   X21A:    .ASCIZ\R5"CONTROLLER RESIDENT DIAGNOSTICS DETECTED FAILURE"NR8R7\
      007353   122     065     042   X22:     .ASCII\R5"STEP BIT DID NOT SET IN SA REGISTER DURING INITIALIZATION"N\
      007451   042     123     124            .ASCIZ\"STEP BIT EXPECTED  "O16NR8R7\
N"    007506   122     065     042   X23A:    .ASCII\R5"CONTROLLER DID NOT CLEAR RING STRUCTURE IN HOST MEMORY DURING INITIALIZATIO
      007627   104     071     042            .ASCII\D9" WORDS WERE TO BE CLEARED STARTING AT ADDRESS "O16N\
      007715   042     106     111            .ASCII\"FIRST SEVERAL WORDS NOT CLEARED (UP TO 6):"N\
      007772   123     066     042            .ASCIZ\S6"ADDRESS"S4"CONTENTS"N\
      010023   123     067     117   X23B:    .ASCIZ\S7O16S5O16N\
      010037   122     065     042   X24:     .ASCII\R5"SA REGISTER DID NOT GO TO ZERO AFTER STEP 3 WRITE OF INITIALIZATION"N\
      010147   042     120     125            .ASCIZ\"PURGE/POLE DIAGNOSTICS WERE REQUESTED"NR8R7\
      010224   122     065     042   X25:     .ASCII\R5"CONTROLLER DID NOT RETURN CORRECT DATA IN SA REGISTER DURING"N\
      010325   042     111     116            .ASCII\"INITIALIZATION"N\
      010346   042     040     040            .ASCIZ\"  SA EXPECTED  "O16NR8R7\
      010400   122     065     042   X30:     .ASCIZ\R5"CONTROLLER REPORTED FATAL ERROR IN SA REGISTER WHILE RUNNING FORMATTER"NR8\
      010516   122     065     042   X31:     .ASCIZ\R5"FORMATTER PROGRAM IS HUNG"N\
      010555   122     065     042   X32:     .ASCIZ\R5"MESSAGE BUFFER RECEIVED FROM FORMATTER WITH UNKNOWN REQUEST NUMBER"N\
      010665   122     065     042   X36:     .ASCII\R5"NO INTERRUPT RECEIVED FROM CONTROLLER FOR 30 SECONDS"N\
      010756   042     127     110            .ASCIZ\"WHILE LOADING FORMATTER"N\
7\    011011   122     065     042   X37:     .ASCIZ\R5"CONTROLLER REPORTED FATAL ERROR IN SA REGISTER WHILE LOADING FORMATTER"NR8R
      011131   122     065     042   X100:    .ASCIZ\R5"FORMATTER ASKED UNEXPECTED QUESTION ("D12")"N\
      011212   122     065     042   X101:    .ASCIZ\R5"FORMATTER REJECTED ANSWER TO DATE OR SERIAL NUMBER QUESTION"N\
 011313      042      115      105  XMSG1:   .ASCIZ\"MESSAGE BUFFER CONTAINS:"N\
 011347      123      063      117  XMSG2:   .ASCIZ\S3016S1016S1016S1016S1016S1016S1016N\
 011414      122      065      042  XPKT1:   .ASCII\R5"RESPONSE PACKET FROM CONTROLLER DOES NOT CONTAIN EXPECTED DATA"N\
 011517      042      105      111           .ASCII\"EITHER CONTROLLER RETURNED ERROR STATUS OR PACKET WAS NOT RECEIVED"N\
 011624      042      103      117           .ASCII\"CORRECTLY"N\
 011640      123      063      042           .ASCIZ\S3"COMMAND PACKET SENT"S6"RESPONSE PACKET RECEIVED"N\
 011725      123      066      117  XPKT2:   .ASCIZ\S6016S1016S14016S1016N\
 011754      042      040      040  XSA:     .ASCIZ\"  SA CONTAINS  "016N\
 012002      042      122      105  XFRU:    .ASCIZ\"REPLACE CONTROLLER PROCESSOR MODULE"N\


 012051      045      101      111  SERNX:   .ASCIZ\%AINPUT ERROR. ANSWER WITH DECIMAL NUMBER LO= 0  HI= %T\
 012141      042      111      116  DATEX:   .ASCIZ\"INPUT ERROR."\
 012160      042      116      101  FILNAM:  .ASCIZ\"NAME OF FILE CONTAINING BAD SECTOR INFORMATION"\
                                             .EVEN
```

```
      1                                        .SBTTL  GLOBAL ERROR REPORT SECTION
      2
      3                                        ;++
      4                                        ; THE GLOBAL ERROR REPORT SECTION CONTAINS MESSAGE PRINTING AREAS
      5                                        ; USED BY MORE THAN TEST TO OUTPUT ADDITIONAL ERROR INFORMATION.  PRINTB
      6                                        ; (BASIC) AND PRINTX (EXTENDED) CALLS ARE USED TO CALL PRINT SERVICES.
      7                                        ;--
      8         177777                         SVCINS= -1                         ; LIST INSTRUCTIONS, SHIFTED RIGHT
      9         177777                         SVCTST= -1                         ; LIST TEST TAGS, SHIFTED RIGHT
     10         177777                         SVCSUB= -1                         ; LIST SUBTEST TAGS, SHIFTED RIGHT
     11         177777                         SVCGBL= -1                         ; LIST GLOBAL TAGS, SHIFTED RIGHT
     12         177777                         SVCTAG= -1                         ; LIST OTHER TAGS, SHIFTED RIGHT
     13
     14 012242                                 BGNMSG ERR001
     15 012242                                         PNTB X1,#X1A
        012242  012746  005313                                                                           MOV #X1A,-(SP)
        012246  004137  016672                                                                           JSR R1,LPNTB
        012252  005372                                                                                   .WORD X1
        012254  000002                                                                                   .WORD PNT.CT
     16 012256                                 ENDMSG
     17
     18 012260                                 BGNMSG ERR002
     19 012260                                         PNTB X2,#X2A
        012260  012746  005313                                                                           MOV #X2A,-(SP)
        012264  004137  016672                                                                           JSR R1,LPNTB
        012270  005475                                                                                   .WORD X2
        012272  000002                                                                                   .WORD PNT.CT
     20 012274                                 ENDMSG
     21
     22 012276                                 BGNMSG ERR003
     23 012276                                         PNTB X3,#X3A
        012276  012746  005313                                                                           MOV #X3A,-(SP)
        012302  004137  016672                                                                           JSR R1,LPNTB
        012306  005551                                                                                   .WORD X3
        012310  000002                                                                                   .WORD PNT.CT
     24 012312                                 ENDMSG
     25
     26 012314                                 BGNMSG ERR004
     27 012314                                         PNTB X4
        012314  004137  016672                                                                           JSR R1,LPNTB
        012320  005643                                                                                   .WORD X4
        012322  000000                                                                                   .WORD PNT.CT
     28 012324                                 ENDMSG
     29
     30 012326                                 BGNMSG ERR008
     31 012326                                         PNTB X8,#X8A
        012326  012746  005313                                                                           MOV #X8A,-(SP)
        012332  004137  016672                                                                           JSR R1,LPNTB
        012336  006034                                                                                   .WORD X8
        012340  000002                                                                                   .WORD PNT.CT
     32 012342                                 ENDMSG
     33
     34 012344                                 BGNMSG ERR009
     35 012344                                         PNTB X9
        012344  004137  016672                                                                           JSR R1,LPNTB
        012350  006107                                                                                   .WORD X9
        012352  000000                                                                                   .WORD PNT.CT
```

K5

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012354                                  ENDMSG

012356                                  BGNMSG ERR010
012356                                          PNTB X10
012356  004137  016672                                                          JSR R1,LPNTB
012362  006301                                                                  .WORD X10
012364  000000                                                                  .WORD PNT.CT
012366                                  ENDMSG

012370                                  BGNMSG ERR014
012370                                          PNTB X14,R2
012370  010246                                                                  MOV R2,-(SP)
012372  004137  016672                                                          JSR R1,LPNTB
012376  006400                                                                  .WORD X14
012400  000002                                                                  .WORD PNT.CT
012402                                  ENDMSG

012404                                  BGNMSG ERR020
012404                                          PNTB X20
012404  004137  016672                                                          JSR R1,LPNTB
012410  006665                                                                  .WORD X20
012412  000000                                                                  .WOPD PNT.CT
012414                                  ENDMSG

012416                                  BGNMSG ERR021
012416  010201                                  MOV R2,R1
012420  000301                                  SWAB R1
012422                                          AND 2,R1
012422  042701  177775                                                          BIC #↑C<2>,R1
012426  001406                                  BEQ ERR21A
012430                                          PNTB X21,R2
012430  010246                                                                  MOV R2,-(SP)
012432  004137  016672                                                          JSR R1,LPNTB
012436  007131                                                                  .WORD X21
012440  000002                                                                  .WORD PNT.CT
012442  000405                                  BR EOFMSG
012444                                  ERR21A:
012444                                          PNTB X21A,R2
012444  010246                                                                  MOV R2,-(SP)
012446  004137  016672                                                          JSR R1,LPNTB
012452  007261                                                                  .WORD X21A
012454  000002                                                                  .WORD PNT.CT
012456                                  EOFMSG:
012456                                  ENDMSG

012460                                  BGNMSG ERR022
012460  042737  100000  020626                  BIC #SA.ERR,UDARSD
012466                                          PNTB X22,UDARSD,R2
012466  010246                                                                  MOV R2,-(SP)
012470  013746  020626                                                          MOV UDARSD,-(SP)
012474  004137  016672                                                          JSR R1,LPNTB
012500  007353                                                                  .WORD X22
012502  000004                                                                  .WORD PNT.CT
012504                                  ENDMSG

012506                                  BGNMSG ERR023
012506                                          PNTB X23A,R3,R1
```

L5

```
012506  010146                                                        MOV R1,-(SP)
012510  010346                                                        MOV R3,-(SP)
012512  004137  016672                                                JSR R1,LPNTB
012516  007506                                                        .WORD X23A
012520  000004                                                        .WORD PNT.CT
012522  005742                           TST -(R2)
012524  005712                   ERR23A: TST (R2)
012526  001406                           BEQ ERR23B
012530                                   PNTB X23B,R2,(R2)
012530  011246                                                        MOV (R2),-(SP)
012532  010246                                                        MOV R2,-(SP)
012534  004137  016672                                                JSR R1,LPNTB
012540  010023                                                        .WORD X23B
012542  000004                                                        .WORD PNT.CT
012544  005722                   ERR23B: TST (R2)+
012546  005303                           DEC R3
012550  001365                           BNE ERR23A
012552                           ERR23C: PNTB XFRU
012552  004137  016672                                                JSR R1,LPNTB
012556  012002                                                        .WORD XFRU
012560  000000                                                        .WORD PNT.CT
012562                           ENDMSG

012564                           BGNMSG ERR024
012564                                   PNTB X24,R2
012564  010246                                                        MOV R2,-(SP)
012566  004137  016672                                                JSR R1,LPNTB
012572  010037                                                        .WORD X24
012574  000002                                                        .WORD PNT.CT
012576                           ENDMSG

012600                           BGNMSG ERR025
012600                                   PNTB X25,R1,R2
012600  010246                                                        MOV R2,-(SP)
012602  010146                                                        MOV R1,-(SP)
012604  004137  016672                                                JSR R1,LPNTB
012610  010224                                                        .WORD X25
012612  000004                                                        .WORD PNT.CT
012614                           ENDMSG

012616                           BGNMSG ERR030
012616                                   PNTB X30,R1
012616  010146                                                        MOV R1,-(SP)
012620  004137  016672                                                JSR R1,LPNTB
012624  010400                                                        .WORD X30
012626  000002                                                        .WORD PNT.CT
012630                           ENDMSG

012632                           BGNMSG ERR031
012632                                   PNTB X31
012632  004137  016672                                                JSR R1,LPNTB
012636  010516                                                        .WORD X31
012640  000000                                                        .WORD PNT.CT
012642                           ENDMSG

012644                           BGNMSG ERR032
012644                                   PNTB X32
```

```
     012644  004137  016672                                                 JSR R1,LPNTB
     012650  010555                                                         .WORD X32
     012652  000000                                                         .WORD PNT.CT
  97 012654  004737  013044                    CALL MSGPKT
  98 012660                           ENDMSG
  99
 100 012662                           BGNMSG ERR033
 101 012662  004737  012752                   CALL PNTPKT
 102 012666                           ENDMSG
 103
 104 012670                           BGNMSG ERR034
 105 012670  004737  012752                   CALL PNTPKT
 106 012674                           ENDMSG
 107
 108 012676                           BGNMSG ERR036
 109 012676                                   PNTB X36
     012676  004137  016672                                                 JSR R1,LPNTB
     012702  010665                                                         .WORD X36
     012704  000000                                                         .WORD PNT.CT
 110 012706                           ENDMSG
 111
 112 012710                           BGNMSG ERR037
 113 012710                                   PNTB X37,R1
     012710  010146                                                         MOV R1,-(SP)
     012712  004137  016672                                                 JSR R1,LPNTB
     012716  011011                                                         .WORD X37
     012720  000002                                                         .WORD PNT.CT
 114 012722                           ENDMSG
 115
 116 012724                           BGNMSG ERR100
 117 012724                                   PNTB X100,(R4)
     012724  011446                                                         MOV (R4),-(SP)
     012726  004137  016672                                                 JSR R1,LPNTB
     012732  011131                                                         .WORD X100
     012734  000002                                                         .WORD PNT.CT
 118 012736                           ENDMSG
 119
 120 012740                           BGNMSG ERR101
 121 012740                                   PNTB X101
     012740  004137  016672                                                 JSR R1,LPNTB
     012744  011212                                                         .WORD X101
     012746  000000                                                         .WORD PNT.CT
 122 012750                           ENDMSG
 123
 124 012752                           PNTPKT: PNTB XPKT1
     012752  004137  016672                                                 JSR R1,LPNTB
     012756  011414                                                         .WORD XPKT1
     012760  000000                                                         .WORD PNT.CT
 125 012762  010401                           MOV R4,R1
 126 012764  062701  000104                   ADD #HC.CPK,R1
 127 012770  010402                           MOV R4,R2
 128 012772  062702  000020                   ADD #HC.MPK,R2
 129 012776  012703  000014                   MOV #12.,R3
 130 013002                           PNTPKL: PNTB XPKT2,2(R1),(R1),2(R2),(R2)
     013002  011246                                                         MOV (R2),-(SP)
     013004  016246  000002                                                 MOV 2(R2),-(SP)
     013010  011146                                                         MOV (R1),-(SP)
```

```
        013012  016146  000002                                                                          MOV 2(R1),-(SP)
        013016  004137  016672                                                                          JSR R1,LPNTB
        013022  011725                                                                                  .WORD XPKT2
        013024  000010                                                                                  .WORD PNT.CT
    131 013026  062701  000004                  ADD #4,R1
    132 013032  062702  000004                  ADD #4,R2
    133 013036  005303                          DEC R3
    134 013040  001360                          BNE PNTPKL
    135 013042  000207                          RETURN
    136
    137 013044                          MSGPKT: PNTB XMSG1
        013044  004137  016672                                                                          JSR R1,LPNTB
        013050  011313                                                                                  .WORD XMSG1
        013052  000000                                                                                  .WORD PNT.CT
    138 013054  016504  000014                  MOV C.RING(R5),R4
    139 013060  062704  000430                  ADD #HC.BF2,R4
    140 013064  012703  000005                  MOV #5,R3
    141 013070                          MSGPKL: PNTB XMSG2,(R4),2(R4),4(R4),6(R4),8.(R4),10.(R4),12.(R4)
        013070  016446  000014                                                                          MOV 12.(R4),-(SP)
        013074  016446  000012                                                                          MOV 10.(R4),-(SP)
        013100  016446  000010                                                                          MOV 8.(R4),-(SP)
        013104  016446  000006                                                                          MOV 6(R4),-(SP)
        013110  016446  000004                                                                          MOV 4(R4),-(SP)
        013114  016446  000002                                                                          MOV 2(R4),-(SP)
        013120  011446                                                                                  MOV (R4),-(SP)
        013122  004137  016672                                                                          JSR R1,LPNTB
        013126  011347                                                                                  .WORD XMSG2
        013130  000016                                                                                  .WORD PNT.CT
    142 013132  062704  000016                  ADD #14.,R4
    143 013136  005303                          DEC R3
    144 013140  001353                          BNE MSGPKL
    145 013142  000207                          RETURN
```

```
     1          000001                  SVCINS= 1                                   ; LIST INSTRUCTIONS, SHIFTED RIGHT
     2          000001                  SVCTST= 1                                   ; LIST TEST TAGS, SHIFTED RIGHT
     3          000001                  SVCSUB= 1                                   ; LIST SUBTEST TAGS, SHIFTED RIGHT
     4          000001                  SVCGBL= 1                                   ; LIST GLOBAL TAGS, SHIFTED RIGHT
     5          000001                  SVCTAG= 1                                   ; LIST OTHER TAGS, SHIFTED RIGHT
```

```
                                   .SBTTL  GLOBAL SUBROUTINES SECTION

                                   ;MEMORY ALLOCATION ERROR
                                   ;
                                   ;THIS ROUTINE PRINTS A SYSTEM FATAL ERROR AND EXITS THE TEST

 013144                            FMERR:  ERRSF 4,,ERR004
 013144  104454                                                                        TRAP    C$ERSF
 013146  000004                                                                        .WORD   4
 013150  000000                                                                        .WORD   0
 013152  012314                                                                        .WORD   ERR004
 013154                                    DOCLN                     ;ABORT
 013154  104444                                                                        TRAP    C$DCLN
```

```
                                ;ALOCM
                                ;
                                ;ALLOCATE A BLOCK OF FREE MEMORY.  REPORT ERROR IF MEMORY EXHAUSTED.
                                ;
                                ;INPUTS:
                                ;       R1 - NUMBER OF WORDS TO ALLOCATE
                                ;       FFREE - FIRST FREE WORD IN MEMORY
                                ;       FSIZE - SIZE OF FREE MEMORY AVAILABLE IN WORDS
                                ;OUTPUTS:
                                ;       R1 - ADDRESS OF FIRST WORD OF ALLOCATED MEMORY
                                ;       FFREE - NEW FIRST FREE WORD IN MEMORY
                                ;       FSIZE - SIZE OF FREE MEMORY LEFT AFTER ALLOCATION
                                ;SYSTEM FATAL ERROR WILL BE REPORTED IF NOT ENOUGH MEMORY AVAILABLE
                                ;AND ENTIRE PROGRAM WILL BE STOPPED.

013156                          ALOCM:  PUSH FFREE                      ;SAVE FFREE AT ENTRY
013156  013746  002140                                                                          MOV FFREE,-(SP)
013162  160137  002142                  SUB R1,FSIZE                    ;REDUCE SIZE OF FREE MEMORY
013166  002766                          BLT FMERR                       ;REPORT ERROR IF NOT ENOUGH MEMORY
013170  060101                          ADD R1,R1                       ;CHANGE WORDS TO BYTES
013172  060137  002140                  ADD R1,FFREE                    ;CALCULATE NEW START OF FREE MEMORY
013176                                  POP R1                          ;GET START OF ALLOCATED MEMORY
013176  012601                                                                                  MOV (SP)+,R1
013200  000207                          RETURN
```

E6

```
                                        ,HCOMM
                                        ;
                                        ;ALLOCATES MEMORY FOR HOST COMM AREA AND PACKET BUFFERS WITH ONE
                                        ;DESCRIPTOR IN EACH RING. TO BE CALLED WHEN INITIALIZING
                                        ;A CONTROLLER WITH SA.MSG=0 AND SA.CMD=0.
                                        ;
                                        ;INPUTS:
                                        ;       R5 - ADDRESS OF CONTROLLER TABLE
                                        ;OUTPUTS:
                                        ;       CONTROLLER TABLE POINTING TC HOST COMM AREA
                                        ;       R4 - ADDRESS OF HOST COMM AREA

 013202  012701  000336                 HCOMM:  MOV #HC.SIZ/2,R1                  ;GET SIZE OF AREA TO ALLOCATE
 013206  004737  013156                         CALL ALOCM                        ;ALLOCATE THE MEMORY
 013212  010165  000014                         MOV R1,C.RING(R5)                         ;GET ADDRESS OF HOST COMM AREA
                                                                                  ;PLACE IN CONTROLLER TABLE
 013216  000207                                 RETURN
```

```
                                 ;RESET
                                 ; RESET ALL UDA-50S IN THE CONTROLLER TABLES
                                 ;
                                 ; INPUTS:
                                 ;          IPADRS - CONTAINS ALL IP ADDRESSES
                                 ; OUTPUTS:
                                 ;          NONE
                                 ;
013220                           RESET:  PUSH <R3,R4>
013220  010346                                                                    MOV R3,-(SP)
013222  010446                                                                    MOV R4,-(SP)
013224  005037  002172                   CLR     NXMAD
013230                                   SETVEC #4,#NXMI,#PRI07
013230  012746  000340                                                            MOV     #PRI07,-(SP)
013234  012746  017602                                                            MOV     #NXMI,-(SP)
013240  012746  000004                                                            MOV     #4,-(SP)
013244  012746  000003                                                            MOV     #3,-(SP)
013250  104437                                                                    TRAP    C$SVEC
013252  062706  000010                                                            ADD     #10,SP
013256                                   BREAK
013256  104422                                                                    TRAP    C$BRK
013260  012703  000010                   MOV     #8.,R3          ; R3 = COUNTER OF ENTRIES
013264  012704  003434                   MOV     #IPADRS,R4      ; R4 -> IP ADDRESS
013270  005714                   1$:     TST     (R4)            ; IS THERE AN ENTRY?
013272  001406                           BEQ     2$              ; IF NOT, DONE
013274  005034                           CLR     @(R4)+          ; INIT UDA
013276  005737  002172                   TST     NXMAD           ; WAS THERE AN ERROR?
013302  001010                           BNE     3$              ; IF SO, EXIT
013304  005303                           DEC     R3              ; MAKE SURE WE DO NOT EXTEND OVER AREA
013306  001370                           BNE     1$              ; IF NOT DONE, BRANCH
013310                           2$:     CLRVEC  #4
013310  012700  000004                                                            MOV     #4,R0
013314  104436                                                                    TRAP    C$CVEC
013316                                   POP     <R4,R3>
013316  012604                                                                    MOV (SP)+,R4
013320  012603                                                                    MOV (SP)+,R3
013322  000207                           RETURN

013324  005744                   3$:     TST     -(R4)           ; R4 -> UDAIP THAT FAILED
013326  010405                           MOV     R4,R5           ; SAVE IN R5 FOR REPORT
013330                                   ERRDF   20,,ERR020
013330  104455                                                                    TRAP    C$ERDF
013332  000024                                                                    .WORD   20
013334  000000                                                                    .WORD   0
013336  012404                                                                    .WORD   ERR020
013340  005014                           CLR     (R4)            ; DESTROY ENTRY SO NOT TO FALL INTO RESET ERROR LOOP
013342                                   DOCLN
013342  104444                                                                    TRAP    C$DCLN
```

```
                                ;RUNDM
                                ;
                                ;LOAD AND RUN A DM PROGRAM IN THE CONTROLLERS. RETURN WHEN ALL
                                ;DM PROGRAMS HAVE TERMINATED.
                                ;
                                ;INPUTS:
                                ;       TSTTAB - POINTER TO FIRST CONTROLLER TABLE
                                ;       R1 - NUMBER OF CONTROLLERS TO TEST
                                ;IMPLICIT INPUTS:
                                ;       DMPROG - POINTER TO START OF DM PROGRAM TN MEMORY
                                ;OUTPUTS:
                                ;       Z SET IF NO CONTROLLERS SUCCESSFULLY STARTED
                                ;ALL REGISTERS ARE USED AND PREVIOUS CONTENTS DESTROYED.

013344  010137  002160          RUNDM:  MOV R1,URUN                     ;SAVE NUMBER OF UNITS TO RUN
013350  005037  002162                  CLR URNING                      ;CLEAR NUMBER OF UNITS RUNNING

                                ;LOAD DM PROGRAM INTO EACH CONTROLLER

013354  013737  002160  002164          MOV URUN,UCNT                   ;SET COUNTER OF UNITS
013362  013705  002154                  MOV TSTTAB,R5                   ;GET FIRST CONTROLLER TABLE
013366                          LDDM:
013366  005065  000012                  CLR C.FLG(R5)                   ;CLEAR ALL FLAGS
013372  116537  000002  002074          MOVB C.UNIT(R5),L$LUN           ;SEE IF UNIT TO BE TESTED
013400  005765  000002                  TST C.UNIT(R5)
013404  100407                          BMI LDNEXT                      ;IF NOT, DON'T LOAD THIS UNIT
013406                                          ASSUME CT.AVL EQ BIT15
013406  004737  013202                  CALL HCOMM                      ;ALLOCATE SPACE FOR HOST COMM AREA
013412  004737  017024                  CALL LOADDM                     ;LOAD THE DM PROGRAM
013416  001402                          BEQ LDNEXT                      ;IF ERROR, GO TO NEXT CONTROLLER
013420  005237  002162                  INC URNING                      ;IF NO ERROR, COUNT UNIT RUNNING
013424  062705  000052          LDNEXT: ADD #C.SIZE,R5                  ;MOVE TO NEXT CONTROLLER TABLE
013430  005337  002164                  DEC UCNT                        ;CHECK IF MORE CONTROLLERS
013434  001354                          BNE LDDM                        ;LOAD NEXT
013436  005037  002170                  CLR UFREEZ                      ;CLEAR UNIT FREEZE FLAG
013442  012737  177777  003176          MOV #-1,FCTNUM  ;INVALIDATE FCT BLOCK NUMBER (BLOCK IN MEMORY)

                                ;CHECK IF ANY CONTROLLERS LOADED

013450  005737  002162                  TST URNING                      ;ANY UNITS LOADED?

                                ;THE DM PROGRAMS ARE NOW IN CONTROL
                                ;RESPDM MUST BE CALLED TO RESPOND TO THEIR REQUESTS

013454  000207                          RETURN
```

```
                                   ;CLOSEF
                                   ;
                                   ;CLOSE DATA FILE FOR DM PROGRAMS
                                   ;
                                   ;INPUTS:
                                   ;       FILOPN - ZERO IF FILE NOT OPEN
                                   ;OUTPUTS:
                                   ;       NONE

   013456  005737  002166          CLOSEF: TST FILOPN                  ;SEE IF FILE CURRENTLY OPEN
   013462  001403                          BEQ 1$
   013464                                  CLOSE                       ; IF SO, CLOSE IT
   013464  104435                                                                     TRAP    C$CLOS
   013466  005037  002166                  CLR FILOPN                  ;AND MARK AS SO
   013472  000207                  1$:     RETURN
```

```
                                ;RESPDM
                                ;
                                ;RESPOND TO DM REQUESTS. RETURN WHEN ALL DM PROGRAMS
                                ;HAVE TERMINATED.

013474  013705  002154          RESPDM: MOV TSTTAB,R5                   ;GET CONTROLLER TABLE ADDRESS
013500  013737  002160  002164          MOV URUN,UCNT                   ;SET COUNTER OF UNITS
013506                          RESPCT: BREAK   ;ALLOW DRS TO SEE TERMINAL INPUT
013506  104422                                                                  TRAP    C$BRK
013510  016504  000014                  MOV C.RING(R5),R4               ;GET HOST COMM AREA ADDRESS
013514  032765  000002  000012          BIT #CT.RN,C.FLG(R5)            ;CHECK IF PROGRAM RUNNING
013522  001502                          BEQ RSPNXT                      ;IF NOT, LOOK AT NEXT
013524  116537  000002  002074          MOVB C.UNIT(R5),L$LUN           ;STORE UNIT NUMBER UNDER TEST
013532  032765  000010  000012          BIT #CT.MSG,C.FLG(R5)           ;SEE IF INTERRUPT RECEIVED
013540  001150                          BNE RSPIN                       ;IF SO, LOOK AT PACKET
013542  032765  000004  000012          BIT #CT.CMD,C.FLG(R5)           ;SEE IF COMMAND HAS BEEN SENT
013550  001002                          BNE 1$                          ;IF NOT, SEND ONE
013552  000137  014320                  JMP RSPOUT

                                ;CHECK IF UDA STILL RUNNING

013556  011503                  1$:     MOV (R5),R3                     ;GET ADDRESS OF UDAIP
013560  016301  000002                  MOV 2(R3),R1                    ;LOOK AT UDASA REGISTER
013564  001405                          BEQ RSPTM                       ;IF ZERO, UDA STILL RUNNING
013566                                  ERRDF 30,,ERR030                ;REPORT UDA HAS FATAL ERROR
013566  104455                                                                  TRAP    C$ERDF
013570  000036                                                                  .WORD   30
013572  000000                                                                  .WORD   0
013574  012616                                                                  .WORD   ERR030
013576  000465                          BR RSPDRP                       ;DROP CONTROLLER FROM TESTING

                                ;CHECK FOR TIMEOUT OF RESPONSE

013600  005765  000042          RSPTM:  TST C.TOT(R5)                   ;SEE IF DUP PROGRAM TO BE TIMED
013604  001451                          BEQ RSPNTO
013606  005737  003206                  TST KW.CSR                      ;SEE IF A CLOCK ON SYSTEM
013612  001446                          BEQ RSPNTO                      ;DON'T TIME IF NO CLOCK
013614  023765  003220  000040          CMP KW.EL+2,C.TOH(R5)           ;COMPARE TO TIMEOUT COUNTER
013622  101005                          BHI RSPTMO
013624  001041                          BNE RSPNTO
013626  023765  003216  000036          CMP KW.EL,C.TO(R5)
013634  103435                          BLO RSPNTO                      ;IF TOO MUCH TIME ELAPSED SINCE LAST INTERRUPT
013636  032765  000040  000012  RSPTMO: BIT #CT.STA,C.FLG(R5)            ;SEE IF A GET DUST STATUS COMMAND OUTSTANDING
013644  001101                          BNE RSPTOE                      ;REPORT ERROR IF SO
013646  005764  000012                  TST HC.CCT(R4)                  ;SEE IF UDA TOOK LAST COMMAND PACKET
013652  100476                          BMI RSPTOE                      ;REPORT ERROR IF NOT
013654  012700  000100                  MOV #CT.TM1,R0                  ;SEE IF FIRST TIMEOUT ALREADY HAPPENED
013660  032765  000100  000012          BIT #CT.TM1,C.FLG(R5)
013666  001401                          BEQ 1$                          ;IF SO,
013670  006300                          ASL R0                          ;SET SECOND TIME OUT FLAG
013672  052700  000040          1$:     BIS #CT.STA,R0                  ;SET THE PROPER TIMEOUT BIT
013676  050065  000012                  BIS R0,C.FLG(R5)                ;  AND STATUS REQUESTED BIT
013702  012700  000001                  MOV #OP.GDS,R0                  ;BUILD GET DUST STATUS COMMAND
013706  004737  017224                  CALL BLDCMD
013712  012764  100000  000012          MOV #RG.OWN,HC.CCT(R4)          ;MARK COMMAND TO UDA
013720  005775  000000                  TST @(R5)                       ;TELL UDA COMMAND IS THERE
013724  000137  014400                  JMP RSPOU4
```

J6

```
     53 013730                           RSPNTO:
```

K6

```
                                          ;SWITCH TO NEXT CONTROLLER

 013730   005737   002170                 RSPNXT: TST UFREEZ        ;FROZEN TO ONE UNIT?
 013734   001264                                  BNE RESPCT        ;STAY THERE IF SO
 013736   062705   000052                         ADD #C.SIZE,R5                    ;MOVE TO NEXT TABLE
 013742   005337   002164                         DEC UCNT                          ;CHECK IF MORE CONTROLLERS
 013746   001257                                  BNE RESPCT                        ;LOOK AT NEXT CONTROLLER
 013750   000651                                  BR RESPDM                         ;LOOK AT FIRST CONTROLLER AGAIN

                                          ;REMOVE A CONTROLLER FROM TESTING

 013752   00506    000012                 RSPDRP: CLR C.FLG(R5)     ;CLEAR PROGRAM RUNNING
 013756   00503/   002170                         CLR UFREEZ
 013762   010504                                  MOV R5,R4
 013764   062704   000016                         ADD #C.DR0,R4
 013770   012702   000010                         MOV #8.,R2
 013774   012403                          1$:     MOV (R4)+,R3
 013776   001420                                  BEQ 3$
 014000   005763   000002                         TST D.UNIT(R3)
 014004                                                   ASSUME DT.AVL EQ BIT15
 014004   100003                                  BPL 2$
 014006   005302                                  DEC R2
 014010   001371                                  BNE 1$
 014012   000412                                  BR 3$
 014014   052763   100000   000002        2$:     BIS #DT.AVL,D.UNIT(R3)
 014022   005302                                  DEC R2
 014024   001405                                  BEQ 3$
 014026   005714                                  TST (R4)
 014030   001403                                  BEQ 3$
 014032   004737   017024                         CALL LOADDM       ;START DM PROGRAM AGAIN
 014036   001223                                  BNE RESPCT
 014040   005337   002162                 3$:     DEC URNING                        ;REDUCE RUNNING CONTROLLERS COUNT
 014044   001331                                  BNE RSPNXT                        ;IF ANY STILL RUNNING, LOOK AT THEM
 014046   000207                                  RETURN                            ;ELSE RETURN TO TEST SECTION

 014050                                   RSPTOE: ERRDF 31,,ERR031                  ;REPORT TIMEOUT ERROR
 014050   104455                                                                                          TRAP     C$ERDF
 014052   0C0037                                                                                          .WORD    31
 014054   000000                                                                                          .WORD    0
 014056   012632                                                                                          .WORD    ERR031
 014060   000734                                  BR RSPDRP                         ;DROP CONTROLLER FROM TESTING
```

L6

```
                                        ;CONTROLLER HAS RESPONDED, LOOK AT MESSAGE PACKET

                                        ;CHECK FOR PROPER OPCODE IN END PACKET

014062  012700  000204                  RSPIN:  MOV #OP.END+OP.SSD,R0             ;GET SEND DATA END PACKET OPCODE
014066  032765  000020  000012                  BIT #CT.REQ,C.FLG(R5)             ;LOOK IF SEND DATA OR RECEIVE DATA
014074  001402                                  BEQ RSPMWR
014076  012700  000205                          MOV #OP.END+OP.RSD,R0             ;CHANGE TO RECEIVE DATA END PACKET OPCODE
014102  120064  000030                  RSPMWR: CMPB R0,HC.MPK+P.OPCD(R4)         ;COMPARE TO OPCODE IN END PACKET
014106  001145                                  BNE RSPERR

                                        ;LOOK AT STATUS CODE

014110  032764  000037  000032                  BIT #ST.MSK,HC.MPK+P.STS(R4)      ;CHECK FOR STATUS CODE ST.SUC (ZERO)
014116  001004                                  BNE RSPERW

                                        ;CHECK FOR EXPECTED REFERENCE NUMBER

014120  026564  000050  000020                  CMP C.REF(R5),HC.MPK+P.CRF(R4)    ;CHECK IF CORRECT REF NUMBER
014126  001405                                  BEQ RSPPTW
014130                                  RSPERW: ERRDF 33,,ERR033
014130  104455                                                                                              TRAP     C$ERDF
014132  000041                                                                                              .WORD    33
014134  000000                                                                                              .WORD    0
014136  012662                                                                                              .WORD    ERR033
014140  000704                                  BR RSPDRP                         ;DROP UNIT FROM TESTING

                                        ;CHECK IF RESPONSE FROM SEND OR RECEIVE DATA COMMAND

014142  032765  000020  000012          RSPPTW: BIT #CT.REQ,C.FLG(R5)             ;CHECK IF RESPONSE FROM DM PROGRAM
014150  001463                          RSPOU:  BEQ RSPOUT                        ;LOOK AT REQUEST NUMBER IF SO
```

```
                                        ;MAINTENANCE READ END PACKET RECEIVED, LOOK AT REQUEST FROM DM PROGRAM

014152  016401  000430                  RSPPT2: MOV HC.BF2(R4),R1               ;GET REQUEST NUMBER
014156  042701  007777                          BIC     #↑C<DU.TYP>,R1          ;CHECK TYPE
014162  001403                                  BEQ 1$                          ;IF ZERO, ERROR
014164  020127  060000                          CMP R1,#DU.SPC                  ;CHECK IF IN EXPECTED RANGE
014170  101405                                  BLOS RSPPT3
014172                                  1$:     ERRDF 32,,ERR032                ;BAD REQUEST NUMBER
014172  104455                                                                                          TRAP    C$ERDF
014174  000040                                                                                          .WORD   32
014176  000000                                                                                          .WORD   0
014200  012644                                                                                          .WORD   ERR032
014202  000663                                  BR RSPDRP                       ;DROP UNIT FROM TESTING

014204  016403  000034                  RSPPT3: MOV HC.MPK+P.BCNT(R4),R3        ;GET BYTE COUNT OF CHARACTERS RECEIVED IN R3
014210  162703  000002                          SUB #2,R3                       ;(FIRST TWO CHARACTERS ARE TYPE WORD)
014214  012700  000004                          MOV #OP.SSD,R0                  ;BUILD A SEND DATA COMMAND PACKET
014220  004737  017224                          CALL BLDCMD                     ;  FOR ANSWER TO DM PROGRAM
014224  012700  000164                          MOV #HC.BF1,R0                  ;POINT TO BUFFER IN PACKET
014230  004737  017366                          CALL CLRBUF                     ; AND CLEAR BUFFER
014234  010402                                  MOV R4,R2                       ;R2 POINTS TO SEND BUFFER
014236  062704  000244                          ADD #HC.BSZ,R4          ;R4 POINTS TO CHARACTERS IN RECEIVE BUFFER
014242  042724  170000                          BIC #DU.TYP,(R4)+       ;CLEAR TYPE FIELD IN BUFFER
014246  000301                                  SWAB R1                         ;GET TYPE RIGHT JUSTIFIED
014250  006201                                  ASR R1                          ;TIMES TWO
014252  006201                                  ASR R1
014254  006201                                  ASR R1
014256  010100                                  MOV R1,R0                       ;COPY MESSAGE TYPE TO R0
014260  005001                                  CLR R1                          ;R1 CONTAINS ZERO SEND BYTE COUNT
014262  004770  014546                          CALL @RSPDSP-2(R0)              ;CALL REQUESTED ROUTINE
014266  001231                                  BNE RSPDRP                      ;ROUTINE RETURNS Z CLEAR TO DROP UNIT FROM TESTING
                                                                                ; Z SET IF UNIT TO CONTINUE RUNNING
014270  016504  000014                          MOV C.RING(R5),R4               ;GET RING ADDRESS
014274  032701  000001                          BIT #1,R1                       ;LOOK AT CHARACTER COUNT TO SEND TO DUP PROGRAM
014300  001401                                  BEQ 1$                          ;IF AN ODD COUNT
014302  005201                                  INC R1                          ;  INCREASE BY ONE
014304  010164  000120                  1$:     MOV R1,HC.CPK+P.BCNT(R4)        ;PUT CHARACTER COUNT IN COMMAND PACKET
014310  100003                                  BPL RSPOUT                      ;IF NEGATIVE BYTE COUNT RETURNED
014312  042765  000020  000012                  BIC #CT.REQ,C.FLG(R5)           ;  DON'T SEND ANY DATA TO UDA

                                        ;SEND COMMAND BACK TO UDA

014320  042765  000350  000012          RSPOUT: BIC #CT.MSG+CT.STA+CT.TM1+CT.TM2,C.FLG(R5)      ;CLEAR MESSAGE RECEIVED FLAG
014326  032765  000020  000012                  BIT #CT.REQ,C.FLG(R5)           ;CHECK WHICH COMMAND TO SEND
014334  001014                                  BNE RSPOU2                      ;BRANCH IF RESPONSE TO REQUEST

014336  012700  000005                          MOV #OP.RSD,R0                  ;BUILD RECEIVE DATA COMMAND
014342  004737  017224                          CALL BLDCMD
014346  012700  000430                          MOV #HC.BF2,R0                  ;POINT TO MESSAGE BUFFER
014352  004737  017366                          CALL CLRBUF                     ;  AND CLEAR IT
014356  052765  000020  000012                  BIS #CT.REQ,C.FLG(R5)           ;SET REQUEST BIT
014364  000403                                  BR RSPOU3

014366  042765  000020  000012          RSPOU2: BIC #CT.REQ,C.FLG(R5)           ;CLEAR REQUEST BIT
014374                                  RSPOU3:
014374  004737  017310                          CALL SNDCMD                     ;SEND COMMAND TO UDA
014400  016500  000042                  RSPOU4: MOV C.TOT(R5),R0                ;SET TIMEOUT
```

```
014404  010501                              MOV R5,R1
014406  062701  000036                      ADD #C.TG,R1                         ;PUT TIME IN CONTROLLER TABLE
014412  004737  017622                      CALL SETTO
014416  000137  013730                      JMP RSPNXT                           ;NOW WAIT FOR END PACKET
014422  122764  000201  000030  RSPERR:     CMPB #OP.END+OP.GDS,HC.MPK+P.OPCD(R4)    ;SEE IF GET DUST STATUS OPCODE
014430  001237                              BNE RSPERW
014432  132764  000010  000037              BITB #DF.ACT,HC.MPK+P.DFLG(R4)       ;IF DUST NO LONGER RUNNING
014440  001603                              BEQ RSPTOE                           ;  REPORT ERROR
014442  042765  000050  000012              BIC #CT.STA+CT.MSG,C.FLG(R5)         ;CLEAR CONTROL BITS
014450  032765  000200  000012              BIT #CT.TM2,C.FLG(R5)                ;IF AT SECOND TIMEOUT
014456  001413                              BEQ 1$
014460  026465  000040  000044              CMP HC.MPK+P.DPI(R4),C.PRI(R5)       ;COMPARE PROGRESS INDICATOR
014466  001004                              BNE 2$
014470  026465  000042  000046              CMP HC.MPK+P.DPI+2(R4),C.PRI+2(R5)        ;COMPARE PROGRESS INDICATOR
014476  001422                              BEQ 4$                               ;REPORT ERROR IF NOT CHANGED
014500  042765  000200  000012  2$:         BIC #CT.TM2,C.FLG(R5)                ;CLEAR TIMEOUT 2 FLAG
014506  032765  000100  000012  1$:         BIT #CT.TM1,C.FLG(R5)                ;IF AT FIRST TIMEOUT
014514  001406                              BEQ 3$
014516  016465  000040  000044              MOV HC.MPK+P.DPI(R4),C.PRI(R5)       ;GET COPY OF PROGRESS INDICATOR
014524  016465  000042  000046              MOV HC.MPK+P.DPI+2(R4),C.PRI+2(R5)        ;GET COPY OF PROGRESS INDICATOR
014532  012764  140000  000006  3$:         MOV #RG.OWN+RG.FLG,HC.MCT(R4)        ;GIVE MESSAGE BUFFER BACK TO UDA
014540  000137  013730                      JMP RSPNXT
014544  000137  014050          4$:         JMP RSPTOE
```

```
                                    ;PESPONSE REQUEST DISPATCH TABLE

 014550  014564                     RSPDSP: .WORD QUEST                         ;QUESTION
 014552  014636                             .WORD DQUEST                        ;QUESTION WITH DEFAULT ANSWER
 014554  015010                             .WORD INFO                          ;INFORMATION MESSAGE FOR OPERATOR
 014556  015136                             .WORD TERM                          ;NORMAL TERMINATION
 014560  015146                             .WORD ERRTRM                        ;FATAL ERROR TERMINATION
 014562  015156                             .WORD SPECL                         ;SPECIAL
         000006                             DSPSIZ=<.-RSPDSP>/2                 ;LEGAL NUMBERS ARE LOWER THAN THIS
```

```
;NORMAL DUP RECEIVE DATA BUFFER DESCRIPTION

;BYTE OFFSET FROM
;START OF BUFFER                  +-------------------------------+
;        0                        ! TYPE !     MESSAGE NUMBER     !  USED TO SELECT ROUTINE
;                                 +-------------------------------+
;        2                        !          DATA BYTES           !  R4 CONTAINS THIS ADDRESS
;                                 +-------------------------------+
;        4                        !          DATA BYTES           !
;                                 +-------------------------------+
;        6                        !          DATA BYTES           !
;                                 +-------------------------------+
;        8                        !          DATA BYTES           !
;                                 +-------------------------------+
;       10                        !          DATA BYTES           !
;                                 +-------------------------------+
;       12                        !          DATA BYTES           !
;                                 +-------------------------------+
;       14                        !          DATA BYTES           !
;                                 +-------------------------------+
;       16                        !          DATA BYTES           !
;                                 +-------------------------------+
;       18                        !          DATA BYTES           !
;                                 +-------------------------------+
;       20                        !          DATA BYTES           !
;                                 +-------------------------------+
;       22                        !          DATA BYTES           !
;                                 +-------------------------------+
;
;
;        .                                       .
;
;        .                                       .
;
;        .                                       .
;
;                                 +-------------------------------+
;       80                        !          DATA BYTES           !
;                                 +-------------------------------+
;NORMAL DUP SEND DATA BUFFER DESCRIPTION GIVEN IN RESPONSE TO ABOVE PACKET

;BYTE OFFSET FROM
;START OF BUFFER                 +---------------------------------+
;       0                        !           DATA BYTES            !  R2 CONTAINS THIS ADDRESS
;                                +---------------------------------+
;       2                        !           DATA BYTES            !
;                                +---------------------------------+
;       4                        !           DATA BYTES            !
;                                +---------------------------------+
;       6                        !           DATA BYTES            !
;                                +---------------------------------+
;       8                        !           DATA BYTES            !
;                                +---------------------------------+
;      10                        !           DATA BYTES            !
;                                +---------------------------------+
;      12                        !           DATA BYTES            !
;                                +---------------------------------+
;      14                        !           DATA BYTES            !
;                                +---------------------------------+
;      16                        !           DATA BYTES            !
;                                +---------------------------------+
;      18                        !           DATA BYTES            !
;                                +---------------------------------+
;      20                        !           DATA BYTES            !
;                                +---------------------------------+
;      22                        !           DATA BYTES            !
;                                +---------------------------------+
;
;
;       .                                      .
;
;       .                                      .
;
;       .                                      .
;
;                                +---------------------------------+
;      80                        !           DATA BYTES            !
;                                +---------------------------------+
                                        ;MESSAGE TYPE 1
                                        ;
                                        ;ANSWER QUESTION FOR DUP PROGRAM
                                        ;
                                        ;INPUT:
                                        ;       R5 - ADDRESS OF CONTROLLER TABLE
                                        ;       R4 - POINTER TO DATA IN RECEIVE BUFFER
                                        ;       R3 - CHARACTER COUNT IN RECEIVE BUFFER
                                        ;       R2 - POINTER TO SEND BUFFER (BUFFER IS CLEARED)
                                        ;       R1 - ZERO
                                        ;OUTPUT:
                                        ;       R1 - COUNT OF CHARACTERS IN SEND BUFFER
                                        ;       Z SET TO CONTINUE RUNNING DUP PROGRAM
                                        ;       Z CLEAR TO STOP THE DUP PROGRAM

014564  004737  015310          QUEST:  CALL GTDRVT       ;GET POINTER TO DRIVE TABLE
014570  062700  000004                  ADD #D.SERN,R0    ;BUMP POINTER TO SERIAL NUMBER
014574  014403                          MOV -(R4),R3      ;GET QUESTION NUMBER
014576  001411                          BEQ QUE0          ;BRANCH IF QUESTION NUMBER 0
014600  020327  000007                  CMP R3,#7         ;IF NOT, SEE IF QUESTION NUMBER 7
014604  001410                          BEQ QUE7
014606                                  ERRDF 100,,ERR100        ;ANY OTHER NUMBER IS AN ERROR
014606  104455                                                                              TRAP    C$ERDF
014610  000144                                                                              .WORD   100
014612  000000                                                                              .WORD   0
014614  012724                                                                              .WORD   ERR100
014616  000244                          CLZ      ;CLEAR Z TO STOP DUP PROGRAM
014620  000207                          RETURN

014622  012700  003304          QUE0:   MOV #DATE0,R0     ;POINT TO DATE STRING
014626                          QUE7:
014626  005201                  QUEL:   INC R1   ;COUNT THE CHARACTERS
014630  112022                          MOVB (R0)+,(R2)+         ; AND PUT THEM IN OUTPUT BUFFER
014632  001375                          BNE QUEL          ;  UNTIL A NUL CHARACTER FOUND
014634  000207                          RETURN   ;RETURN WITH Z SET
```

```
                                ;MESSAGE TYPE 2
                                ;
                                ;ANSWER QUESTIuN FOR DUP PROGRAM WITH DEFAULT ANSWER
                                ;
                                ;INPUT:
                                ;       R5 - ADDRESS OF CONTROLLER TABLE
                                ;       R4 - POINTER TO DATA IN RECEIVE BUFFER
                                ;       R3 - CHARACTER COUNT IN RECEIVE BUFFER
                                ;       R2 - POINTER TO SEND BUFFER (BUFFER IS CLEARED)
                                ;       R1 - ZERO
                                ;OUTPUT:
                                ;       R1 - COUNT OF CHARACTERS IN SEND BUFFER
                                ;       Z SET TO CONTINUE RUNNING DUP PROGRAM
                                ;       Z CLEAR TO STOP THE DUP PROGRAM

014636  004737  015310          DQUEST: CALL GTDRVT     ;GET DRIVE TABLE ADDRESS INTO R0
014642  014403                          MOV -(R4),R3    ;GET QUESTION NUMBER
014644  020327  000006                  CMP R3,#DQUESZ
014650  101035                          BHI DQUEX
014652  006303                          ASL R3
014654  000173  014660                  JMP @DQUEJP(R3)
014660  014744                  DQUEJP: .WORD DQUEX     ; 0  (NOT USED)
014662  014676                          .WORD DQUNIT    ; 1  ENTER UNIT NUMBER TO FORMAT
014664  014744                          .WORD DQUEX     ; 2  (NOT USED)
014666  014744                          .WORD DQUEX     ; 3  (NOT USED)
014670  014750                          .WORD DQRFMT    ; 4  USE EXISTING BAD SECTOR INFORMATION
014672  014770                          .WORD DQRSTR    ; 5  DOWN-LINE LOAD BAD SECTOR BLOCK INFORMATION
014674  015000                          .WORD DQCONT    ; 6  CONTINUE IF BAD BLOCK INFO INACCESSIBLE
        000006                                  DQUESZ=<<.-DQUEJP>/2>-1

                                ;ENTER UNIT NUMBER TO FORMAT

014676                          DQUNIT: PUSH R5
014676  010546                                                                  MOV R5,-(SP)
014700  005004                          CLR R4
014702  011003                          MOV (R0),R3     ;GET DRIVE NUMBER
014704                                          ASSUME D.DRV EQ 0
014704  012700  000012                  MOV #10.,R0     ;RADIX 10.
014710  004737  016766          DQUNL1: CALL DIVIDE
014714                                  PUSH R5
014714  010546                                                                  MOV R5,-(SP)
014716  005201                          INC R1
014720  005703                          TST R3
014722  001372                          BNE DQUNL1
014724  010100                          MOV R1,R0
014726                          DQUNL2: POP R5
014726  012605                                                                  MOV (SP)+,R5
014730  062705  000060                  ADD #'0,R5
014734  110522                          MOVB R5,(R2)+
014736  005300                          DEC R0
014740  001372                          BNE DQUNL2
014742                                  POP R5
014742  012605                                                                  MOV (SP)+,R5
014744  000264                  DQUEX:  SEZ
014746  000207                          RETURN

014750  032737  000003  003200  DQRFMT: BIT #SO.FMT,MODE
```

```
014756  001410                          BEQ DQNO
014760  112712  000131          DQYES:  MOVB #'Y,(R2)
014764  005201                          INC R1
014766  000766                          BR DQUEX

014770  032737  000010  003200  DQRSTR: BIT #SO.STR,MODE
014776  001370                          BNE DQYES
015000                          DQCONT:
015000  112712  000116          DQNO:   MOVB #'N,(R2)
015004  005201                          INC R1
015006  000756                          BR DQUEX
```

```
                                            ;MESSAGE TYPE 3
                                            ;
                                            ;PRINT INFORMATION FROM DUP PROGRAM
                                            ;
                                            ;INPUT:
                                            ;       R5 - POINTER TO CONTROLLER TABLE
                                            ;       R4 - POINTER TO DATA IN RECEIVE BUFFER
                                            ;       R3 - CHARACTER COUNT IN RECEIVE BUFFER
                                            ;       R2 - POINTER TO SEND BUFFER (BUFFER IS CLEARED)
                                            ;       R1 - ZERO
                                            ;OUTPUT:
                                            ;       R1 - BIT 15 SET TO PREVENT SENDING DATA TO DUP PROGRAM
                                            ;       Z SET TO CONTINUE RUNNING DUP PROGRAM

015010  016400  177776                      INFO:   MOV -2(R4),R0    ;GET MESSAGE NUMBER
015014  001434                                      BEQ INFOB        ;IF ZERO, PRINT BEGUN MESSAGE
015016  020027  000100                              CMP R0,#100      ;IF OCTAL 100
015022  001423                                      BEQ INFOE        ;  PRINT ERROR MESSAGE
015024  020027  000200                              CMP R0,#200      ;SEE IF 200 OR GREATER
015030  002005                                      BGE INFOH        ;  IF SO, PRINT WITHOUT FREEZING
015032  005737  002170                              TST UFREEZ
015036  001007                                      BNE INFOP
015040  005237  002170                              INC UFREEZ
015044  004737  015310                      INFOH:  CALL GTDRVT
015050  010002                                      MOV R0,R2
015052  004737  015334                              CALL HEADER
015056  004737  015254                      INFOP:  CALL MESG        ;PRINT THE MESSAGE
015062  012701  100000                      INFOX:  MOV #BIT15,R1                   ;RETURN A NEGATIVE BYTE COUNT
015066  000264                                      SEZ
015070  000207                                      RETURN                          ;RETURN WITH Z SET

015072                                      INFOE:  ERRDF 101 ,ERR101       ;ANSWER WAS REJECTED BY DUP PROGRAM
015072  104455                                                                                      TRAP     C$ERDF
015074  000145                                                                                      .WORD    101
015076  000000                                                                                      .WORD    0
015100  012740                                                                                      .WORD    ERR101
015102  000244                                      CLZ     ;RETURN WITH Z CLEAR TO STOP DUP PROGRAM
015104  000207                                      RETURN

015106  004737  015310                      INFOB:  CALL GTDRVT      ;PRINT FORMAT BEGUN MESSAGE
015112  010002                                      MOV R0,R2
015114  004737  015334                              CALL HEADER
015120  004737  015254                              CALL MESG
015124                                              PNT WNSTOP       ;PRINT WARNING NOT TO STOP NOW
015124  004137  016720                                                                              JSR R1,LPNT
015130  004355                                                                                      .WORD WNSTOP
015132  000000                                                                                      .WORD PNT.CT
015134  000752                                      BR INFOX
```

```
                                        ;MESSAGE TYPE 4
                                        ;
                                        ;TERMINATION MESSAGE
                                        ;
                                        ;INPUT:
                                        ;       R5 - POINTER TO CONTROLLER TABLE
                                        ;       R4 - POINTER TO DATA IN RECEIVE BUFFER
                                        ;       R3 - CHARACTER COUNT IN RECEIVE BUFFER
                                        ;       R2 - POINTER TO SEND BUFFER (BUFFER IS CLEARED)
                                        ;       R1 - ZERO
                                        ;OUTPUT:
                                        ;       Z CLEAR TO TERMINATE DUP PROGRAM

   015136  004737  015010               TERM:   CALL INFO       ;PRINT THE MESSAGE
   015142  000244                               CLZ
   015144  000207                               RETURN                          ;RETURN Z CLEAR TO TERMINATE DUP PROGRAM
```

```
                                  ;MESSAGE TYPE 5
                                  ;
                                  ;ERROR TERMINATION MESSAGE
                                  ;
                                  ;INPUT:
                                  ;       R5 - POINTER TO CONTROLLER TABLE
                                  ;       R4 - POINTER TO DATA IN RECEIVE BUFFER
                                  ;       R3 - CHARACTER COUNT IN RECEIVE BUFFER
                                  ;       R2 - POINTER TO SEND BUFFER (BUFFER IS CLEARED)
                                  ;       R1 - ZERO
                                  ;OUTPUT:
                                  ;       Z CLEAR TO TERMINATE DUP PROGRAM

 015146  004737  015010           ERRTRM: CALL INFO
 015152  C00244                           CLZ
 015154  000207                           RETURN                          ;RETURN Z CLEAR TO TERMINATE DUP PROGRAM
```

```
                                          ;MESSAGE TYPE 6
                                          ;
                                          ;SPECIAL TYPE - READ FCT BLOCK FROM FILE
                                          ;
                                          ;INPUT:
                                          ;       R5 - POINTER TO CONTROLLER TABLE
                                          ;       R4 - POINTER TO DATA IN RECEIVE BUFFER
                                          ;       R3 - CHARACTER COUNT IN RECEIVE BUFFER
                                          ;       R2 - POINTER TO SEND BUFFER (BUFFER IS CLEARED)
                                          ;       R1 - ZERO
                                          ;OUTPUT:
                                          ;       Z SET TO SEND DATA TO PROGRAM

015156  023714  003176                    SPECL:  CMP FCTNUM,(R4) ;SEE IF DESIRED BLOCK IS IN MEMORY
015162  001425                                    BEQ SPECLX      ; IF SO, SEND TO DUP PROGRAM
015164  002407                                    BLT SPECLR      ; IF LOWER NUMBERED BLOCK IN MEMORY,
                                                                  ;   GO READ NEXT BLOCK
015166                                    SPECLC:
015166                                            CLOSE   ;OTHERWISE, START READING FROM BEGINNING AGAIN
015166  104435                                                                                 TRAP    C$CLOS
015170                                            OPEN #FNAME
015170  012700  003230                                                                         MOV     #FNAME,R0
015174  104434                                                                                 TRAP    C$OPEN
015176  012737  177777  003176                    MOV #-1,FCTNUM
015204  012703  001000            SPECLR: MOV #512.,R3     ;GET BYTE COUNT IN A BLOCK
015210  012701  002176                    MOV #FCTBUF,R1   ;POINT TO STORAGE AREA
015214                                    SPECLL: GETBYTE (R1)+    ;READ THE FILE
015214  104426                                                                                 TRAP    C$GETB
015216  110021                                                                                 MOVB    R0,(R1)+
015220                                            BNCOMPLETE SPECLE       ;PRINT ERROR IF NO MORE BYTES IN FILE
015220  103005                                                                                 BCC     SPECLE
015222  005303                                    DEC R3  ;COUNT THE BYTES
015224  001373                                    BNE SPECLL
015226  005237  003176                            INC FCTNUM      ;KEEP COUNT OF BLOCK IN MEMORY
015232  000751                                    BR SPECL

015234  005212                            SPECLE: INC (R2)        ;TELL DUP PROGRAM DATA NOT AVAILABLE
015236  012762  002176  000002            SPECLX: MOV #FCTBUF,2(R2)       ;PUT ADDRESS OF DATA IN OUTPUT BUFFER
015244  012701  000006                            MOV #6,R1       ;SEND 3 WORDS TO DUP PROGRAM
015250  000264                                    SEZ
015252  000207                                    RETURN                  ;RETURN WITH Z SET TO SEND DATA TO DUP PROGRAM
```

```
                        ;PRINT A MESSAGE IN THE RECEIVE BUFFER FROM THE DUP PROGRAM
                        ;
                        ;INPUT:
                        ;       R4 - POINTER TO DATA IN RECEIVE BUFFER
                        ;       R3 - CHARACTER COUNT IN RECEIVE BUFFER
                        ;OUTPUT:
                        ;       R4 - POINTER TO CHARACTER AFTER MESSAGE IN RECEIVE BUFFER
                        ;       R3 - ZERO
                        ;       R1 - BIT 15 SET TO PREVENT SENDING DATA TO DUP PROGRAM
                        ;       R0 - CONTENTS DESTROYED
                        ;       Z SET TO CONTINUE RUNNING DUP PROGRAM

015254                  MESG:
015254 112400           1$:     MOVB (R4)+,R0           ;PRINT CHARACTERS FROM DUP PROGRAM
015256 001405                   BEQ 2$                  ;  DISCARDING LF AND NULL CHARACTERS
015260 020027 000012            CMP R0,#12
015264 001402                   BEQ 2$
015266                          PRINT R0
015266 004737 016510                                                            CALL CPNT
015272 005303           2$:     DEC R3                  ;COUNT THE CHARACTERS
015274 003367                   BGT 1$
015276                          PRINT #CR
015276 112700 000015                                                            MOVB #CR,R0
015302 004737 016510                                                            CALL CPNT
015306 000207                   RETURN
```

```
                                ;GTDRVT
                                ;
                                ;GET DRIVE TABLE ADDRESS FROM CONTROLLER TABLE
                                ;
                                ;INPUTS:
                                ;       R5 - CONTROLLER TABLE ADDRESS
                                ;OUTPUTS:
                                ;       R0 - ADDRESS OF FIRST DRIVE TABLE AVAILABLE FOR TESTING
                                ;               (WITH DT.AVL BIT CLEAR)

015310                          GTDRVT: PUSH R5
015310  010546                                                                                  MOV R5,-(SP)
015312  062705  000016                  ADD #C.DR0,R5
015316  012500                  GTDRVL: MOV (R5)+,R0
015320  016037  000002  002074          MOV D.UNIT(R0),L$LUN
015326                                          ASSUME DT.AVL EQ BIT15
015326  100773                          BMI GTDRVL
015330                                  POP R5
015330  012605                                                                                  MOV (SP)+,R5
015332  000207                          RETURN
```

N7

```
                                        ;HEADER
                                        ;
                                        ;PRINT A HEADER IN FRONT OF EACH MESSAGE FROM DUP PROGRAM.
                                        ;A UDA ADDRESS IS PRINTED IF MORE THAN ONE UDA IS IN HARDWARE P-TABLE.
                                        ;A RUNTIME IS PRINTED IF A CLOCK IS BEING USED TO TIME PROGRAM EXECUTION.
                                        ;
                                        ;INPUT:
                                        ;       R5 - POINTER TO CONTROLLER TABLE
                                        ;OUTPUT:
                                        ;       R0 - POINTER TO DRIVE TABLE
                                        ;       PRINTED MESSAGE
                                        ;
015334  022737  000001  002012  HEADER: CMP #1,L$UNIT                  ;IF MORE THAN ONE UNIT BEING TESTED
015342  001411                          BEQ 1$
015344                                  PNTF MESSG,D.UNIT(R2),(R5),(R2)         ;PRINT UDA ADDRESS
015344  011246                                                                          MOV (R2),-(SP)
015346  011546                                                                          MOV (R5),-(SP)
015350  016246  000002                                                                  MOV D.UNIT(R2),-(SP)
015354  004137  016662                                                                  JSR R1,LPNTF
015360  004035                                                                          .WORD MESSG
015362  000006                                                                          .WORD PNT.CT
015364                                          ASSUME C.UADR EQ 0
015364                                          ASSUME D.DRV EQ 0
015364  000407                          BR 2$
015366  005737  003206          1$:     TST KW.CSR                     ;IF NO CLOCK BEING USED
015372  001406                          BEQ 3$                         ;BYPASS RUNTIME MESSAGE
015374                                  PRINT #CR
015374  112700  000015                                                                  MOVB #CR,R0
015400  004737  016510                                                                  CALL CPNT
015404  004737  020652          2$:     CALL RNTIME                    ;PRINT RUNTIME IF A CLOCK IN USE
015410                          3$:     PRINT #CR
015410  112700  000015                                                                  MOVB #CR,R0
015414  004737  016510                                                                  CALL CPNT
015420  000207                          RETURN
```

```
                                    ;OSTRNG
                                    ;
                                    ;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 TC 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.
                                    ;
                                    ;OUTPUT A MESSAGE ACCORDING TO A FORMAT STRING
                                    ;
                                    ;INPUTS:
                                    ;       R2 - ADDRESS OF START OF FORMAT STRING
                                    ;       R4 - ADDRESS OF PARAMETERS
                                    ;OUTPUTS:
                                    ;       R2 AND R4 UPDATED TO END OF STRING AND PARAMETERS

 015422  112201                     OSTRNG: MOVB (R2)+,R1                       ;GET CONTROL CHARACTER
 015424  001421                             BEQ OSTRE                           ;EXIT IF NULL CHARACTER
 015426  012700  015722                     MOV #ERRC,R0                        ;GET POINTER TO CHARACTER TABLE
 015432  120110                     NCONS:  CMPB R1,(R0)                        ;COMPARE CHARACTER WITH TABLE ENTRY
 015434  001407                             BEQ NCONF                           ;BRANCH IF MATCH FOUND
 015436  105720                             TSTB (R0)+                          ;INCREMENT POINTER
 015440  001374                             BNE NCONS                           ;CONTINUE SEARCH IF NOT END OF TABLE
 015442                                     PNTF ERRME1                         ;REPORT BAD CONTROL CHARACTER
 015442  004137  016662                                                                                     JSR R1,LPNTF
 015446  003746                                                                                             .WORD ERRME1
 015450  000000                                                                                             .WORD PNT.CT
 015452  000406                             BR OSTRE
 015454  162700  015722             NCONF:  SUB #ERRC,R0                        ;GET INCREMENT INTO TABLE
 015460  006300                             ASL R0                              ;DOUBLE TO WORD COUNT
 015462  004770  015734                     CALL @ERRD(R0)                      ;DISPATCH TO PRINT ROUTINE
 015466  000755                             BR OSTRNG                           ;GET NEXT
 015470  000207                     OSTRE:  RETURN
```

```
                                  ;CONTROL CHARACTER WAS A QUOTE. PRINT ALL CHARACTERS TO THE NEXT QUOTE.

 015472  112200                   CON.QU: MOVB (R2)+,R0                      ;GET CHARACTER
 015474  120027  000042                   CMPB R0,#'"                        ;CHECK IF ENDING QUOTE
 015500  001403                           BEQ CON.QX                         ;IF SO, GO GET NEXT CONTROL CHARACTER
 015502                                   PRINT R0                           ;PRINT THE CHARACTER
 015502  004737  016510                                                              CALL CPNT
 015506  000771                           BR CON.QU                          ;CONTINUE PRINTING
 015510  000207                   CON.QX: RETURN

                                  ;CONTROL CHARACTER WAS AN A. PRINT ASCII CHARACTERS FROM PARAMETERS.

 015512  004737  016170           CON.A:  CALL GETCNT                        ;GET COUNT OF CHARACTERS
 015516                           CON.A1: PRINT (R4)+                        ;PRINT THE CHARACTER
 015516  112400                                                                      MOVB (R4)+,R0
 015520  004737  016510                                                              CALL CPNT
 015524  005301                           DEC R1                             ;COUNT THE CHARACTERS
 015526  001373                           BNE CON.A1                         ;PRINT UNTIL COUNT REACHES ZERO
 015530  032704  000001                   BIT #1,R4                          ;CHECK IF R4 NOW ODD
 015534  001401                           BEQ CON.A2
 015536  005204                           INC R4                             ;IF SO, INCREMENT TO NEXT EVEN ADDRESS
 015540  000207                   CON.A2: RETURN                             ;NOW GET NEXT CONTROL CHARACTER

                                  ;CONTROL CHARACTER WAS A D. PRINT DECIMAL NUMBER.

 015542  012701  000012           CON.D:  MOV #10.,R1                        ;LOAD RADIX
 015546  004737  016246                   CALL PNTNUM                        ;PRINT NUMBER
 015552  000207                           RETURN                             ;NOW GET NEXT CONTROL CHARACTER

                                  ;CONTROL CHARACTER WAS AN H. PRINT HEX NUMBER.

 015554  012701  000020           CON.H:  MOV #16.,R1                        ;LOAD RADIX
 015560  004737  016246                   CALL PNTNUM                        ;PRINT NUMBER
 015564  000207                           RETURN                             ;NOW GET NEXT CONTROL CHARACTER
```

```
                                ;CONTROL CHARACTER WAS AN O. PRINT OCTAL NUMBER.

015566  012701  000010          CON.O:  MOV #8.,R1                      ;LOAD RADIX
015572  004737  016246                  CALL PNTNUM                     ;PRINT NUMBER
015576  000207                          RETURN                          ;NOW GET NEXT CONTROL CHARACTER

                                ;CONTROL CHARACTER WAS AN N. PRINT NEW LINE SEQUENCE.

015600  004737  016170          CON.N:  CALL GETCNT                     ;GET COUNT
015604                          CON.N1: PRINT #CR                       ;PRINT NEW LINE SEQUENCE
015604  112700  000015                                                          MOVB #CR,R0
015610  004737  016510                                                          CALL CPNT
015614  005301                          DEC R1                          ;COUNT THE SEQUENCES
015616  001372                          BNE CON.N1
015620  000207                          RETURN                          ;NOW GET NEXT CONTROL CHARACTER

                                ;CONTROL CHARACTER WAS AN R. CALL A PRE-PROGRAMMED ROUTINE.

015622  004737  016170          CON.R:  CALL GETCNT                     ;GET ROUTINE NUMBER
015626  020127  000010                  CMP R1,#ERRRSZ                  ;CHECK IF DEFINED ROUTINE NUMBER
015632  101004                          BHI CON.R1
015634  060101                          ADD R1,R1                       ;DOUBLE COUNT TO GET WORD INDEX
015636  004771  015700                  CALL @ERRRTB-2(R1)              ;CALL ROUTINE
015642  000207                          RETURN                          ;NOW GET NEXT CONTROL CHARACTER
015644                          CON.R1: PNTF ERRME1                     ;REPORT BAD MESSAGE STRING
015644  004137  016662                                                          JSR R1,LPNTF
015650  003746                                                                  .WORD ERRME1
015652  000000                                                                  .WORD PNT.CT
015654                                  POP R1                          ;FIX THE STACK
015654  012601                                                                  MOV (SP)+,R1
015656  000207                          RETURN

                                ;CONTROL CHARACTER WAS AN S. PRINT SPACES.

015660  004737  016170          CON.S:  CALL GETCNT                     ;GET COUNT
015664                          CON.S1: PRINT <#' >                     ;PRINT A SPACE
015664  112700  000040                                                          MOVB #' ,R0
015670  004737  016510                                                          CALL CPNT
015674  005301                          DEC R1                          ;COUNT THE SPACES
015676  001372                          BNE CON.S1
015700  000207                          RETURN                          ;NOW GET NEXT CONTROL CHARACTER
```

```
                              ;ERROR ROUTINE DISPATCH TABLE

015702  015754                ERRRTB: .WORD CALRE                    ;NOT USED
015704  015754                        .WORD CALRE                    ;NOT USED
015706  015754                        .WORD CALRE                    ;NOT USED
015710  015766                        .WORD CALR4                    ;PRINT BASIC LINE WITHOUT UDA ADDRESS
015712  016042                        .WORD CALR5                    ;PRINT BASIC LINE WITH UDA ADDRESS
015714  016120                        .WORD CALR6                    ;CALL ALTERNATE PRINT STRING IN PDP-11 MEMORY
015716  016134                        .WORD CALR7                    ;PRINT  "REPLACE PROCESSOR MODULE"
015720  016152                        .WORD CALR8                    ;PRINT  "  UDASA CONTAINS  XXXXXX"
        000010                        ERRRSZ=<.-ERRRTB>/2

                              ;BUILD TWO TABLES
                              ;       FIRST CONTAINING CONTROL CHARACTERS
                              ;       SECOND CONTAINING ROUTINE ADDRESSES

                              .MACRO BUILD
                                      ENTRY ",CON.QU
                                      ENTRY A,CON.A
                                      ENTRY D,CON.D
                                      ENTRY H,CON.H
                                      ENTRY O,CON.O
                                      ENTRY N,CON.N
                                      ENTRY R,CON.R
                                      ENTRY S,CON.S
                              .ENDM
```

```
                                  ;HERE IS FIRST TABLE

                                  .MACRO ENTRY ARG1,ARG2
                                          .LIST
                                          .BYTE ''ARG1
                                          .NLIST
                                  .ENDM

 015722                           ERRC:   BUILD
 015722     042                           .BYTE '"
 015723     101                           .BYTE 'A
 015724     104                           .BYTE 'D
 015725     110                           .BYTE 'H
 015726     117                           .BYTE 'O
 015727     116                           .BYTE 'N
 015730     122                           .BYTE 'R
 015731     123                           .BYTE 'S
 015732     000                           .BYTE 0                                 ;FOLLOW WITH A NULL BYTE
                                          .EVEN

                                  ;HERE IS SECOND TABLE

                                  .MACRO ENTRY ARG1,ARG2
                                          .LIST
                                          .WORD ARG2
                                          .NLIST
                                  .ENDM

 015734                           ERRD:   BUILD
 015734  015472                           .WORD CON.QU
 015736  015512                           .WORD CON.A
 015740  015542                           .WORD CON.D
 015742  015554                           .WORD CON.H
 015744  015566                           .WORD CON.O
 015746  015600                           .WORD CON.N
 015750  015622                           .WORD CON.R
 015752  015660                           .WORD CON.S
```

```
                                         ;PRE-PROGRAMMED ROUTINES 1, 2 AND 3
                                         ;NOT USED - PRINTS ERROR MESSAGE

  015754                                 CALRE:  PNTF ERRME1                  ;PRINT ERROR MESSAGE
  015754  004137  016662                                                                           JSR R1,LPNTF
  015760  003746                                                                                   .WORD ERRME1
  015762  000000                                                                                   .WORD PNT.CT
  015764  000207                                 RETURN
```

```
                                   ;PRE-PROGRAMMED ROUTINE 4
                                   ;PRINT BASIC LINE FOR HOST PROGRAM ERROR WITHOUT UDA ADDRESS
                                   ;THEN SWITCH TO EXTENDED FORMAT

 015766                            CALR4:  PNTB BASLN,#BASNO,#BAS,#BAS,#BAS
 015766  012746  004247                                                          MOV #BAS,-(SP)
 015772  012746  004247                                                          MOV #BAS,-(SP)
 015776  012746  004247                                                          MOV #BAS,-(SP)
 016002  012746  004165                                                          MOV #BASNO,-(SP)
 016006  004137  016672                                                          JSR R1,LPNTB
 016012  004250                                                                  .WORD BASLN
 016014  000010                                                                  .WORD PNT.CT
 016016  004737  020652                    CALL RNTIME
 016022                                    PRINT #CR
 016022  112700  000015                                                          MOVB #CR,R0
 016026  004737  016510                                                          CALL CPNT
 016032  012737  016610  003222            MOV #PX,PTYPE
 016040  000207                            RETURN
```

```
                                        ;PRE-PROGRAMMED ROUTINE 5
                                        ;PRINT BASIC LINE FOR HOST PROGRAM ERROR WITH UDA ADDRESS
                                        ;THEN SWITCH TO EXTENDED FORMAT

 016042                                 CALR5:  PNTB BASLN,#BASNO,#BASL2,(R5),#BAS,#BAS
 016042  012746  004247                                                                  MOV #BAS,-(SP)
 016046  012746  004247                                                                  MOV #BAS,-(SP)
 016052  011546                                                                          MOV (R5),-(SP)
 016054  012746  004204                                                                  MOV #BASL2,-(SP)
 016060  012746  004165                                                                  MOV #BASNO,-(SP)
 016064  004137  016672                                                                  JSR R1,LPNTB
 016070  004250                                                                          .WORD BASLN
 016072  000012                                                                          .WORD PNT.CT
 016074  004737  020652                         CALL RNTIME
 016100                                         PRINT #CR
 016100  112700  000015                                                                  MOVB #CR,R0
 016104  004737  016510                                                                  CALL CPNT
 016110  012737  016610  003222                 MOV #PX,PTYPE
 016116  000207                                 RETURN
```

```
                                ;PRE-PROGRAMMED ROUTINE 6
                                ;CALL ALTERNATE PRINT ROUTINE IN PDP-11 MEMORY

016120                          CALR6:  PUSH R2                         ;SAVE CURRENT STRING POINTER
016120  010246                                                                                  MOV R2,-(SP)
016122  012402                          MOV (R4)+,R2                    ;GET NEW STRING POINTER
016124  004737  015422                  CALL OSTRNG                     ;OUTPUT USING THIS STRING
016130                                  POP R2                          ;GET OLD POINTER BACK
016130  012602                                                                                  MOV (SP)+,R2
016132  000207                          RETURN                          ;NOW CONTINUE THE OLD STRING
```

```
                                    ;PRE-PROGRAMMED ROUTINE 7
                                    ;PRINT "REPLACE PROCESSOR MODULE"

  016134                             CALR7:  PUSH R2
  016134  010246                                                                   MOV R2 -(SP)
  016136  012702  012002                     MOV #XFRU,R2
  016142  004737  015422                     CALL OSTRNG
  016146                                     POP R2
  016146  012602                                                                   MOV (SP)+,R2
  016150  000207                             RETURN
```

```
                                   ;PRE-PROGRAMMED ROUTINE 8
                                   ;PRINT  "  UDASA CONTAINS  XXXXXX"

  016152                           CALR8:  PUSH R2
  016152  010246                                                                  MOV R2,-(SP)
  016154  012702  011754                   MOV #XSA,R2
  016160  004737  015422                   CALL OSTRNG
  016164                                   POP R2
  016164  012602                                                                  MOV (SP)+,R2
  016166  000207                           RETURN
```

```
                             ;GETCNT
                             ;
                             ;GET COUNT IN NEXT CHARACTERS OF STRING POINTED TO BY R2.
                             ;NUMBER WILL BE IN DECIMAL. IF NO NUMBER, RETURN A
                             ;DEFAULT OF 1.
                             ;
                             ;INPUTS:
                             ;       R2 - POINTER TO ASCII STRING
                             ;OUTPUTS:
                             ;       R1 - NUMBER READ OR A ONE
                             ;       R2 - POINTING TO CHARACTER AFTER NUMBER

016170                       GETCNT: PUSH R0
016170  010046                                                                MOV R0,-(SP)
016172  005001                       CLR R1                  ;START WITH ZERO COUNT
016174  121227  000060       GETCNX: CMPB (R2),#'0           ;CHECK IF CHARACTER A DIGIT
016200  103415                       BLO GETCDN              ;BRANCH IF LOWER THAN ZERO
016202  121227  000071               CMPB (R2),#'9
016206  101012                       BHI GETCDN              ;BRANCH IF HIGHER THAN NINE
016210  006301                       ASL R1                  ;MULTIPLY NUMBER BY 10
016212  010100                       MOV R1,R0               ; SAVE 2N
016214  006301                       ASL R1                  ; COMPUTE 4N
016216  006301                       ASL R1                  ; COMPUTE 8N
016220  060001                       ADD R0,R1               ; 8N + 2N = 10N
016222  112200                       MOVB (R2)+,R0           ;GET DIGIT FROM STING
016224  162700  000060               SUB #'0,R0              ;GET RID OF ASCII
016230  060001                       ADD R0,R1               ;ADD TO NUMBER
016232  000760                       BR GETCNX               ;GO TO NEXT CHARACTER
016234  005701               GETCDN: TST R1                  ;CHECK IF NUMBER IS ZERO
016236  001001                       BNE GETCXX              ;IF ZERO, CHANGE
016240  005201                       INC R1                  ; TO DEFAULT OF ONE
016242                       GETCXX: POP R0
016242  012600                                                                MOV (SP)+,R0
016244  000207                       RETURN
```

```
                                   ;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.
                                   ;        R0 - CONTENTS DESTROYED

016246  010100                     PNTNUM: MOV R1,R0                       ;SAVE RADIX
016250  004737  016170                     CALL GETCNT                     ;GET COUNT OF BITS
016254                             PNTNUS: PUSH <R2,R3,R5>
016254  010246                                                                        MOV R2,-(SP)
016256  010346                                                                        MOV R3,-(SP)
016260  010546                                                                        MOV R5,-(SP)
016262  012403                             MOV (R4)+,R3                    ;GET ONE PARAMETER WORD
016264  005005                             CLR R5                          ;CLEAR STORAGE FOR OTHER
016266  020127  000020                     CMP R1,#16.                     ;MORE THAN 16 BITS IN NUMBER?
016272  003401                             BLE 1$
016274  012405                             MOV (R4)+,R5                    ;YES, GET SECOND PARAMETER WORD
016276                             1$:     PUSH R4
016276  010446                                                                        MOV R4,-(SP)
016300  010504                             MOV R5,R4                       ;PUT HIGH WORD IN R4
016302  012702  000020                     MOV #16.,R2                     ;COMPUTE BITS NOT WANTED
016306  160102                             SUB R1,R2                       ;BY SUBTRACTING BITS TO USE
016310  002002                             BGE 2$                          ;FROM 16.
016312  062702  000020                     ADD #16.,R2                     ;IF NEGATIVE, ADD 16 FOR FIRST WORD
016316  001414                     2$:     BEQ 6$                          ;IF ZERO, NO BITS NEED BE CLEARED
016320  012705  100000                     MOV #BIT15,R5                   ;START MASK WITH SIGN BIT SET
016324  005302                     3$:     DEC R2                          ;COUNT BITS IN MASK
016326  001402                             BEQ 4$
016330  006205                             ASR R5                          ;SHIFT MORE BITS TO RIGHT
016332  000774                             BR 3$
016334  020127  000020             4$:     CMP R1,#16.                     ;MORE THAN 16 BITS IN NUMBER?
016340  003402                             BLE 5$
016342  040504                             BIC R5,R4                       ;YES, CLEAR IN HIGH WORD
016344  000401                             BR 6$
016346  040503                     5$:     BIC R5,R3                       ;NO, CLEAR IN LOW WORD
016350  004737  016766             6$:     CALL DIVIDE                     ;DIVIDE BY RADIX IN R0
016354                                     PUSH R5                         ;PUSH REMAINDER ON STACK
016354  010546                                                                        MOV R5,-(SP)
016356  005202                             INC R2                          ;COUNT DIGITS ON STACK
016360  005703                             TST R3                          ;CHECK IF QUOTIENT IS ZERO
016362  001372                             BNE 6$
016364  005704                             TST R4
016366  001370                             BNE 6$
```

```
016370  020027  000012           CMP R0,#10.             ;IF RADIX IS DECIMAL
016374  001423                   BEQ 10$                 ; JUST GO PRINT DIGITS ON STACK
016376  010103                   MOV R1,R3               ;OTHERWISE COMPUTE NUMBER OF LEADING ZEROS
016400  162700  000014           SUB #12.,R0             ;DIVIDEND IS BITS IN NUMBER
016404  003002                   BGT 7$                  ;DIVISOR IS BITS PER DIGIT PRINTED
016406  012700  000003           MOV #3,R0               ;   (3 OR 4)
016412  004737  016766   7$:     CALL DIVIDE
016416  005705                   TST R5                  ;IF REMAINDER NOT ZERO
016420  001401                   BEQ 8$                  ;INCREMENT QUOTIENT
016422  005203                   INC R3
016424  160203           8$:     SUB R2,R3               ;SUBTRACT DIGITS ON STACK
016426  001406                   BEQ 10$                 ;NO LEADING ZEROS IF ZERO
016430                   9$:     PRINT #'0               ;PRINT A ZERO
016430  112700  000060                                                           MOVB #'0,R0
016434  004737  0 6510                                                           CALL CPNT
016440  005303                   DEC R3
016442  001372                   BNE 9$                  ;REPEAT UNTIL COUNT REACHES ZERO

016444                   10$:    POP R5                  ;GET CHACACTER FROM STACK
016444  012605                                                                   MOV (SP)+,R5
016446  062705  000060           ADD #'0,R5              ;CNVERT TO ASCII DIGIT
016452  020527  000071           CMP R5,#'9              ;IF GREATER THAN A 9
016456  003402                   BLE 11$                 ; CONVERT TO A OR HIGHER
016460  062705  000007           ADD #<'A-'9-1>,R5       ; FOR HEX DIGIT
016464                   11$:    PRINT R5                ;PRINT THE CHARACTER
016464  110500                                                                   MOVB R5,R0
016466  004737  016510                                                           CALL CPNT
016472  005302                   DEC R2                  ;REPEAT FOR ALL DIGITS
016474  001363                   BNE 10$                 ; ON STACK
016476                           POP <R4,R5,R3,R2>
016476  012604                                                                   MOV (SP)+,R4
016500  012605                                                                   MOV (SP)+,R5
016502  012603                                                                   MOV (SP)+,R3
016504  012602                                                                   MOV (SP)+,R2
016506  000207                   RETURN
```

```
                                  ;PRINT ONE CHARACTER
                                  ;
                                  ;CALL WITH MACRO PRINT

 016510  110037  003224          CPNT:   MOVB R0,ERRCHR
 016514                                  PUSH R1
 016514  010146                                                          MOV R1,-(SP)
 016516  012701  003704                  MOV #ERRONE,R1
 016522  120027  000015                  CMPB R0,#CR
 016526  001002                          BNE 1$
 016530  012701  003707                  MOV #ERRNL,R1
 016534  000177  164462          1$:     JMP @PTYPE
 016540                          PF:     PRINTF R1,#ERRCHR
 016540  012746  003224                                                  MOV     #ERRCHR,-(SP)
 016544  010146                                                          MOV     R1,-(SP)
 016546  012746  000002                                                  MOV     #2,-(SP)
 016552  010600                                                          MOV     SP,R0
 016554  104417                                                          TRAP    C$PNTF
 016556  062706  000006                                                  ADD     #6,SP
 016562  000435                          BR CPNTX
 016564                          PB:     PRINTB R1,#ERRCHR
 016564  012746  003224                                                  MOV     #ERRCHR,-(SP)
 016570  010146                                                          MOV     R1,-(SP)
 016572  012746  000002                                                  MOV     #2,-(SP)
 016576  010600                                                          MOV     SP,R0
 016600  104414                                                          TRAP    C$PNTB
 016602  062706  000006                                                  ADD     #6,SP
 016606  000423                          BR CPNTX
 016610                          PX:     PRINTX R1,#ERRCHR
 016610  012746  003224                                                  MOV     #ERRCHR,-(SP)
 016614  010146                                                          MOV     R1,-(SP)
 016616  012746  000002                                                  MOV     #2,-(SP)
 016622  010600                                                          MOV     SP,R0
 016624  104415                                                          TRAP    C$PNTX
 016626  062706  000006                                                  ADD     #6,SP
 016632  000411                          BR CPNTX
 016634                          PS:     PRINTS R1,#ERRCHR
 016634  012746  003224                                                  MOV     #ERRCHR,-(SP)
 016640  010146                                                          MOV     R1,-(SP)
 016642  012746  000002                                                  MOV     #2,-(SP)
 016646  010600                                                          MOV     SP,R0
 016650  104416                                                          TRAP    C$PNTS
 016652  062706  000006                                                  ADD     #6,SP
 016656                          CPNTX:  POP R1
 016656  012601                                                          MOV (SP)+,R1
 016660  000207                          RETURN
```

```
                                        ;PRINT FORMATTED MESSAGE
                                        ;
                                        ;CALL WITH MACRO PNT, PNTF, PNTB, PNTX, OR PNTS

 016662  012737  016540  003222  LPNTF:  MOV #PF,PTYPE
 016670  000413                          BR LPNT
 016672  012737  016564  003222  LPNTB:  MOV #PB,PTYPE
 016700  000407                          BR LPNT
 016702  012737  016610  003222  LPNTX:  MOV #PX,PTYPE
 016710  000403                          BR LPNT
 016712  012737  016634  003222  LPNTS:  MOV #PS,PTYPE
 016720                          LPNT:   PUSH <R2,R3,R4,R5>
 016720  010246                                                                  MOV R2,-(SP)
 016722  010346                                                                  MOV R3,-(SP)
 016724  010446                                                                  MOV R4,-(SP)
 016726  010546                                                                  MOV R5,-(SP)
 016730  012102                          MOV (R1)+,R2                ;GET ADDRESS OF STRING
 016732  010604                          MOV SP,R4                   ;COMPUTE ADDRESS OF ARGUMENTS
 016734  062704  000012                  ADD #10.,R4                 ;  WHICH ARE NOW ON STACK (IF ANY)
 016740                                  PUSH R1                     ;SAVE RETURN ADDRESS
 016740  010146                                                                  MOV R1,-(SP)
 016742  004737  015422                  CALL OSTRNG                 ;PRINT THE FORMATTED MESSAGE
 016746                                  POP <R0,R5,R4,R3,R2,R1>     ;RESTORE ALL REGISTERS
 016746  012600                                                                  MOV (SP)+,R0
 016750  012605                                                                  MOV (SP)+,R5
 016752  012604                                                                  MOV (SP)+,R4
 016754  012603                                                                  MOV (SP)+,R3
 016756  012602                                                                  MOV (SP)+,R2
 016760  012601                                                                  MOV (SP)+,R1
 016762  062006                          ADD (R0)+,SP                ;ADJUST STACK POINTER OVER ARGUMENTS
 016764  000110                          JMP @R0                     ;RETURN
```

```
                                ;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

016766                          DIVIDE: PUSH R2
016766  010246                                                                    MOV R2,-(SP)
016770  012702  000040                  MOV #32.,R2             ;SET UP SHIFT COUNT
016774  005005                          CLR R5                  ;START WITH ZERO REMAINDER
016776  006303                  1$:     ASL R3                  ;SHIFT LEFT INTO R5
017000  006104                          ROL R4
017002  006105                          ROL R5
017004  020005                          CMP R0,R5               ;WILL DIVISOR GO INTO REMAINDER
017006  101002                          BHI 2$                  ;ONLY SUBTRACT IF IT WILL
017010  160005                          SUB R0,R5               ;SUBTRACT DIVISOR
017012  005203                          INC R3                  ;PUT A ONE INTO QUOTIENT
017014  005302                  2$:     DEC R2                  ;COUNT THE SHIFTS
017016  001367                          BNE 1$
017020                                  POP R2
017020  012602                                                                    MOV (SP)+,R2
017022  000207                          RETURN
```

```
                                         ;LOADDM
                                         ;
                                         ;LOAD AND START A DM PROGRAM INTO A CONTROLLER
                                         ;
                                         ;INPUTS:
                                         ;       R5 - CONTROLLER TABLE ADDRESS
                                         ;       DMPROG - POINTER TO START OF DM PROGRAM IN MEMORY
                                         ;OUTPUTS:
                                         ;       IF LOAD SUCCEEDS - Z CLEAR
                                         ;                       CONTROLLER TABLE MARKED LOADED
                                         ;       IF ERROR - Z SET

017024  013701  002156                   LOADDM: MOV DMPROG,R1               ;GET STORAGE ADDRESS OF DM PROGRAM
017030  116165  000021  000042                   MOVB DMTMO(R1),C.TOT(R5)    ;GET TIMEOUT VALUE
017036  105065  000043                           CLRB C.TOT+1(R5)
017042  016504  000004                           MOV C.VEC(R5),R4            ;GET VECTOR OF UDA
017046                                           AND CT.VEC,R4
017046  042704  177000                                                                           BIC #↑C<CT.VEC>,R4
017052  010501                                   MOV R5,R1                   ;GET INTERRUPT SERVICE LINK
017054  062701  000006                           ADD #C.JSR,R1
017060                                           SETVEC R4,R1,#PRI07         ;SET UP INTERRUPT VECTOR
017060  012746  000340                                                                           MOV     #PRI07,-(SP)
017064  010146                                                                                   MOV     R1,-(SP)
017066  010446                                                                                   MOV     R4,-(SP)
017070  012746  000003                                                                           MOV     #3,-(SP)
017074  104437                                                                                   TRAP    C$SVEC
017076  062706  000010                                                                           ADD     #10,SP
                                                                             ;INITIALIZE UDA WITH SMALLEST
017102  004737  017704                           CALL UDAINT                 ; RING BUFFER AND INTERRUPTS ENABLED
017106  001444                                   BEQ LOADER                  ;BRANCH IF AN ERROR
```

```
017110  012700  000002                  MOV #OP.ESP,R0                 ;BUILD EXECUTE SUPPLIED PROGRAM COMMAND PACKET
017114  004737  017224                  CALL BLDCMD
017120  013764  002156  000124          MOV DMPROG,HC.CPK+P.UADR(R4)   ;LOAD MAIN PROGRAM ADDRESS
017126  017764  163024  000120          MOV @DMPROG,HC.CPK+P.BCNT(R4)  ;  AND SIZE
017134  013764  002156  000140          MOV DMPROG,HC.CPK+P.OVRL(R4)   ;LOAD OVERLAY ADDRESS
017142  067764  163010  000140          ADD @DMPROG,HC.CPK+P.OVRL(R4)
017150  004737  017310                  CALL SNDCMD                    ;SEND COMMAND TO UDA
017154  004737  017430                  CALL WAITMS                    ;WAIT FOR MESSAGE RESPONSE
017160  001417                          BEQ LOADER      ;ABORT IF NO RESPONSE
017162  032764  000037  000032          BIT #ST.MSK,HC.MPK+P.STS(R4)   ;CHECK FOR ERRORS
017170  001007                          BNE LOADE1
017172  042765  000024  000012          BIC #CT.CMD+CT.REQ,C.FLG(R5)   ;CLEAR COMMAND OUTSTANDING FLAG
017200  052765  000002  000012          BIS #CT.RN,C.FLG(R5)           ;SET DM PROGRAM RUNNING FLAG
017206  000207                          RETURN
```

```
                                   ;UDA FAILED TO DOWNLINE LOAD DM PROGRAM

  017210                           LOADE1: ERRDF 34,,ERR034
  017210  104455                                                                          TRAP    C$ERDF
  017212  000042                                                                          .WORD   34
  017214  000000                                                                          .WORD   0
  017216  012670                                                                          .WORD   ERR034
  017220  000264                   LOADER: SEZ                         ;SET Z TO INDICATE ERROR OCCURRED
  017222  000207                           RETURN
```

_9

```
                              ;BLDCMD
                              ;
                              ;BUILD A COMMAND IN COMMAND PACKET
                              ;
                              ;INPUTS:
                              ;         R5 - CONTROLLER TABLE ADDRESS
                              ;         R0 - COMMAND CODE
                              ;OUTPUTS:
                              ;         R4 - ADDRESS OF HOST COMM AREA
                              ;         COMMAND PACKET CONTAINING REF NUMBER AND OPCODE. ALL OTHER FIELDS CLEARED.
                              ;         CMD REFERRENCE NUMBER IN CONTROLLER TABLE INCREMENTED AND RESULT
                              ;         IN COMMAND PACKET.
                              ;         R0 - CONTENTS DESTROYED

017224                        BLDCMD: PUSH <R1,R0>
017224  010146                                                                    MOV R1,-(SP)
017226  010046                                                                    MOV R0,-(SP)
017230  016504  000014                MOV C.RING(R5),R4           ;GET ADDRESS OF HOST COMM AREA
017234  010400                        MOV R4,R0                   ;COPY TO R0
017236  062700  000100                ADD #HC.CEV,R0              ;COMPUTE ADDRESS OF COMMAND ENVELOPE
017242  012720  000060                MOV #HC.PSZ,(R0)+           ;LOAD PACKET LENGTH
017246  012701  001000                MOV #DUP,R1                 ;LOAD DIAG CIRCUIT IDENTIFIER
017252  022716  000031                CMP #OP.MWR,(SP)            ;IF CODE IS MAINTENANCE WRITE
017256  001002                        BNE BLDC0                   ;  GET OTHER CIRCUIT IDENTIFIER
017260  012701  177777                MOV #DIAG,R1
017264  010120                BLDC0:  MOV R1,(R0)+                ;PUT IDENTIFIER INTO PACKET
017266  012701  000030                MOV #<HC.PSZ>/2,R1          ;GET WORDS TO CLEAR
017272  005020                BLDC1:  CLR (R0)+                   ;CLEAR PACKET
017274  005301                        DEC R1
017276  001375                        BNE BLDC1
017300                                POP HC.CPK+P.OPCD(R4)       ;PUT OPCODE IN PACKET
017300  012664  000114                                                            MOV (SP)+,HC.CPK+P.OPCD(R4)
017304                                POP R1                      ;RESTORE R1
017304  012601                                                                    MOV (SP)+,R1
017306  000207                        RETURN
```

```
                                        ;SNDCMD
                                        ;
                                        ;SEND A COMMAND TO THE UDA.
                                        ;MARK BOTH PACKETS AVAILABLE TO THE
                                        ;UDA. SET COMMAND ISSUED BIT IN CONTROLLER TABLE AND INITIALIZE
                                        ;TIMEOUT COUNTER.
                                        ;
                                        ;INPUTS:
                                        ;       R5 - CONTROLLER TABLE ADDRESS
                                        ;OUTPUTS:
                                        ;       R4 - ADDRESS OF HOST COMM AREA


017310                                  SNDCMD: PUSH <R0,R1>
017310  010046                                                                                MOV R0,-(SP)
017312  010146                                                                                MOV R1,-(SP)
017314  016504  000014                          MOV C.RING(R5),R4               ;LOAD R4 WITH HOST COMM AREA ADDRESS
017320  005265  000050                          INC C.REF(R5)                   ;INCREMENT CMD REFERENCE NUMBER
017324  016564  000050  000104                  MOV C.REF(R5),HC.CPK+P.CRF(R4)  ;PUT IN PACKET
017332  012764  140000  000006                  MOV #RG.OWN+RG.FLG,HC.MCT(R4)   ;MARK MESSAGE PACKET AVAI! ABLE
017340  012764  100000  000012                  MOV #RG.OWN,HC.CCT(R4)          ;MARK COMMAND TO UDA
017346  005775  000000                          TST @(R5)                       ;TELL UDA COMMAND IS THERE
017352  052765  000004  000012                  BIS #CT.CMD,C.FLG(R5)           ;MARK COMMAND ISSUED
017360                                          POP <R1,R0>
017360  012601                                                                                MOV (SP)+,R1
017362  012600                                                                                MOV (SP)+,R0
017364  000207                                  RETURN
```

```
                                         ;CLRBUF
                                         ;
                                         ;CLEAR THE SPECIFIED DATA BUFFER IN THE HOST COMM AREA
                                         ;AND LOAD BUFFER DESCRIPTOR IN COMMAND PACKET TO THE BUFFER
                                         ;
                                         ;INPUTS:
                                         ;       R5 - CONTROLLER TABLE ADDRESS
                                         ;       R4 - ADDRESS OF HOST COMM AREA
                                         ;       R0 - OFFSET INTO HOST COMM AREA TO DATA BUFFER
                                         ;OUTPUTS:
                                         ;       DATA BUFFER CLEARED
                                         ;       COMMAND PACKET POINTING TO BUFFER
                                         ;       BYTE COUNT SET TO SIZE OF BUFFER
                                         ;       R4 - ADDRESS OF DATA BUFFER

 017366                                  CLRBUF: PUSH <R0,R1>
 017366  010046                                                                                          MOV R0,-(SP)
 017370  010146                                                                                          MOV R1,-(SP)
 017372  060400                                  ADD R4,R0                          ;ADD START OF HOST COMM AREA TO OFFSET
 017374  010064  000124                          MOV R0,HC.CPK+P.UADR(R4)           ;PUT BUFFER ADDRESS IN COMMAND PACKET
 017400  012764  000244  000120                  MOV #HC.BSZ,HC.CPK+P.BCNT(R4)      ;PUT SIZE OF BUFFER IN COMMAND PACKET
 017406  010004                                  MOV R0,R4                          ;PUT BUFFER ADDRESS IN R4
 017410  012701  000122                          MOV #HC.BSZ/2,R1                   ;GET SIZE OF BUFFER IN WORDS
 017414  005020                          CLRBFL: CLR (R0)+                          ;CLEAR ALL THE WORDS
 017416  005301                                  DEC R1
 017420  001375                                  BNE CLRBFL
 017422                                          POP <R1,R0>
 017422  012601                                                                                          MOV (SP)+,R1
 017424  012600                                                                                          MOV (SP)+,R0
 017426  000207                                  RETURN
```

L9

```
                                        ;WAITMS
                                        ;
                                        ;WAIT FOR UDA TO RESPOND WITH A MESSAGE PACKET
                                        ;
                                        ;INPUTS:
                                        ;       R5 - ADDRESS OF CONTROLLER TABLE
                                        ;OUTPUTS:
                                        ;       Z CLEAR IF NO ERROR
                                        ;       Z SET IF ERROR, MESSAGE PRINTED

017430                                  WAITMS: PUSH <R0,R1>
017430  010046                                                                          MOV R0,-(SP)
017432  010146                                                                          MOV R1,-(SP)
017434  012700  000036                          MOV #30.,R0                     ;SET TIME OUT VALUE OF 30 SECONDS
017440  010501                                  MOV R5,R1                       ;POINT TO TIME OUT COUNTER
017442  062701  000036                          ADD #C.TO,R1
017446  004737  017622                          CALL SETTO
017452  011500                          1$:     MOV (R5),R0                     ;GET ADDRESS OF UDAIP REGISTER
017454  032765  000010  000012                  BIT #CT.MSG,C.FLG(R5)           ;LOOK IF INTERRUPT OCCURRED
017462  001030                                  BNE 3$                          ;BRANCH IF SO
017464  016001  000002                          MOV 2(R0),R1                    ;LOOK AT UDASA REGISTER
017470  001034                                  BNE 4$                          ;BRANCH IF ERROR CODE PRESENT
017472                                          BREAK
017472  104422                                                                          TRAP    C$BRK
017474  005737  003206                          TST KW.CSR                      ;SEE IF A CLOCK ON SYSTEM
017500  001764                                  BEQ 1$
017502  023765  003220  000040                  CMP KW.EL+2,C.TOH(R5)           ;CHECK IF TIMEOUT HAS HAPPENED
017510  101005                                  BHI 2$
017512  001357                                  BNE 1$
017514  023765  003216  000036                  CMP KW.EL,C.TO(R5)
017522  103753                                  BLO 1$
017524                                  2$:     ERRDF 36,,ERR036
017524  104455                                                                          TRAP    C$ERDF
017526  000044                                                                          .WORD   36
017530  000000                                                                          .WORD   0
017532  012676                                                                          .WORD   ERR036
017534                                          POP <R1,R0>
017534  012601                                                                          MOV (SP)+,R1
017536  012600                                                                          MOV (SP)+,R0
017540  000264                                  SEZ
017542  000207                                  RETURN
```

```
  017544  042765  000010  000012  3$:     BIC #CT.MSG,C.FLG(R5)          ;CLEAR MESSAGE RECEIVED FLAG
  017552                                  POP <R1,R0>
  017552  012601                                                                             MOV (SP)+,R1
  017554  012600                                                                             MOV (SP)+,R0
  017556  000244                          CLZ                            ;GIVE NO ERROR RETURN
  017560  000207                          RETURN
  017562                          4$:     ERRDF 37,,ERR037
  017562  104455                                                                             TRAP    C$ERDF
  017564  000045                                                                             .WORD   37
  017566  000000                                                                             .WORD   0
  017570  012710                                                                             .WORD   ERR037
  017572                                  POP <R1,R0>
  017572  012601                                                                             MOV (SP)+,R1
  017574  012600                                                                             MOV (SP)+,R0
  017576  000264                          SEZ
  017600  000207                          RETURN
```

```
                                        ;NXMI
                                        ;
                                        ;NON-EXISTANT MEMORY SERVICE ROUTINE
                                        ;
                                        ;INPUTS:
                                        ;       NXMAD SET TO ZERO
                                        ;OUTPUTS:
                                        ;       NXMAD SET TO ONES IF NON-EXISTANT TRAP OCCURED
                                        ;
 017602                                 BGNSRV NXMI
 017602                                                                                      NXMI::

 017602  012737  177777  002172                 MOV #-1,NXMAD

 017610                                 ENDSRV
 017610                                                                                      L10031:
 017610  000002                                                                                     RTI
```

```
                                        ;UDASRV
                                        ;
                                        ;UDA INTERRUPT SERVICE ROUTINE. MARKS UDA CONTROLLER TABLE THAT AN
                                        ;INTERRUPT HAS BEEN RECEIVED.
                                        ;
                                        ;THIS ROUTINE IS CALLED BY A [JSR R0,UDASRV] INSTRUCTION FROM WITHIN
                                        ;THE CONTROLLER TABLE. THE PC STORED IN R0 IS THE ADDRESS OF THE C.FLG
                                        ;WORD IN THE CONTROLLER TABLE. THE STACK CONTAINS THE SAVED CONTENTS
                                        ;OF R0 FOLLOWED BY THE INTERRUPTED PC AND PS.
                                        ;
                                        ;INPUTS:
                                        ;       R0 - ADDRESS OF C.FLG WORD IN CONTROLLER TABLE
                                        ;       STACK - SAVED CONTENTS OF R0
                                        ;OUTPUTS:
                                        ;       CT.CMD CLEARED AND CT.MSG SET IN C.FLG WORD OF CONTROLLER TABLE
                                        ;       R0 - RESTORED FROM STACK

017612                                  BGNSRV UDASRV
017612                                                                          UDASRV::
017612  052710  000010                          BIS #CT.MSG,(R0)        ;SET CT.MSG
017616                                          POP R0                  ;RESTORE R0
017616  012600                                                                          MOV (SP)+,R0
017620                                  ENDSRV
017620                                                                          L10032:
017620  000002                                                                          RTI
```

```
                        ;SETTO
                        ;
                        ;SET TIMEOUT COUNTER TO SOME NUMBER OF SECONDS FROM CURRENT TIME.
                        ;
                        ;INPUTS:
                        ;         R0 - NUMBER OF SECONDS FOR TIMEOUT
                        ;         R1 - ADDRESS WHERE TWO WORD TIME TO BE PUT
                        ;OUTPUTS:
                        ;         R0 - CONTENTS DESTROYED
                        ;         R1 - INCREMENTED BY 2

                        ;COMPUTE CLOCK TICKS TIL TIMEOUT

017622                  SETTO:    PUSH <R2,R3>
017622  010246                                                                  MOV R2,-(SP)
017624  010346                                                                  MOV R3,-(SP)
017626  005002                    CLR R2                  ;CLEAR PRODUCT
017630  013703  003214            MOV KW.HZ,R3            ;GET MULTIPLICAND
017634  006200          SET00:    ASR R0                  ;SHIFT MULTIPLIER TO RIGHT
017636  103001                    BCC SET01               ;IF A ONE BIT SHIFTED OUT
017640  060302                    ADD R3,R2               ;  ADD MULTIPLICAND TO PRODUCT
017642  006303          SET01:    ASL R3                  ;DOUBLE THE MULTIPLICAND
017644  005700                    TST R0
017646  001372                    BNE SET00               ;CONTINUE UNTIL MULTIPLIER IS ZERO

                        ;GET CURRENT TIME

017650  013700  003216  SET02:    MOV KW.EL,R0            ;GET TIME
017654  013703  003220            MOV KW.EL+2,R3
017660  020037  003216            CMP R0,KW.EL            ;IF CHANGED DURING RETRIEVAL
017664  001371                    BNE SET02               ;  GET IT AGAIN

                        ;ADD TIME TIL TIMEOUT

017666  060200                    ADD R2,R0               ;ADD
017670  005503                    ADC R3

                        ;PUT RESULT IN STORAGE

017672  010021                    MOV R0,(R1)+
017674  010311                    MOV R3,(R1)

017676                            POP <R3,R2>
017676  012603                                                                  MOV (SP)+,R3
017700  012602                                                                  MOV (SP)+,R2
017702  000207                    RETURN
```

```
                                  ;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.
                                  ;IMPLICIT INPUTS:
                                  ;       C.RING(R5) - ADDRESS GIVEN TO UDA AS START OF RING BUFFER.
                                  ;       LENGTH OF RING STRUCTURE IS ONE ENTRY EACH.
                                  ;OUTPUTS:
                                  ;       CONDITION Z - SET IF ANY ERROR REPORTED. CLEAR IF NO ERROR.
                                  ;       R4 - ADDRESS OF UDAIP REGISTER IN UDA
                                  ;       R5 - UNCHANGED.
                                  ;
                                  ;FILL HOST COMMUNICATION AREA WITH ALL ONES

 017704  016502  000014           UDAINT: MOV C.RING(R5),R2                        ;GET FIRST ADDRESS OF RING BUFFER
 017710  012703  000006                   MOV #<HC.RSZ*2+HC.ISZ>/2,R3                       ;GET SIZE OF RING BUFFER
 017714  012722  177777           UDAI1L: MOV #-1,(R2)+                   ;WRITE ONES TO BUFFER
 017720  005303                           DEC R3                          ;COUNT THE WORDS IN BUFFER
 017722  003374                           BGT UDAI1L                      ;LOOP UNTIL ENTIRE BUFFER WRITTEN

                                  ;DO THE INITIALIZATION

 017724  004737  020152                   CALL UDAIST                     ;DO FIRST THREE STEPS
 017730  103506                           BCS UDAIEX                      ;GET OUT IF UDA MICROCODE REPORTED FAILURE
 017732  012364  000002                   MOV (R3)+,2(R4)                 ;WRITE NEXT WORD TO UDASA REGISTER
 017736  012703  000310                   MOV #200.,R3                    ;GET TRY COUNTER
 017742  016402  000002           UDAI1A: MOV 2(R4),R2                    ;LOOK AT UDASA
 017746  001407                           BEQ UDAI1C
 017750  005303                           DEC R3
 017752  001373                           BNE UDAI1A
 017754                                   ERRDF 24,,ERR024
 017754  104455                                                                             TRAP    C$ERDF
 017756  000030                                                                             .WORD   24
 017760  000000                                                                             .WORD   0
 017762  012564                                                                             .WORD   ERR024
 017764  000470                           BR UDAIEX
 017766  010264  000002           UDAI1C: MOV R2,2(R4)                    ;WRITE 0 TO UDASA (PURGE)
 017772  011402                           MOV (R4),R2                     ;READ FROM UDAIP (POLL)
 017774  004737  020470                   CALL UDARSP                     ;WAIT FOR STEP OR ERROR BIT
 020000  103462                           BCS UDAIEX                      ;GET OUT IF UDA MICROCODE REPORTED FAILURE
 020002  042702  174017                   BIC #↑C<SA.CNT>,R2              ;CLEAR OTHER BITS
 020006  006202                           ASR R2                          ;MOVE TO RIGHT OF REGISTER
 020010  006202                           ASR R2
 020012  006202                           ASR R2
 020014  006202                           ASR R2
 020016  020227  000006                   CMP R2,#6                       ;CONTROLLER MODEL MUST BE 6
 020022  001410                           BEQ UDAI2
 020024  020227  000015                   CMP R2,#13.                     ;  OR 13
 020030  001405                           BEQ UDAI2
 020032                                   ERRDF 14,,ERR014                ;REPORT CONTROLLER NEEDS NEW REVISION
 020032  104455                                                                             TRAP    C$ERDF
 020034  000016                                                                             .WORD   14
```

```
        020036  000000                                                                  .WORD   0
        020040  012370                                                                  .WORD   ERR014
     52 020042  000441                          BR UDAIEX
```

```
                                         ;CHECK HOST COMMUNICATION AREA FOR ALL ZEROS

020044  016502  000014                   UDAI2:  MOV C.RING(R5),R2            ;GET FIRST ADDRESS OF RING BUFFER
020050  010201                                   MOV R2,R1                    ;SAVE FOR ERROR MFSSAGE
020052  012703  000006                           MOV #<HC.RSZ*2+HC.ISZ>/2,R3  ;GET SIZE OF RING BUFFER
020056  005722                           UDAI2L: TST (R2)+                    ;CHECK WORD IN BUFFER
020060  001003                                   BNE UDAI2E                   ;GO TO ERROR REPORTER IF NOT ZERO
020062  005303                                   DEC R3                       ;COUNT THE WORDS IN BUFFER
020064  003374                                   BGT UDAI2L                   ;LOOP UNTIL ALL WORDS CHECKED
020066  000405                                   BR UDAI3

020070                                   UDAI2E: ERRDF 23,,ERR023             ;REPORT BUFFER NOT CLEARED
020070  104455                                                                             TRAP    C$ERDF
020072  000027                                                                             .WORD   23
020074  000000                                                                             .WORD   0
020076  012506                                                                             .WORD   ERR023
020100  000422                                   BR UDAIEX

                                         ;SEND GO BIT TO UDASA REGISTER TO END INITIALIZATION

020102                                   UDAI3:
020102  012700  000001                           MOV #SA.GO,R0
020106  010064  000002                           MOV R0,2(R4)                 ;SEND TO UDA
020112  016501  000014                           MOV C.RING(R5),R1
020116  010161  000004                           MOV R1,HC.MSG(R1)
020122  062761  000020  000004                   ADD #HC.MPK,HC.MSG(R1)
020130  010161  000010                           MOV R1,HC.CMD(R1)
020134  062761  000104  000010                   ADD #HC.CPK,HC.CMD(R1)
020142  000244                                   CLZ                          ;CLEAR Z AS NO ERROR INDICATION
020144  000207                                   RETURN

                                         ;ERROR RETURN

020146  000264                           UDAIEX: SEZ                          ;SET Z TO INDICATE ERROR OCCURRED
020150  000207                                   RETURN
```

```
                                        ;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

                                        ;LOAD TABLE OF DATA TO SEND TO UDASA REGISTER

020152                                  UDAIST: BREAK
020152  104422                                                                                  TRAP    C$BRK
020154                                          PUSH R1
020154  010146                                                                                  MOV R1,-(SP)
020156  016504  000004                          MOV C.VEC(R5),R4
020162                                          AND CT.VEC,R4
020162  042704  177000                                                                          BIC #↑C<CT.VEC>,R4
020166  006204                                  ASR R4
020170  006204                                  ASR R4
020172  052704  100000                          BIS #SA.STP,R4                  ;SET STEP BIT IN DATA WORD
020176  010437  020370                          MOV R4,UDAID1                   ;LOAD INTERRUPT VECTOR
020202  016537  000014  020374                  MOV C.RING(R5),UDAID2           ; )AD MEMORY ADDRESS
020210  062737  000004  020374                  ADD #HC.MSG,UDAID2              ;  OF FIRST RESPONSE RING

                                        ;START THE INITIALIZATION BY WRITING TO UDAIP REGISTER

020216  016504  000000                          MOV C.UADR(R5),R4               ;GET ADDRESS OF UDAIP REGISTER
020222  005037  002172                          CLR NXMAD                       ;CLEAR MEMORY ERROR FLAG
020226                                          SETVEC #4,#NXMI,#PRI07          ;SET UP VECTOR 4
020226  012746  000340                                                                          MOV     #PRI07,-(SP)
020232  012746  017602                                                                          MOV     #NXMI,-(SP)
020236  012746  000004                                                                          MOV     #4,-(SP)
020242  012746  000003                                                                          MOV     #3,-(SP)
020246  104437                                                                                  TRAP    C$SVEC
020250  062706  000010                                                                          ADD     #10,SP
020254  005764  000002                          TST 2(R4)                       ;ACCESS UDASA REGISTER
020260  005014                                  CLR (R4)                        ;WRITE TO UDAIP
020262                                          CLRVEC #4                       ;GIVE UP THE VECTOR
020262  012700  000004                                                                          MOV     #4,R0
020266  104436                                                                                  TRAP    C$CVEC
020270  005737  002172                          TST NXMAD                       ;SEE IF A MEMORY ERROR OCCURRED
020274  001406                                  BEQ UDAISG
020276                                          ERRDF 20,,ERR020
020276  104455                                                                                  TRAP    C$ERDF
020300  000024                                                                                  .WORD   20
020302  000000                                                                                  .WORD   0
020304  012404                                                                                  .WORD   ERR020
020306  000261                                  SEC
020310  000424                                  BR UDAISE
```

```
                                          ;SET UP LOOP PARAMETERS TO EXECUTE THE FOUR STEPS OF INITIALIZATION

 020312  012737  004000  020626   UDAISG: MOV #SA.S1,UDARSD                  ;STORE RESPONSE MASK
 020320  012703  020366                   MOV #UDAIDT,R3                     ;AND INDEX TO TABLE

                                  ;WAIT FOR AND CHECK RESPONSE DATA

 020324  004737  020470           UDAISL: CALL UDARSP                        ;WAIT FOR STEP OR ERROR BITS
 020330  103414                           BCS UDAISE                         ;EXIT IF ERROR
 020332  004733                           CALL @(R3)+                        ;CALL RESPONSE CHECKER FOR STEP
 020334  103412                           BCS UDAISE                         ;GET OUT IF ERROR
 020336  006337  020626                   ASL UDARSD                         ;SHIFT TO NEXT STEP BIT
 020342  032737  040000  020626           BIT #SA.S4,UDARSD                  ;CHECK IF NOW AT STEP 4
 020350  001003                           BNE UDAISX                         ;GET OUT IF SO
 020352  012364  000002                   MOV (R3)+,2(R4)                    ;WRITE DATA TO UDASA REGISTER
 020356  000762                           BR UDAISL                          ;STAY IN LOOP

 020360  000241                   UDAISX: CLC                                ;CLEAR CARRY FOR NO ERROR INDICATION
 020362                           UDAISE: POP R1
 020362  012601                                                                             MOV (SP)+,R1
 020364  000207                           RETURN
```

```
                                  ;DATA TO BE SENT AND RECEIVED BY UDA INITIALIZATION

020366  020402                    UDAIDT: .WORD UDAIR1                 ;FIRST WORD RESPONSE CHECK ROUTINE
020370  000000                    UDAID1: .WORD 0                      ;FIRST WORD TO SEND TO UDASA
020372  020414                            .WORD UDAIR2                 ;SECOND WORD RESPONSE CHECK ROUTINE
020374  000000                    UDAID2: .WORD 0                      ;SECOND WORD TO SEND TO UDASA
020376  020434                            .WORD UDAIR3                 ;THIRD WORD RESPONSE CHECK ROUTINE
020400  100000                    UDAID3: .WORD SA.TST                 ;THIRD WORD TO SEND TO UDASA

                                  ;RESPONSE CHECK FOR FIRST WORD FROM UDASA
                                  ;CHECK FOR PROPER CONTROLLER TYPE

020402  012701  004400            UDAIR1: MOV #SA.S1+SA.DI,R1          ;SET STEP ONE BIT
020406  042702  001140                    BIC #<SA.QB+SA.MP+SA.SM>,R2  ;MASK OFF UNWANTED BITS
020412  000416                            BR UDAIRC                    ;NOW COMPARE

                                  ;RESPONSE CHECK FOR SECOND WORD FROM UDASA
                                  ;CHECK FOR ECHO OF INTI AND VECTOR

020414  013701  020370            UDAIR2: MOV UDAID1,R1                ;GET WORD SENT TO UDASA
020420  000301                            SWAB R1                      ;GET HIGH 8 BITS
020422  042701  177400                    BIC #177400,R1
020426  052701  010000                    BIS #SA.S2,R1                ;SET STEP 2 BIT
020432  000406                            BR UDAIRC                    ;NOW COMPARE

                                  ;RESPONSE CHECK FOR THIRD WORD FROM UDASA
                                  ;CHECK FOR ECHO OF MESSAGE AND COMMAND RING LENGTHS

020434  013701  020370            UDAIR3: MOV UDAID1,R1                ;GET WORD SENT TO UDASA
020440  042701  177400                    BIC #177400,R1               ;JUST LOW 8 BITS
020444  052701  020000                    BIS #SA.S3,R1                ;SET STEP 3 BIT

                                  ;COMPARE EXPECTED DATA IN R1 WITH ACTUAL DATA IN R2

020450  020102                    UDAIRC: CMP R1,R2                    ;COMPARE THE DATA
020452  001405                            BEQ UDAIRX                   ;EXIT IF COMPARED CORRECTLY
020454                                    ERRDF 25,,ERR025             ;REPORT ERROR
020454  104455                                                                                 TRAP     C$ERDF
020456  000031                                                                                 .WORD    25
020460  000000                                                                                 .WORD    0
020462  012600                                                                                 .WORD    ERR025
020464  000261                            SEC
020466  000207                    UDAIRX: RETURN
```

```
                                      ;UDARSP
                                      ;
                                      ;WAIT FOR UDA TO RESPOND WITH DATA IN UDASA REGISTER.
                                      ;EITHER STEP BIT FROM MASK IN LOCATION UDARSD OR ERROR BIT
                                      ;WILL CAUSE A TERMINATION.
                                      ;AN ERROR MESSAGE WILL BE PRINTED IF THE UDA DOES NOT RESPOND
                                      ;IN 10 SECONDS OR IF ERROR SETS.
                                      ;
                                      ;INPUTS:
                                      ;        UDASRD - MASK OF STEP BIT TO LOOK FOR
                                      ;        R5 - ADDRESS OF CONTROLLER TABLE
                                      ;        R4 - ADDRESS OF UDAIP REGISTER
                                      ;OUTPUTS:
                                      ;        ERROR MESSAGE IF TIME OUT ON RESPONSE OR ERROR BIT SETS
                                      ;        R2 - DATA FROM UDASA REGISTER
                                      ;        CARRY SET IF ERROR BIT SETS OR TIME OUT

020470                                UDARSP: PUSH R1
020470  010146                                                                                MOV R1,-(SP)
020472  052737  100000  020626                BIS #SA.ERR,UDARSD          ;SET ERROR BIT IN MASK WORD
020500  012700  000012                        MOV #10.,R0                 ;SET UP FOR 10 SECOND TIMEOUT
020504  010501                                MOV R5,R1                   ;POINT TO COUNTER IN CONTROLLER TABLE
020506  062701  000036                        ADD #C.TO,R1
020512  004737  017622                        CALL SETTO
020516                                        POP R1
020516  012601                                                                                MOV (SP)+,R1
020520  033764  020626  000002        UDARS1: BIT UDARSD,2(R4)            ;LOOK AT ERROR AND STEP BIT
020526  001024                                BNE UDARS2                  ;BRANCH IF EITHER SET
020530                                        BREAK
020530  104422                                                                                TRAP    C$BRK
020532  005737  003206                        TST KW.CSR                  ;SEE IF CLOCK ON SYSTEM
020536  001770                                BEQ UDARS1
020540  023765  003220  000040                CMP KW.EL+2,C.TOH(R5)       ;CHECK IF TIME OUT OCCURRED
020546  101005                                BHI 1$
020550  001363                                BNE UDARS1
020552  023765  003216  000036                CMP KW.EL,C.TO(R5)
020560  103757                                BLO UDARS1
020562  016402  000002                1$:     MOV 2(R4),R2                ;GET REGISTER CONTENTS
020566                                        ERRDF 22,,ERR022            ;REPORT TIME OUT ERROR
020566  104455                                                                                TRAP    C$ERDF
020570  000026                                                                                .WORD   22
020572  000000                                                                                .WORD   0
020574  012460                                                                                .WORD   ERR022
020576  000407                                BR UDARSE
```

```
                                   ;CHECK IF ERROR BIT SET

020600  016402  000002             UDARS2: MOV 2(R4),R2                 ;GET REGISTER CONTENTS
020604  100006                             BPL UDARSX                   ;EXIT IF ERROR NOT SET
020606                                     ERRDF 21,,ERR021             ;REPORT ERROR INFO
020606  104455                                                                                TRAP    C$ERDF
020610  000025                                                                                .WORD   21
020612  000000                                                                                .WORD   0
020614  012416                                                                                .WORD   ERR021
020616  000261                     UDARSE: SEC
020620  000207                             RETURN

                                   ;NORMAL EXIT

020622  000241                     UDARSX: CLC                          ;CLEAR CARRY AS NO ERROR INDICATION
020624  000207                             RETURN

                                   ;LOCATION FOR STEP BIT MASK

020626  000000                     UDARSD: .WORD 0                      ;LOAD BY CALLING ROUTINE
```

```
                                        ;KW11I
                                        ;
                                        ;CLOCK INTERRUPT SERVICE ROUTINE

020630                                  BGNSRV KW11I
020630                                                                                  KW11I::
020630  062737  000001  003216                   ADD #1,KW.EL                ;COUNT THE INTERRUPT
020636  005537  003220                           ADC KW.EL+2
020642  012777  000105  162336                   MOV #KWOUT.,@KW.CSR         ;RESTART THE CLOCK
020650                                  ENDSRV
020650                                                                                  L10033:
020650  000002                                                                                   RTI
```

```
                                ;RNTIME
                                ;
                                ;PRINT RUNTIME
                                ;
                                ;INPUTS:
                                ;       KW.EL - CONTAINS ELAPSED TIME
                                ;       KW.HZ - HERTZ OF CLOCK
                                ;OUTPUTS:
                                ;       IF CLOCK ON SYSTEM:
                                ;          "  RUNTIME HH:MM:SS " PRINTED
                                ;       IF NO CLOCK: ONE SPACE IS PRINTED

020652  005737  003206          RNTIME: TST KW.CSR              ;CHECK IF A CLOCK PRESENT
020656  001465                          BEQ RNTIMX              ;BRANCH IF NOT
020660                                  PUSH <R0,R3,R4,R5>
020660  010046                                                                          MOV R0,-(SP)
020662  010346                                                                          MOV R3,-(SP)
020664  010446                                                                          MOV R4,-(SP)
020666  010546                                                                          MOV R5,-(SP)
020670  013703  003216                  MOV KW.EL,R3            ;GET ELAPSED TIME
020674  013704  003220                  MOV KW.EL+2,R4
020700  013700  003214                  MOV KW.HZ,R0            ;GET SPEED OF CLOCK
020704  004737  016766                  CALL DIVIDE             ;COMPUTE SECONDS OF ELAPSED TIME
020710  012700  000074                  MOV #60.,R0             ;NOW DIVIDE BY 60
020714  004737  016766                  CALL DIVIDE             ; TO COMPUTE MINUTES
020720                                  PUSH R5                 ;SAVE REMAINDER AS SECONDS
020720  010546                                                                          MOV R5,-(SP)
020722  004737  016766                  CALL DIVIDE             ;DIVIDE BY 60 AGAIN
020726                                  PNT RNTIM,R3            ;PRINT HOURS
020726  010346                                                                          MOV R3,-(SP)
020730  004137  016720                                                                  JSR R1,LPNT
020734  003712                                                                          .WORD RNTIM
020736  000002                                                                          .WORD PNT.CT
020740  020527  000011                  CMP R5,#9.              ;IF MINUTES 9 OR LESS
020744  003004                          BGT 1$
020746                                  PRINT #'0               ;PRINT A LEADING ZERO
020746  112700  000060                                                                  MOVB #'0,R0
020752  004737  016510                                                                  CALL CPNT
020756                          1$:     PNT RNTIM1,R5           ;NOW PRINT MINUTES
020756  010546                                                                          MOV R5,-(SP)
020760  004137  016720                                                                  JSR R1,LPNT
020764  003735                                                                          .WORD RNTIM1
020766  000002                                                                          .WORD PNT.CT
020770                                  POP R5                  ;GET SECONDS
020770  012605                                                                          MOV (SP)+,R5
020772  020527  000011                  CMP R5,#9.              ;IF 9 OR LESS
020776  003004                          BGT 2$
021000                                  PRINT #'0               ;PRINT A LEADING ZERO
021000  112700  000060                                                                  '.OVB #'0,R0
021004  004737  016510                                                                  CALL CPNT
021010                          2$:     PNT RNTIM2,R5           ;NOW PRINT SECONDS
021010  010546                                                                          MOV R5,-(SP)
021012  004137  016720                                                                  JSR R1,LPNT
021016  003743                                                                          .WORD RNTIM2
021020  000002                                                                          .WORD PNT.CT
021022                                  POP <R5,R4,R3,R0>       ;HOUPS IN R3
021022  012605                                                                          MOV (SP)+,R5
```

```
        021024  012604                                                                                   MOV (SP)+,R4
        021026  012603                                                                                   MOV (SP)+,R3
        021030  012600                                                                                   MOV (SP)+,R0
     35 021032                            RNTIMX: PRINT <#' >                 ;PRINT A SPACE
        021032  112700  000040                                                                           MOVB #' ,R0
        021036  004737  016510                                                                           CALL CPNT
     36 021042  000207                            RETURN
```

```
021044                          DATE:   GMANID DATEQ,DATEI,A,-1,1,11.,YES       ;GET DATE
021044  104443                                                                                  TRAP    C$GMAN
021046  000406                                                                                  BR      10000$
021050  003270                                                                                  .WORD   DATEI
02'052  000152                                                                                  .WORD   T$CODE
021054  003544                                                                                  .WORD   DATEQ
021056  177777                                                                                  .WORD   -1
021060  000001                                                                                  .WORD   T$LOLIM
021062  000013                                                                                  .WORD   T$HILIM
021064                                                                                  10000$:
021064  012705  003270                  MOV #DATEI,R5   ;GET POINTER TO ANSWER
021070  121527  000060                  CMPB (R5),#'0
021074  103443                          BLO DERR
021076  122527  000071          DAY:    CMPB (R5)+,#'9
021102  101040                          BHI DERR
021104  121527  000055                  CMPB (R5),#'-
021110  001406                          BEQ DAS1
021112  121527  000060                  CMPB (R5),#'0
021116  103432                          BLO DERR
021120  122527  000071                  CMPB (R5)+,#'9
021124  101027                          BHI DERR
021126  122527  000055          DAS1:   CMPB (R5)+,#'-
021132  001024                          BNE DERR
021134  012704  000014                  MOV #12.,R4     ;GET NUMBER OF MONTH
021140  012703  003345                  MOV #MONTHS,R3  ;GET POINTER TO MONTH NAMES
021144  005000                  MON1:   CLR R0
021146  121523                          CMPB (R5),(R3)+
021150  001401                          BEQ MON2
021152  005200                          INC R0
021154  126523  000001          MON2:   CMPB 1(R5),(R3)+
021160  001401                          BEQ MON3
021162  005200                          INC R0
021164  126523  000002          MON3:   CMPB 2(R5),(R3)+
021170  001401                          BEQ MON4
021172  005200                          INC R0
021174  005700                  MON4:   TST R0
021176  001407                          BEQ MON5
021200  005304                          DEC R4
021202  001360                          BNE MON1
021204                          DERR:   PNTF DATEX
021204  004137  016662                                                                          JSR R1,LPNTF
021210  012141                                                                                  .WORD DATEX
021212  000000                                                                                  .WORD PNT.CT
021214  000713                          BR DATE
021216  012701  003304          MON5:   MOV #DATEO,R1   ;GET POINTER TO DATE FOR FORMATTER
021222  010403                          MOV R4,R3       ;GET COPY OF MONTH NUMBER
021224  020327  000012                  CMP R3,#10.     ;  IF 10 OR GREATER
021230  103404                          BLO MON6
021232  112721  000061                  MOVB #'1,(R1)+  ;PUT A "1" IN OUTPUT
021236  162703  000012                  SUB #10.,R3
021242  062703  000060          MON6:   ADD #'0,R3      ;CONVERT MONTH NUMBER TO ASCII
021246  110321                          MOVB R3,(R1)+   ;PUT A NUMBER IN OUTPUT
021250  112721  000055                  MOVB #'-,(R1)+  ;PUT A "-" IN OUTPUT
021254  062704  003410                  ADD #DAYS-1,R4  ;GET POINTER TO DAYS IN MONTH
                                                                ;INDEXED BY NUMBER OF MONTH
021260  012703  003270                  MOV #DATEI,R3   ;GET POINTER TO DATE INPUT
021264  005000                          CLR R0
```

```
021266  121327  000055        DAY1:   CMPB (R3),#'-
021272  001413                        BEQ DAY2
021274  111321                        MOVB (R3),(R1)+ ;PUT DAY CHARACTER IN OUTPUT
021276  006300                        ASL R0
021300  010002                        MOV R0,R2
021302  006300                        ASL R0
021304  006300                        ASL R0
021306  060200                        ADD R2,R0
021310  112302                        MOVB (R3)+,R2
021312  162702  000060                SUB #'0,R2
021316  060200                        ADD R2,R0
021320  000762                        BR DAY1
021322  120014                DAY2:   CMPB R0,(R4)
021324  101327                        BHI DERR
021326  005700                        TST R0   ;SEE IF DATE IS ZERO
021330  001725                        BEQ DERR        ;ERROR IF SO
021332  062705  000003                ADD #3,R5
021336  121527  000055                CMPB (R5),#'-   ;CHECK FOR "-" BETWEEN DAY
021342  001320                        BNE DERR        ;  AND YEAR IN OUTPUT
021344  112521                        MOVB (R5)+,(R1)+        ;PUT "-" IN OUTPUT
021346  010504                        MOV R5,R4       ;GET COPY OF INPUT STRING POINTER
021350  005000                        CLR R0
021352  005002                        CLR R2
021354  121427  000060        YER1:   CMPB (R4),#'0
021360  103416                        BLO YER2
021362  121427  000071                CMPB (R4),#'9
021366  101013                        BHI YER2
021370  006300                        ASL R0
021372  010003                        MOV R0,R3
021374  006300                        ASL R0
021376  006300                        ASL R0
021400  060300                        ADD R3,R0
021402  112403                        MOVB (R4)+,R3
021404  162703  000060                SUB #'0,R3
021410  060300                        ADD R3,R0
021412  005202                        INC R2
021414  000757                        BR YER1
021416  105714                YER2:   TSTB (R4)
021420  001271                        BNE DERR
021422  020227  000002                CMP R2,#2
021426  001407                        BEQ YER3
021430  020227  000004                CMP R2,#4
021434  001263                        BNE DERR
021436  020027  003554                CMP R0,#1900.
021442  103660                        BLO DERR
021444  000413                        BR YER5
021446  012702  003425        YER3:   MOV #YEAR19,R2
021452  020027  000106                CMP R0,#70.
021456  103002                        BHIS YER4
021460  012702  003430                MOV #YEAR20,R2
021464  105712                YER4:   TSTB (R2)
021466  001402                        BEQ YER5
021470  112221                        MOVB (R2)+,(R1)+
021472  000774                        BR YER4
021474  112521                YER5:   MOVB (R5)+,(R1)+
021476  001376                        BNE YER5
021500  000207                        RETURN
```

```

021502  000000          BRSAV:  .WORD   0                       ;DEFAULT BR LEVEL AND VECTOR

021504                          ENDMOD
```

```
                                .SBTTL  PROTECTION TABLE

021504                                  BGNMOD

                                ;++
                                ; THIS TABLE IS USED BY THE RUNTIME SERVICES
                                ; TO PROTECT THE LOAD MEDIA.
                                ;--

021504                                  BGNPROT
021504                                                                  L$PROT::

021504  177777                          -1                      ;OFFSET INTO P-TABLE FOR CSR ADDRESS
021506  177777                          -1                      ;OFFSET INTO P-TABLE FOR MASSBUS ADDRESS
021510  177777                          -1                      ;OFFSET INTO P-TABLE FOR DRIVE NUMBER

021512                                  ENDPROT

```

```

                                     .SBTTL  INITIALIZE SECTION

                                     ;++
                                     ;       THE INITIALIZE SECTION CONTAINS THE CODING THAT IS PERFORMED
                                     ;       AT THE BEGINNING OF EACH PASS. THIS CODE IS EXECUTED UNDER FIVE
                                     ;       CONDITIONS.  THERE
                                     ;       ARE SUPERVISOR EVENT FLAGS THAT ARE USED TO LET THE
                                     ;       DIAGNOSTIC KNOW UNDER WHICH CONDITION THE EXECUTION IS TAKING
                                     ;       PLACE.  THE EVENT FLAGS ARE READ USING THE "READEF" MACRO.
                                     ;       THE CONDITIONS UNDER WHICH THE INIT CODE IS EXECUTED AND THE
                                     ;       CORRRESPONDING EVENT FLAGS ARE:
                                     ;               START COMMAND           EF.START
                                     ;               RESTART COMMAND         EF.RESTART
                                     ;               CONTINUE COMMAND        EF.CONTINUE
                                     ;               POWERDOWN/POWERUP       EF.PWR
                                     ;               NEW PASS                EF.NEW
                                     ;
                                     ;       IF HERE FROM START COMMAND THEN
                                     ;               SET ISTRT BIT & CLEAR OTHER BITS IN FLAG
                                     ;
                                     ;       IF HERE FROM RESTART COMMAND THEN
                                     ;               SET IREST BIT IN IFLAGS
                                     ;
                                     ;       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
                                     ;
                                     ;       IF HERE FROM CONTINUE COMMAND THEN
                                     ;               SET ICONT BIT IN IFLAGS
                                     ;               EXIT INIT SECTION
                                     ;
                                     ;       IF HERE FROM POWER FAIL RESTART THEN
                                     ;               EXIT INIT SECTION
                                     ;
                                     ;       IF HERE FROM NEW PASS OR SUB-PASS THEN
                                     ;               LOOK FOR ANY ADDED OR DROPPED UNITS
                                     ;               EXIT INIT SECTION
                                     ;--

 021512                                      BGNINIT
 021512                                                                          L$INIT::
                                                                 ;HERE FROM START COMMAND?
 021512                                      READEF  #EF.STA
 021512  012700  000040                                                                  MOV     #EF.STA,R0
 021516  104447                                                                          TRAP    C$REFG
                                                                 ;BRANCH TO 1$ IF NOT, ELSE
 021520                                      BNCOMPLETE      1$
 021520  103004                                                                          BCC     1$
 021522  012737  000010  003204              MOV     #ISTRT,IFLAGS           ;SET START BIT IN FLAG.
 021530  000432                              BR      INIT1
 021532                              1$:                                 ;HERE FROM RESTART COMMAND?
 021532                                      READEF  #EF.RES
```

```
021532  012700  000037                                                                          MOV     #EF.RES,R0
021536  104447                                                                                  TRAP    C$REFG
                                                                    ;BRANCH TO 2$ IF NOT, ELSE
021540                                    BNCOMPLETE      2$
021540  103004                                                                                  BCC     2$
021542  052737  000004  003204            BIS     #IREST,IFLAGS     ;SET RESTART BIT IN FLAG.
021550  000422                            BR      INIT1
021552                            2$:                               ;HERE FROM CONTINUE COMMAND?
021552                                    READEF  #EF.CON
021552  012700  000036                                                                          MOV     #EF.CON,R0
021556  104447                                                                                  TRAP    C$REFG
                                                                    ;BRANCH TO 3$ IF NOT, ELSE
021560                                    BNCOMPLETE      3$
021560  103007                                                                                  BCC     3$
021562  042737  000020  003204            BIC     #ISTRTH,IFLAGS    ;CLEAR 1ST TIME THRU FLAG AND
021570  052737  000002  003204            BIS     #ICONT,IFLAGS     ;SET CONTINUE BIT IN FLAG.
021576  000405                            BR      INIT0
021600                            3$:                               ;HERE FROM POWER FAIL?
021600                                    READEF  #EF.PWR
021600  012700  000034                                                                          MOV     #EF.PWR,R0
021604  104447                                                                                  TRAP    C$REFG
                                                                    ;BRANCH TO INIT0 IF POWER FAIL, ELSE
021606                                    BCOMPLETE       INIT0
021606  103401                                                                                  BCS     INIT0
021610                            INITQT: DOCLN                     ; ABORT PROGRAM ON NEW PASS
021610  104444                                                                                  TRAP    C$DCLN

021612  000137  022376            INIT0:  JMP     INITXX            ; EXIT THE INITIALIZE SECTION.

                                  ;
                                  ;       INITIALIZE KW11 CLOCK, FREE MEMORY AND IP ADDRESS TABLE
                                  ;       DURING START OR RESTART COMMAND ONLY
                                  ;

021616  012700  000003            INIT1:  MOV     #SO.FMT,R0        ; GET BITS FOR REFORMAT MODE FLAG
021622  030037  002136                    BIT     R0,SFPTBL         ; CHECK IF REFORMAT
021626  001011                            BNE     1$                ; IF SO, CONTINUE
021630  012700  000004                    MOV     #SO.CNS,R0        ; GET BIT FOR RECONSTRUCT FLAG
021634  030037  002136                    BIT     R0,SFPTBL         ; CHECK IF RECONSTRUCT MODE
021640  001004                            BNE     1$                ; IF SO, CONTINUE
021642  006300                            ASL     R0                ; GET BIT FOR RESTORE MODE
021644  030037  002136                    BIT     R0,SFPTBL         ; CHECK IF RESTORE MODE
021650  001757                            BEQ     INITQT            ; IF NONE OF ABOVE, ABORT TEST
021652  010037  003200            1$:     MOV     R0,MODE           ; SAVE MODE FLAGS

        000105                            KWOUT.=105                ; DATA TO START CLOCK

021656  005037  003216                    CLR     KW.EL             ;CLEAR ELAPSED TIME
021662  005037  003220                    CLR     KW.EL+2
021666                                    CLOCK   L,R0              ;SEE IF L-CLOCK PRESENT
021666  012700  000114                                                                          MOV     #'L,R0
021672  104462                                                                                  TRAP    C$CLCK
021674                                    BCOMPLETE       2$
021674  103413                                                                                  BCS     2$
021676                                    CLOCK   P,R0              ;SEE IF P-CLOCK PRESENT
021676  012700  000120                                                                          MOV     #'P,R0
021702  104462                                                                                  TRAP    C$CLCK
```

```
 96 021704                              BCOMPLETE       2$
    021704  103407                                                                  BCS     2$
 97 021706  005037  003206              CLR     KW.CSR          ;IF NEITHER, CLEAR CSR STORAGE WORD
 98 021712                              PNTF    NOCLOCK
    021712  004137  016662                                                          JSR R1,LPNTF
    021716  004110                                                                  .WORD NOCLOCK
    021720  000000                                                                  .WORD PNT.CT
 99 021722  000426                      BR      3$
100
101 021724  012037  003206      2$:     MOV     (R0)+,KW.CSR    ;STORE DATA RETURNED
102 021730  012037  003210              MOV     (R0)+,KW.BRL
103 021734  012037  003212              MOV     (R0)+,KW.VEC
104 021740  012037  003214              MOV     (R0)+,KW.HZ
105                                                             ;SETUP KW11 VECTOR ADDRESS
106 021744                              SETVEC  KW.VEC,#KW11I,#PRI07
    021744  012746  000340                                                          MOV     #PRI07,-(SP)
    021750  012746  020630                                                          MOV     #KW11I,-(SP)
    021754  013746  003212                                                          MOV     KW.VEC,-(SP)
    021760  012746  000003                                                          MOV     #3,-(SP)
    021764  104437                                                                  TRAP    C$SVEC
    021766  062706  000010                                                          ADD     #10,SP
107 021772  012777  000105  161206          MOV     #KWOUT.,@KW.CSR ;START THE CLOCK
108 022000  004737  013220      3$:     CALL    RESET           ;RESET ALL CONTROLLERS
109 022004                              MEMORY  FFREE           ;RESET START OF FREE MEMORY
    022004  104431                                                                  TRAP    C$MEM
    022006  010037  002140                                                          MOV     R0,FFREE
110 022012  017737  160122  002142      MOV     @FFREE,FSIZE    ;RESET SIZE OF FREE MEMORY
111
112                             ;
113                             ;       ALLOCATE DRIVE TABLES TO MEMORY
114                             ;
115
116 022020  013737  002140  003202  INIT2:  MOV     FFREE,DTABS     ;STORE START OF DRIVE TABLES AND
117 022026  005077  161150              CLR     @DTABS          ;MARK ZERO END.
118 022032  013700  002012              MOV     L$UNIT,R0       ;GET NUMBER OF LOGICAL UNITS TO RUN.
119 022036  012701  000001              MOV     #1,R1           ;GET INITIAL SIZE OF DRIVE TABLE AND
120 022042  062701  000015      1$:     ADD     #<D.SIZE>/2,R1  ;ACCUMULATE DRIVE TABLE SIZE.
121 022046  005300                      DEC     R0              ;SEE IF ANY MORE LOGICAL UNITS.
122 022050  001374                      BNE     1$              ;BRANCH IF NOT, ELSE
123 022052  004737  013156              CALL    ALOCM           ;ALLOCATE ALL DRIVE TABLES TO MEMORY.
124                                                             ; R1 POINTS TO 1ST WORD IN DRIVE TABLE
125
126                             ;
127                             ;       INITIALIZE CONTROLLER TABLE STORAGE WITH A WORD OF ZEROS
128                             ;
129
130 022056  013737  002140  002150  INIT3:  MOV     FFREE,CTABS     ; STORE START OF CONTROLLER TABLES AND
131 022064  005077  160060              CLR     @CTABS          ; MARK ZEROS END.
132 022070  005037  002152              CLR     CTRLRS          ; CLEAR CONTROLLER COUNT
133 022074  012701  003434              MOV     #IPADRS,R1      ; R1 -> IP ADDRESS
134 022100  012702  000010              MOV     #8.,R2          ; GET MAXIMUM # OF CONTROLLERS
135 022104  005021              1$:     CLR     (R1)+           ; CLEAR ENTRY
136 022106  005302                      DEC     R2              ; DONE?
137 022110  001375                      BNE     1$              ; IF NOT, BRANCH
138
139                             ;
140                             ;       BUILD CONTROLLER TABLES
```

```
                                           ;
       
   022112  005005                          INIT4:  CLR     R5              ;CLEAR CUSTOMER DATA FLAG
   022114  005002                                  CLR     R2              ;START WITH LOGICAL UNIT 0
   022116  012737  005160  021502                  MOV     #5160,BRSAV     ; SAVE DEFAULT FOR BR LEVEL & VECTOR
   022124                                  1$:     GPHARD  R2,R0           ; GET POINTER TO IT'S P-TABLE
   022124  010200                                                                                  MOV     R2,R0
   022126  104442                                                                                  TRAP    C$GPHRD
   022130                                          BNCOMPLETE      16$     ; BRANCH TO 16$ IF NOT AVAILABLE
   022130  103104                                                                                  BCC     16$
   022132  013703  002150                          MOV     CTABS,R3        ; GET ADDRESS OF 1ST CONTROLLER TABLE
   022136  005713                          2$:     TST     (R3)            ; CHECK IF ANY MORE TABLES
   022140  001405                                  BEQ     6$              ; BUILD NEW TABLE IF FOUND ZERO WORD
   022142  021013                                  CMP     (R0),(R3)       ; CHECK IF SAME CSR ADDRESS.
   022144                                                  ASSUME  C.UADR EQ 0
   022144                                                  ASSUME  HO.UBA EQ 0
   022144  001444                                  BEQ     11$             ; BRANCH IF SO


   022146  062703  000052                  5$:     ADD     #C.SIZE,R3      ;POINT TO BEGINNING OF NEXT CONTROLLER
   022152  000771                                  BR      2$              ;TABLE IN MEMORY.


                                           ;
                                           ;       BUILD NEW CONTROLLER TABLE
                                           ;

   022154  012704  003434                  6$:     MOV     #IPADRS,R4      ;GET BEGINNING OF IP ADDRESS TABLE
   022160  020427  003444                  7$:     CMP     R4,#IPADRS+8.   ;SEE IF END OF IP ADDRESS TABLE,
   022164  101004                                  BHI     9$              ;BRANCH IF SO, ELSE
   022166  005724                                  TST     (R4)+           ;DID WE FIND AN OPEN ENTRY ?
   022170  001401                                  BEQ     8$              ;BRANCH IF SO, ELSE
   022172  000772                                  BR      7$              ;LOOK AGAIN.

   022174  011044                          8$:     MOV     (R0),-(R4)      ;TAKE CSR ADDRESS FROM P-TABLE
                                                                           ;AND STORE IT IN THE IP ADDRESS TABLE.
   022176  012701  000025                  9$:     MOV     #<C.SIZE>/2,R1  ;GET # OF ENTRIES IN CONTROLLER TABLE
   022202  004737  013156                          CALL    ALOCM           ;AND ALLOCATE A TABLE TO MEMORY.
                                                                           ; R0 => 1ST WORD P-TABLE
                                                                           ; R1 => 1ST WORD IN CONTROLLER TABLE
   022206  011021                                  MOV     (R0),(R1)+      ; STORE CSR ADDRESS AND
   022210  010221                                  MOV     R2,(R1)+        ; UNIT NUMBER IN THE CONTROLLER TABLE.
   022212  013704  021502                          MOV     BRSAV,R4        ; GET DEFAULT VECTOR & BR LEVEL
   022216  162704  000004                          SUB     #4,R4           ; GET NEXT VECTOR
   022222  010437  021502                          MOV     R4,BRSAV        ; SAVE NEXT VECTOR
   022226  010421                                  MOV     R4,(R1)+        ;STORE IT IN THE CONTROLLER TABLE.
   022230  012721  004037                          MOV     #4037,(R1)+     ;THE 'JSR R0' INSTRUCION AND
   022234  012721  017612                          MOV     #UDASRV,(R1)+   ;THE ADDRESS OF THE INTERRUPT SERVICE
                                                                           ;ROUTINE IN THE CONTROLLER TABLE.
   022240  012704  000020                          MOV     #<C.SIZE-C.FLG>/2,R4    ;GET # OF ENTRIES TO END OF TABLE,
   022244  005021                          10$:    CLR     (R1)+           ;CLEAR REST OF TABLE AND
   022246  005304                                  DEC     R4              ;ADD ZERO WORD AT END.
   022250  002375                                  BGE     10$             ;LOOP TIL ALL CLEARED
   022252  005237  002152                          INC     CTRLRS          ;KEEP TRACK OF CONTROLLER COUNT

                                           ;
                                           ;       BUILD DRIVE TABLES
                                           ;
```

```

 022256  013701  003202          11$:    MOV     DTABS,R1                ;GET ADDRESS OF CURRENT DRIVE TABLE
 022262  062703  000016                  ADD     #C.DR0,R3               ; INDEX TO 1ST DRIVE IN TABLE
 022266  012704  000010                  MOV     #8.,R4                  ; GET # OF DRIVES PER CONTROLLER
 022272  005713                  12$:    TST     (R3)                    ;ANY ENTRY TO DRIVE TABLE.
 022274  001411                          BEQ     14$                     ;BRANCH IF NOT, ELSE
 022276  026033  000002                  CMP     H0.LDR(R0),@(R3)+       ;COMPARE DRIVE NUMBER IN DRIVE TABLE.
 022302  001002                          BNE     13$                     ;BRANCH IF DIFFERNENT, ELSE
 022304  000137  022410                  JMP     MLDRER                  ;FOUND TWO P-TABLES WITH SAME DRIVE.

 022310  005304                  13$:    DEC     R4                      ; COUNT DRIVES
 022312  001367                          BNE     12$                     ; IF FOUR DRIVE TABLES ALREADY EXIST,
 022314  000137  022426                  JMP     TOOMER                  ;  THEN REPORT ERROR

 022320  010113                  14$:    MOV     R1,(R3)                 ;STORE ADDRESS OF DRIVE TABLE IN
                                                                         ;CONTROLLER TABLE.
 022322  016021  000002                  MOV     H0.LDR(R0),(R1)+        ;STORE DRIVE NUMBER AND
 022326  010221                          MOV     R2,(R1)+                ;LOGICAL UNIT NUMBER IN DRIVE TABLE.

 022330  062737  000032  003202          ADD     #D.SIZE,DTABS           ;NEXT DRIVE TABLE ADDRESS AND
 022336  005077  160640                  CLR     @DTABS                  ;MARK ZERO END.
 022342  005202                  16$:    INC     R2                      ;INCREMENT LOGICAL UNIT NUMBER
 022344  020237  002012                  CMP     R2,L$UNIT               ;CHECK IF GOT ALL TABLES
 022350  002665                          BLT     1$                      ;IF NOT, GO BACK FOR NEXT, ELSE
 022352  012701  000001                  MOV     #1,R1                   ;GET 1 WORD TO TERMINATE ALL CONTROLLER
 022356  004737  013156                  CALL    ALOCM                   ;TABLES AND ALLOCATE IT TO MEMORY.

                                 ;
                                 ;       SAVE CURRENT PARAMETERS TO FREE MEMORY SO EACH TEST CAN USE ALL OF IT
                                 ;

 022362  013737  002140  002144  INIT6:  MOV     FFREE,FMEM              ;SAVE START ADDRESS
 022370  013737  002142  002146          MOV     FSIZE,FMEMS             ;SAVE SIZE

                                 ;
                                 ;       EXIT INITIALIZE SECTION
                                 ;

 022376                          INITXX: SETPRI  #PRI00                  ;SET RUNNING PRIORITY TO ZERO
 022376  012700  000000                                                          MOV     #PRI00,R0
 022402  104441                                                                  TRAP    C$SPRI

 022404                                  EXIT    INIT
 022404  104432                                                                  TRAP    C$EXIT
 022406  000036                                                                  .WORD   L10035-.

                                 ;TWO P-TABLES FOR SAME DRIVE
 022410  013705  003242          MLDRER: MOV TEMP,R5             ;GET CONTROLLER ADDRESS
 022414                                  ERRSF 2,,ERR002
 022414  104454                                                                  TRAP    C$ERSF
 022416  000002                                                                  .WORD   2
 022420  000000                                                                  .WORD   0
 022422  012260                                                                  .WORD   ERR002
 022424                                  DOCLN
 022424  104444                                                                  TRAP    C$DCLN

                                 ;MORE THAN EIGHT DRIVES SELECTED ON ONE CONTROLLER
```

```

022426  013705  003242          TOOMER: MOV TEMP,R5             ;GET CONTROLLER ADDRESS
022432                                  ERRSF 3,,ERR003
022432  104454                                                                          TRAP    C$ERSF
022434  000003                                                                          .WORD   3
022436  000000                                                                          .WORD   0
022440  012276                                                                          .WORD   ERR003
022442                                  DOCLN
022442  104444                                                                          TRAP    C$DCLN


022444                                  ENDINIT
022444                                                                          L10035:
022444  104411                                                                          TRAP    C$INIT
```

```
                                  .SBTTL  AUTODROP SECTION

                                  ;++
                                  ; THIS CODE IS EXECUTED IMMEDIATELY AFTER THE INITIALIZE CODE IF
                                  ; THE "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.
                                  ;-

022446                                 BGNAUTO
022446                                                                   L$AUTO::

022446                                 ENDAUTO
022446                                                                   L10036:
022446  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.
                                        ;--

 022450                                         BGNCLN
 022450                                                                                         L$CLEAN::

 022450  004737  013456                         CALL CLOSEF                     ;CLOSE DATA FILE
 022454                                         SETVEC #4,#NXMI,#PRI07
 022454  012746  000340                                                                                 MOV     #PRI07,-(SP)
 022460  012746  017602                                                                                 MOV     #NXMI,-(SP)
 022464  012746  000004                                                                                 MOV     #4,-(SP)
 022470  012746  000003                                                                                 MOV     #3,-(SP)
 022474  104437                                                                                         TRAP    C$SVEC
 022476  062706  000010                                                                                 ADD     #10,SP
 022502  012703  000010                         MOV     #8.,R3          ; R3 = COUNTER OF ENTRIES
 022506  012704  003434                         MOV     #IPADRS,R4      ; R4 -> IP ADDRESS
 022512  005714                         1$:     TST     (R4)            ; IS THERE AN ENTRY?
 022514  001403                                 BEQ     2$              ; IF NOT, DONE
 022516  005034                                 CLR     @(R4)+          ; INIT UDA
 022520  005303                                 DEC     R3              ; MAKE SURE WE DO NOT EXTEND OVER AREA
 022522  001373                                 BNE     1$              ; IF NOT DONE, BRANCH
 022524                                 2$:     CLRVEC  #4
 022524  012700  000004                                                                                 MOV     #4,R0
 022530  104436                                                                                         TRAP    C$CVEC

 022532                                         ENDCLN
 022532                                                                                         L10037:
 022532  104412                                                                                         TRAP    C$CLEAN

 022534                                         ENDMOD
```

```
                                         .SBTTL  TEST 1: DUP PROGRAM DRIVER

 022534                                          BGNMOD

 022534                                          BGNTST
 022534                                                                                 T1::
 022534                                          PNTX WNSTRT             ;PRINT WARNING MESSAGE
 022534   004137  016702                                                                          JSR R1,LPNTX
 022540   004565                                                                                  .WORD WNSTRT
 022542   000000                                                                                  .WORD PNT.CT
 022544                                          PNTX WNTIME             ;PRINT WARNING TIMES
 022544   004137  016702                                                                          JSR R1,LPNTX
 022550   005043                                                                                  .WORD WNTIME
 022552   000000                                                                                  .WORD PNT.CT
 022554                                          MANUAL                  ;SEE IF MANUAL INTERVENTION ALLOWED
 022554   104450                                                                                  TRAP     C$MANI
 022556                                          BNCOMPLETE T1MODE       ;IF NOT, JUST RUN THE PROGRAM
 022556   103020                                                                                  BCC      T1MODE
 022560   005037  003242                         CLR TEMP                ;CLEAR WORD FOR ANSWER
 022564                                          GMANIL WNQUES,TEMP,1,YES         ;ASK IF STILL WANT TO RUN
 022564   104443                                                                                  TRAP     C$GMAN
 022566   000404                                                                                  BR       10000$
 022570   003242                                                                                  .WORD    TEMP
 022572   000130                                                                                  .WORD    T$CODE
 022574   003630                                                                                  .WORD    WNQUES
 022576   000001                                                                                  .WORD    1
 022600                                                                                 10000$:
 022600   005737  003242                         TST TEMP                         ;LOOK AT ANSWER
 022604   001417                                 BEQ T1QUIT              ;IF NO, QUIT NOW
 022606   005737  003304                         TST DATEO        ;SEE IF ALREADY ASKED FOR DATE
 022612   001002                                 BNE T1MODE
 022614   004737  021044                         CALL DATE        ;IF NOT, GET IT NOW

 022620   032737  000003  003200  T1MODE:        BIT #SO.FMT,MODE
 022626   001164                                 BNE T1FMT
 022630                                          MANUAL
 022630   104450                                                                                  TRAP     C$MANI
 022632                                          BCOMPLETE T1GO
 022632   103406                                                                                  BCS      T1GO
 022634                                          ERRSF 10,,ERR010
 022634   104454                                                                                  TRAP     C$ERSF
 022636   000012                                                                                  .WORD    10
 C22640   000000                                                                                  .WORD    0
 022642   012356                                                                                  .WORD    ERR010
 022644                           T1QUIT:        EXIT TST
 022644   104432                                                                                  TRAP     C$EXIT
 022646   000362                                                                                  .WORD    L10040-.
 022650   032737  000010  003200  T1GO:          BIT #SO.STR,MODE
 022656   001435                                 BEQ T1CNS
 022660   023727  002012  000001                 CMP L$UNIT,#1
 022666   001406                                 BEQ T1RST
 022670                                          ERRSF 9,,ERR009
 022670   104454                                                                                  TRAP     C$ERSF
 022672   000011                                                                                  .WORD    9
 022674   000000                                                                                  .WORD    0
 022676   012344                                                                                  .WORD    ERR009
 022700                                          EXIT TST
```

```
     022700  104432                                                                        TRAP     C$EXIT
     022702  000326                                                                        .WORD    L10040-.
  30
  31 022704                                  T1RST:  PNTF FILNAM
     022704  004137  016662                                                                JSR R1,LPNTF
     022710  012160                                                                        .WORD FILNAM
     022712  000000                                                                        .WORD PNT.CT
  32 022714                                          GMANID FILNAQ,FNAME,A,-1,1,10.,NO      ;GET FILE NAME
     022714  104443                                                                        TRAP     C$GMAN
     022716  000406                                                                        BR       10001$
     022720  003230                                                                        .WORD    FNAME
     022722  000142                                                                        .WORD    T$CODE
     022724  003574                                                                        .WORD    FILNAQ
     022726  177777                                                                        .WORD    -1
     022730  000001                                                                        .WORD    T$LOLIM
     022732  000012                                                                        .WORD    T$HILIM
     022734                                                                         10001$:
  33 022734                                          OPEN #FNAME
     022734  012700  003230                                                                MOV      #FNAME,R0
     022740  104434                                                                        TRAP     C$OPEN
  34 022742  012737  177777  002166                  MOV #-1,FILOPN  ;MARK FLAG AS FILE OPEN
  35 022750  000513                                  BR T1FMT
  36 022752  013705  002150          T1CNS:  MOV CTABS,R5
  37 022756  010504                  T1SER1: MOV R5,R4
  38 022760  062704  000016                  ADD #C.DR0,R4
  39 022764  012703  000010                  MOV #8.,R3
  40 022770  011402                  T1SER2: MOV (R4),R2     ;GET DRIVE TABLE POINTER
  41 022772  001476                          BEQ T1SERN
  42 022774                                  PNTF SERNUM,D.UNIT(R2),(R5),(R2)
     022774  011246                                                                        MOV (R2),-(SP)
     022776  011546                                                                        MOV (R5),-(SP)
     023000  016246  000002                                                                MOV D.UNIT(R2),-(SP)
     023004  004137  016662                                                                JSR R1,LPNTF
     023010  004261                                                                        .WORD SERNUM
     023012  000006                                                                        .WORD PNT.CT
  43 023014                                                  ASSUME C.UADR EQ 0
  44 023014                                                  ASSUME D.DRV EQ 0
  45 023014                          T1SER3: GMANID SERNQ,TEMP,A,-1,1,20.,NO ;GET SERIAL NUMBER
     023014  104443                                                                        TRAP     C$GMAN
     023016  000406                                                                        BR       10002$
     023020  003242                                                                        .WORD    TEMP
     023022  000142                                                                        .WORD    T$CODE
     023024  003626                                                                        .WORD    SERNQ
     023026  177777                                                                        .WORD    -1
     023030  000001                                                                        .WORD    T$LOLIM
     023032  000024                                                                        .WORD    T$HILIM
     023034                                                                         10002$:
  46 023034  012701  003242                  MOV #TEMP,R1
  47 023040  005000                          CLR R0
  48 023042  105711                  T1SER4: TSTB (R1)
  49 023044  001410                          BEQ T1SER5
  50 023046  005200                          INC R0
  51 023050  121127  000060                  CMPB (R1),#'0
  52 023054  103420                          BLO T1SER7
  53 023056  122127  000071                  CMPB (R1)+,#'9
  54 023062  101767                          BLOS T1SER4
  55 023064  000414                          BR T1SER7
```

```
   023066  020027  000024          T1SER5: CMP RO,#20.
   023072  103424                          BLO T1SER8
   023074  012701  003242                  MOV #TEMP,R1
   023100  012700  003320                  MOV #HIGHEST,RO
   023104  105710                  T1SER6: TSTB (RO)
   023106  001416                          BEQ T1SER8
   023110  122120                          CMPB (R1)+,(RO)+
   023112  001774                          BEQ T1SER6
   023114  103413                          BLO T1SER8
   023116                          T1SER7: PRINTF #SERNX,#HIGHEST
   023116  012746  003320                                                                     MOV     #HIGHEST,-(SP)
   023122  012746  012051                                                                     MOV     #SERNX,-(SP)
   023126  012746  000002                                                                     MOV     #2,-(SP)
   023132  010600                                                                             MOV     SP,RO
   023134  104417                                                                             TRAP    C$PNTF
   023136  062706  000006                                                                     ADD     #6,SP
   023142  000724                          BR T1SER3
   023144  062702  000004          T1SER8: ADD #D.SERN,R2  ;PUT ANSWER INTO DRIVE TABLE
   023150  012701  003242                  MOV #TEMP,R1
   023154  112122                  T1SER9: MOVB (R1)+,(R2)+
   023156  001376                          BNE T1SER9
   023160  005303                          DEC R3
   023162  001402                          BEQ T1SERN
   023164  005724                          TST (R4)+
   023166  000700                          BR T1SER2
   023170  062705  000052          T1SERN: ADD #C.SIZE,R5
   023174  005715                          TST (R5)
   023176  001267                          BNE T1SER1
   023200  013737  002150  002154  T1FMT:  MOV CTABS,TSTTAB                ;GET FIRST TABLE ADDRESS
   023206  013701  002152                  MOV CTRLRS,R1                   ;RUN DM PROGRAM ON ALL CONTROLLERS
   023212  004737  013344                  CALL RUNDM                      ;  RUN ALL CONTROLLERS OF ONE TYPE AT ONCE
   023216  001402                          BEQ 6$
   023220  004737  013474                  CALL RESPDM
   023224                          6$:     EXIT TST
   023224  104432                                                                             TRAP    C$EXIT
   023226  000002                                                                             .WORD   L10040-.
   023230                                  ENDTST
   023230                                                                            L10040:
   023230  104401                                                                             TRAP    C$ETST
   023232                                  ENDMOD
```

```
                                        .SBTTL  HARDWARE PARAMETER CODING SECTION

 023232                                         BGNMOD

                                        ;++
                                        ; THE HARDWARE 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.
                                        ;--

 023232                                         BGNHRD
 023232   000011                                                                                 .WORD L10041-L$HARD/2
 023234                                                                                  L$HARD::

                                        ;FORMAT OF HARDWARE P-TABLE IS AS FOLLOWS:

 023234                                 TABLE                                 ;START A TEBLE DEFINITION

 023234                                 ITEM HO.UBA     2                     ; UNIBUS ADDRESS
 023234                                 ITEM HO.LDR     2                     ; DRIVE NUMBER
 023234                                 END
```

```
      1 023234                                  GPRMA   H.UBA,HO.UBA,0,160000,177774,YES         ,BUS ADDRESS
        023234  000031                                                                                    .WORD   T$CODE
        023236  023256                                                                                    .WORD   H.UBA
        023240  160000                                                                                    .WORD   T$LOLIM
        023242  177774                                                                                    .WORD   T$HILIM
      2 023244                                  GPRMD   H.LDR,HO.LDR,D,-1,0.,255.,YES   ; DRIVE SELECT NUMBER
        023244  001052                                                                                    .WORD   T$CODE
        023246  023272                                                                                    .WORD   H.LDR
        023250  177777                                                                                    .WORD   -1
        023252  000000                                                                                    .WORD   T$LOLIM
        023254  000377                                                                                    .WORD   T$HILIM
      3 023256                                  ENDHRD
                                                                                                          .EVEN
        023256                                                                                    L10041:
      4
      5 023256     103     123     122  H.UBA:  .ASCIZ  \CSR ADDRESS\
      6 023272     104     122     111  H.LDR:  .ASCIZ  \DRIVE NUMBER\
      7                                         .EVEN
```

```
                                .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.
                                ;--

023310                                  BGNSFT
023310  000022                                                                                   .WORD L10042-L$SOFT/2
023312                                                                                   L$SOFT::

                                ;FORMAT OF SOFTWARE P-TABLE IS AS FOLLOWS:

023312                          TABLE                                   ;START A TABLE DEFINITION

023312                          ITEM SO.BIT     2                       ;YES/NO ANSWERS
        000001                          SO.FM1 = BIT0                   ;  REFORMAT MODE
        000002                          SO.FM2 = BIT1                   ;  (AGAIN)
        000003                            SO.FMT = SO.FM1+SO.FM2
        000004                          SO.CNS = BIT2                   ;  RECONSTRUCT MODE
        000010                          SO.STR = BIT3                   ;  RESTORE MODE

023312                          END
```

```
  023312                                   GPRML S.FMT,SO.BIT,SO.FM1,YES   ;REFORMAT?
  023312  000130                                                                               .WORD   T$CODE
  023314  023527                                                                               .WORD   S.FMT
  023316  000001                                                                               .WORD   SO.FM1
  023320                                   XFERT SWEND
  023320  017024                                                                               .WORD   T$CODE
  023322                                   GPRML S.NRF,SO.BIT,SO.FM2,YES   ;AGAIN - REFORMAT?
  023322  000130                                                                               .WORD   T$CODE
  023324  023356                                                                               .WORD   S.NRF
  023326  000002                                                                               .WORD   SO.FM2
  023330                                   XFERT SWEND
  023330  013024                                                                               .WORD   T$CODE
  023332                                   GPRML S.CNS,SO.BIT,SO.CNS,YES   ;RECONSTRUCT
  023332  000130                                                                               .WORD   T$CODE
  023334  023606                                                                               .WORD   S.CNS
  023336  000004                                                                               .WORD   SO.CNS
  023340                                   XFERT SWEND
  023340  007024                                                                               .WORD   T$CODE
  023342                                   GPRML S.RST,SO.BIT,SO.STR,YES   ;RESTORE?
  023342  000130                                                                               .WORD   T$CODE
  023344  023651                                                                               .WORD   S.RST
  023346  000010                                                                               .WORD   SO.STR
  023350                                   XFERT SWEND
  023350  003024                                                                               .WORD   T$CODE
  023352                                   DISPLAY S.NOF   ;WARNING
  023352  000003                                                                               .WORD   T$CODE
  023354  023772                                                                               .WORD   S.NOF
  023356                           SWEND:  ENDSFT
                                                                                               .EVEN
  023356                                                                               L10042:

  023356     015      012          S.NRF:  .BYTE 15,12
  023360     116      117      124         .ASCII\NOT USING EXISTING INFORMATION WILL DESTROY THE FACTORY BAD SECTOR\
  023462     015      012                  .BYTE 15,12
  023464     111      116      106         .ASCII\INFORMATION ON THE DISKS.\
  023515     015      012                  .BYTE 15,12
  023517     101      107      101         .ASCII\AGAIN - \
  023527     122      105      106 S.FMT:  .ASCIZ\REFORMAT USING EXISTING BAD SECTOR INFORMATION\
  023606     122      105      103 S.CNS:  .ASCIZ\RECONSTRUCT BAD SECTOR INFORMATION\
  023651     104      117      040 S.RST:  .ASCII\DO YOU HAVE A FILE ON THE SYSTEM LOAD DEVICE\
  023725     015      012                  .BYTE 15,12
  023727     040      103      117         .ASCIZ\ CONTAINING BAD SECTOR INFORMATION\
  023772     131      117      125 S.NOF:  .ASCIZ\YOU CANNOT PROCEED WITHOUT SUCH A FILE.\
  024042     122      105      123         .ASCIZ\RESTART PROGRAM AND SELECT TO REFORMAT OR RECONSTRUCT DISK.\
  024136     000                           .BYTE 0
                                           .EVEN

                                           .DSABL AMA
  000000                                   .PSECT END
```

```
                                            .SBTTL  PATCH AREA

 000000                            $PATCH::
          000050                            .REPT 40.
                                            .WORD 0
                                            .ENDR

 000120                                     LASTAD
                                                                                   .EVEN
 000120   000134'                                                                  .WORD T$FREE
 000122   000004                                                                   .WORD T$SIZE
 000124                            L$LAST::

 000124                                     ENDMOD
```

_12

```
 000124                              BGNSETUP        1

 000124                              BGNPTAB
 000124  000000                                                                            .WORD   0
 000126  000002                                                                            .WORD   L10045 ./2-1
 000130                                                                          L10043:

 000130  172150                      .WORD   172150                ; UNIBUS ADDRESS
 000132  000000                      .WORD   0.                    ; LOGICAL DRIVE NUMBER

 000134                              ENDPTAB
 000134                                                                          L10045:

 000134                              ENDSETUP








         000001                 .END
Errors detected:  0

*** Assembler statistics


Work  file  reads: 597
Work  file writes: 517
Size of work file: 29648 Words  ( 116 Pages)
Size of core pool: 14080 Words  ( 55 Pages)
Operating  system: RT-11 (Under RTEM-11)

Elapsed time: 00:02:22.00
ZUDKBO,ZUDKBO/C=SVC34R.MLB/P:1,ZUDKBO.DOC,ZUCKBO
```

```
$PATCH   124-3#
ADR      30-10#
ALOCM    56-16#    57-14   116-123   116-174   116-220
ASSEMB    26-8      26 8
BAS      50-14#     83 5      83-5      83-5      84-5      84-5
BASL2    50-12#     84-5
BASL3    50-13#
BASLN    50-16#     83-5      84-5
BASNO    50-11#     83-5      84-5
BIT0     30-10#   122-19
BIT00    30-10     30-10#
BIT01    30-10     30-10#
BIT02    30-10     30-10#
BIT03    30-10     30-10#
BIT04    30-10     30-10#
BIT05    30-10     30-10#
BIT06    30-10     30-10#
BIT07    30-10     30-10#
BIT08    30-10     30-10#
BIT09    30-10     30-10#
BIT1     30-10#    33-26     41-22    122-20
BIT10    30-10#
BIT11    30-10#
BIT12    30-10#
BIT13    30-10#
BIT14    30-10#
BIT15    30-10#    41-15     42-12     59-27     62-20     70-28     75-15     89-29
BIT2     30-10#    33-27     41-23    122-22
BIT3     30-10#    33-28     41-24    122-23
BIT4     30-10#    33-29     41-26
BIT5     30-10#    41-29
BIT6     30-10#    41-30
BIT7     30-10#    41-32
BIT8     30-10#
BIT9     30-10#
BLDC0    97-22     97-24#
BLDC1    97-26#    97-28
BLDCMD   61-49     64-14     64-44      95-2     97-15#
BOE      30-10#
BRSAV  114-104#  116-145*  116-179   116-181*
C$AU      26-8#
C$AUTO    26-8#   117-12
C$BRK     26-8#    58-12      61-8    100-21    107-12    110-27
C$BSEG    26-8#
C$BSUB    26-8#
C$CEFG    26-8#
C$CLCK    26-8#   116-93    116-95
C$CLEA    26-8#   118-21
C$CLOS    26-8#    60-12     73-19
C$CLP1    26-8#
C$CVEC    26-8#    58-22    107-30    118-19
C$DCLN    26-8#     55-8     58-30    116-69   116-240   116-246
C$DODU    26-8#
C$DRPT    26-8#
C$DU      26-8#
C$EDIT    26-8#    26-34
```

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```
C$ERDF   26-8#     58-28     61-24     62-36     63-21     64-8      68-22     70-32     96-3      100-29    101-5     105-36    105-51    106-12
         107-33    109-37    110-36    111-5
C$ERHR   26-8#
C$ERRO   26-8#
C$ERSF   26-8#     55-7      116-239   116-245   119-22    119-28
C$ERSO   26-8#
C$ESCA   26-8#
C$ESEG   26-8#
C$ESUB   26-8#
C$ETST   26-8#     119-84
C$EXIT   26-8#     116-235   119-23    119-29    119-83
C$GETB   26-8#     73-24
C$GETW   26-8#
C$GMAN   26-8#     114-1     119-11    119-32    119-45
C$GPHR   26-8#     116-146
C$GPLO   26-8#
C$GPRI   26-8#
C$INIT   26-8#     116-249
C$INLP   26-8#
C$MANI   26-8#     119-8     119-20
C$MEM    26-8#     116-109
C$MSG    26-8#     53-16     53-20     53-24     53-28     53-32     53-36     53-40     53-44     53-48     53-60     53-65     53-77     53-81
         53-85     53-89     53-93     53-98     53-102    53-106    53-110    53-114    53-118    53-122
C$OPEN   26-8#     73-20     119-33
C$PNTB   26-8#     91-14
C$PNTF   26-8#     91-12     119-65
C$PNTS   26-8#     91-18
C$PNTX   26-8#     91-16
C$QIO    26-8#
C$RDBU   26-8#
C$REFG   26-8#     116-47    116-53    116-59    116-66
C$RESE   26-8#     26-8#
C$REVI   26-8#     26-34
C$RFLA   26-8#
C$RPT    26-8#
C$SEFG   26-8#
C$SPRI   26-8#     116-233
C$SVEC   26-8#     58-11     94-20     107-27    116-106   118-11
C$TPRI   26-8#
C.DR0    41-34#    62-15     75-12     116-197   119-38
C.DR1    41-35#
C.DR2    41-36#
C.DR3    41-37#
C.DR4    41-38#
C.DR5    41-39#
C.DR6    41-40#
C.DR7    41-41#
C.FLG    41-21#    59-23*    61-10     61-13     61-15     61-38     61-43     61-47*    62-12*    63-6      63-26     64-35*    64-39*    64-40
         64-47*    64-50*    64-62*    64-63     64-69*    64-70     95-12*    95-13*    98-21*    100-17    101-1*    116-186
C.JAD    41-20#
C.JSR    41-19#    94-19
C.PRI    41-45#    64-65     64-67     64-72*    64-73*
C.REF    41-46#    63-19     98-16*    98-17
C.RING   41-33#    53-138    57-15*    61-9      64-29     97-16     98-15     105-20    106-3     106-20    107-20
C.SIZE   41-48#    59-32     62-5      116-157   116-173   116-186   119-75
C.TO     41-42#    61-36     64-55     100-14    100-27    110-22    110-33
```

```
C.TOH    41-43#   61-33    100-24   110-30
C.TOT    41-44#   61-29     64-53    94-14*   94-15*
C.UADR   41-12#   76-16    107-25   116-152  119-43
C.UNIT   41-13#   59 24     59-25    61-12
C.VEC    41-16#   94-16    107-14
CALR4    80-6     83-5#
CALP5    80 7     84-5#
CALR6    80 8     85-4#
CALR7    80 9     86-4#
CALR8    80 10    87-4#
CALRE    80-3     80-4      80-5     82-4#
CF 576   37-39#
CF.ATN   37 34#
CF.MSC   37-35#
CF.OTH   37-36#
CF.SHD   37-38#
CF.THS   37-37#
CLOSEF   60-10#  118-10
CLRBFL   99-22#   99-24
CLRBUF   64-16    64-46     99-16#
CON.A    78-12#   81-21
CON.A1   78-13#   78-15
CON.A2   78-17    78-19#
CON.D    78-23#   81-21
CON.H    78-29#   81-21
CON.N    79-9#    81-21
CON.N1   79-10#   79-12
CON.O    79-3#    81-21
CON.QU   78-3#    78-7      81-21
CON.QX   78-5     78-8#
CON.R    79-17#   81-21
CON.R1   79-19    79-23#
CON.S    79-29#   81-21
CON.S1   79-30#   79-32
CPNT     74-18    74-21     76-21    76-23    78-6     78-13    79-10    79-30    83-7     84-7     90-13    90-22    91-5#   113-27
        113-32   113-35
CPNTX    91-13    91-15     91-17    91-19#
CR       30-12#   74-21     76-21    76-23    79-10    83-7     84-7     91-8
CT.AVL   41-15#   59-27
CT.BRL   41-18#
CT CMD   41-23#   61-15     95-12    98-21
CT.MSG   41-24#   61-13     64-39    64-62   100-17   101-1    103-19
CT.REQ   41-26#   63-6      63-26    64-35    64-40    64-47    64-50    95-12
CT.RN    41-22#   61-10     95-13
CT.STA   41-29#   61 38     61-46    64-39    64-62
CT.TM1   41-30#   61-42     61-43    64-39    64-70
CT.TM2   41-32#   64-39     64-63    64-69
CT.UNT   41-14#
CT.VEC   41-17#   94-17    107-15
CTABS    46-12#  116-130* 116-131* 116-148  119-36   119-78
CTRLRS   46-13#  116-132* 116-190* 119-79
D.DRV    42-9#    69-36     76-17   119-44
D.SERN   42-13#   68-17    119-67
D.SIZE   42-15#  116-120   116-214
D.UNIT   42-10#   62-19     62-25*   75-14    76-15   119-42
DAS1    114-8    114-13#
```

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```
DATE    114-1#   114-32   119-16
DATEI    47-2#   114-1    114-2    114-44
DATEO    47-4#    68-26   114-33   119-14
DATEQ    49-3#   114-1
DATEX    52-13#  114-31
DAY     114-5#
DAY1    114-46#  114-57
DAY2    114-47   114-58#
DAYS     47-19#  114-42
DERR    114-4    114-6    114-10   114-12   114-14   114-31#  114-59   114-61   114-64   114-84   114-88   114-90
DF.ACT   40-21#   64-60
DF.LCL   40-24#
DF.NES   40-22#
DF.SA    40-26#
DFPTBL   28-10#
DIAG     34-33#   97-23
DIAGMC   26-8     26-8
DIVIDE   69-38    89-39    90-7     93-16#  113-19   113-21   113-23
DMFRST   40-47#
DMMAIN   40-46#
DMOVRL   40-44#
DMPROG   46-16#   94-13    95-3     95-4     95-5     95-6
DMTMO    40-45#   94-14
DMTRLN   40-43#
DQCONT   69-28    69-61#
DQNO     69-54    69-62#
DQRFMT   69-26    69-53#
DQRSTR   69-27    69-59#
DQUEJP   69-21    69-22#   69-29
DQUEST   65-4     69-16#
DQUESZ   69-18    69-29#
DQUEX    69-19    69-22    69-24    69-25    69-50#   69-57    69-64
DQUNIT   69-23    69-33#
DQUNL1   69-38#   69-42
DQUNL2   69-44#   69-48
DQYES    69-55#   69-60
DSPSIZ   65-9#
DT.AVL   42-12#   62-20    62-25    75-15
DT.UNT   42-11#
DTABS    46-30#  116-116* 116-117* 116-196  116-214* 116-215*
DU.DFL   40-33#
DU.FTL   40-36#
DU.INF   40-34#
DU.QUE   40-32#
DU.SPC   40-37#   64-6
DU.TER   40-35#
DU.TYP   40-39#   64-4     64-19
DUP      34-34#   97-20
E$END    26-8#
E$LOAD   26-8#    26-34
EF.BBR   37-27#
EF.BBU   37-28#
EF.CON   30-10#  116-59
EF.LOG   37-29#
EF.NEW   30-10#
EF.PWR   30-10#  116-66
```

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```
EF.RES   30-10#    116-53
EF.SEX   37-30#
EF.STA   30-10#    116-47
E0FMSG   53-56      53-59#
ERR001   53 14#
ERR002   53-18#    116-239
ERR003   53-22#    116-245
ERR004   53-26#     55-7
ERR008   53-30#
ERR009   53-34#    119-28
ERR010   53-38#    119-22
ERR014   53-42#    105-51
ERR020   53-46#     58-28     107-33
ERR021   53-50#    111-5
ERR022   53-62#    110-36
ERR023   53-67#    106-12
ERR024   53-79#    105-36
ERR025   53-83#    109-37
ERR030   53-87#     61-24
ERR031   53 91#     62-36
ERR032   53-95#     64-8
ERR033   53-100#    63-21
ERR034   53 104#    96-3
ERR036   53 108#  100-29
ERR037   53 112#  101-5
ERR100   53-116#    68-22
ERR10    53-120#    70-32
ERR21A   53 54      53 57#
ERR23A   53-70#     53-75
ERR23B   53 71      53-73#
ERR23C   53 76#
ERRC     77 36      77-43     81-9#
ERRCHR   46-42#     91-5*     91-12     91-14     91-16     91-18
ERRD     77-45      81-21#
ERRME1   50-8#      77-41     79-23     82-4
ERRNL    50-4#      91-10
ERRONE   50-3#      91-7
ERRRSZ   79-18      80-11#
ERRRTB   79-21      80-3#     80 11
ERRTRM   65-7       72-14#
EVL      30-10#
F$AU     26-8#
F$AUTO   26-8#     117-10    117-12
F$BGN    26-8#      26-26     29-16     30-3      53-14     53-18     53-22     53-26     53-30     53-34     53-38     53-42     53-46     53-50
          53-62     53-67     53-79     53-83     53-87     53-91     53-95     53-100    53-104    53-108    53-112    53-116    53-120   102-10
        103-18    112-5     114-106   115-3     115-10    116-45    116-235   117-10    118-8     118-23    119-3     119-5     119-23    119-29
        119-83    119-84    119-85    120-3     120-14    122-12    123-9     123-9     124-10    125-1     125-3     125-3     125-8     125 10
F$CLEA   26-8#     118-8     118 21
F$DU     26-8#
F$END    26-8       26-8      26-8      26-8      26-8      26-8      26-8      26-8      26-8      26-8      26-8      26-8      26-8      26-8
         26-8       26-8      26-8#     26-26     29-16     30-3      53-16     53-20     53-24     53-28     53-32     53-36     53-40     53-44
         53-48      53-60     53-65     53-77     53-81     53-85     53-89     53-93     53-98     53-102    53-106    53-110    53-114    53-118
         53-122    102-14    103-21    112-9     114-106   115-3     116-235   116-249   117-12    118-21    118-23    119-3     119-5     119-5
        119-5      119-23    119-29    119-83    119-84    119-84    119-85    120-3     121-3     123-10    124-10    125-1     125-3     125-8
        125-10
F$HARD   26-8#     120-14    121-3     123 2     123-4     123-6     123-8
```

```
F$HW      26-8#     28-10     28 14
F$INIT    26-8#     116-45    116-249
F$JMP     26 8#     116-235   119-23    119-29    119-83
F$MOD     26 8#     26-26     29-10     30-3      114-106   115-3     118-23    119-3     119-85    120-3     124-10
F$MSG     26-8#     53-14     53-16     53-18     53-20     53-22     53-24     53-26     53-28     53-30     53-32     53-34     53-36     53-38
          53-40     53-42     53-44     53-46     53-48     53-50     53-60     53-62     53-65     53-67     53-77     53-79     53-81     53-83
          53 85     53-87     53-89     53-91     53-93     53-95     53-98     53-100    53-102    53-104    53-106    53-108    53-110    53-112
          53 114    53-116    53-118    53-120    53-122
F$PROT    26 8#     115-10    115-16
F$PWR     26-8#
F$RPT     26 8#
F$SEG     26-8#
F$SOFT    26-8#     122-12    123-2     123-4     123-6     123-8     123-10
F$SRV     26 8#     102-10    102-14    103-18    103-21    112-5     112-9
F$SUB     26-8#
F$SW      26-8#     29-10     29-14
F$TEST    26-8#     119-5     119-84
FCTBUF    46-24#    73-23     73 32
FCTNUM    46-25#    59-36*    73-14     73-21*    73-28*
FDATA     46-23#
FFREE     46-8#     56-16     56-20*    116-109*  116-110   116-116   116-130   116-226
FILNAM    52-14#    119-31
FILNAQ    49-4#     119-32
FILOPN    46-20#    60-10     60-13*    119-34*
FMEM      46-10#    116-226*
FMEMS     46-11#    116-227*
FMERR     55-7#     56-18
FNAME     46-44#    73-20     119-32    119-33
FSIZE     46-9#     56-17*    116-110*  116-227
G$CNTO    26-8#
G$DELM    26-8#
G$DISP    26-8#     123-9
G$EXCP    26-8#
G$HILI    26-8#
G$LOLI    26-8#
G$NO      26-8#     119-32    119-45
G$OFFS    26-8#     114-1     119-11    119-32    119-45    121-1     121-2     123-1     123-3     123-5     123-7
G$OFSI    26-8#     114-1     119-11    119-32    119-45    121-1     121-2     123-1     123-3     123-5     123-7
G$PFMA    26-8#     121-1
G$PRMD    26-8#     114-1     119-32    119-45    121-2
G$PRML    26-8#     119-11    123-1     123-3     123-5     123-7
G$RADA    26-8#     114-1     119-32    119-45
G$RADB    26-8#
G$RADD    26-8#     121-2
G$RADL    26-8#     119-11    123-1     123-3     123-5     123-7
G$PADO    26-8#     121-1
G$XFER    26-8#     123-2     123-4     123-6     123-8
G$YES     26-8#     114-1     119-11    121-1     121-2     123-1     123-3     123-5     123-7
GETCON    88-16     88-18     88-28#
GETCNT    78-12     79-9      79-17     79-29     88-13#    89-15
GETCNX    88-15#    88-27
GETCXX    88-29     88-31#
GTDRVL    75-13#    75-16
GTDRVT    68-16     69-16     70-24     70-36     75-11#
H LDR     121-2     121-6#
H UBA     121-1     121-5#
```

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HC.BF1   34-24#    34-25     64-15
HC.BF2   34-25#    34-27     53-139    64-3      64-45
HC.BSZ   34-13#    34-25     34-27     64-18     99-19     99-21
HC.CCT   34-19#    61-40     61-50*    98-19*
HC.CEV   34-22#    34-23     97 18
HC.CMD   34-18#    34-19     34-20     106-23*   106-24*
HC.CPK   34-23#    34-24     53-126    64-33*    95-3*     95-4*     95-5*     95-6*     97 29*    98-17*    99-18*    99-19*    106-24
HC.ESZ   34-11#    34-21     34-23
HC.INT   34-15#    34-16
HC.ISZ   34-9#     34-16     105-21    106-5
HC.MCT   34 17#    64-74*    98-18*
HC.MEV   34-20#    34-21
HC.MPK   34-21#    34-22     53-128    63-9      63-14     63-19     64-11     64-58     64-60     64-65     64-67     64-72     64-73     95-10
        106-22
HC.MSG   34-16#    34-17     34-18     106-21*   106-22*   107-21
HC.PSZ   34-12#    34-22     34-24     97-19     97-25
HC.RSZ   34-10#    34-18     34-20     105-21    106-5
HC.SIZ   34-27#    57-13
HCOMM    57-13#    59-28
HEADER   70-26     70-38     76-13#
HIGHES   47-6#     119-59    119-65
HO.LDR  116-201    116-211   120-21#   121-2     121-2     121-2
HO.UBA  116-153    120-20#   121-1     121-1     121-1
HOE      30-10#
I$AU     26-8#
I$AUTO   26-8#     117-10#   117-12#
I$CLN    26-8#     118-8#    118-21#
I$DU     26-8#
I$HRD   120-14#    121-3#    123-9
I$INIT   26-8#     116-45#   116-235   116-249#
I$MOD    26-8#     26-26     26-26#    29-16     29-16#    30-3      30-3#     114-106   114-106#  115-3     115-3#    118-23    118-23#   119-3
        119-3#     119-85    119-85#   120-3     120-3#    124-10    124-10#
I$MSG    26-9#     53-14#    53-16#    53-18#    53-20#    53-22#    53-24#    53-26#    53-28#    53-30#    53-32#    53-34#    53-36#    53-38#
         53-40#    53-42#    53-44#    53-46#    53-48#    53-50#    53-60#    53-62#    53-65#    53-67#    53-77#    53-79#    53-81#    53-83#
         53-85#    53-87#    53-89#    53-91#    53-93#    53-95#    53-98#    53-100#   53-102#   53-104#   53-106#   53-108#   53-110#   53-112#
         53-114#   53-116#   53-118#   53-120#   53-122#
I$PROT   26-8#     115-10#
I$PTAB   26-8#     125-3     125-3#    125-8     125-8#
I$PWR    26-8#
I$RPT    26-8#
I$SEG    26-8#     119-5
I$SETU   26-8#     125-1     125-1#    125-3     125-10    125-10#
I$SFT   122-12#    123-9     123-10#
I$SRV    26-8#     102-10#   102-14#   103-18#   103-21#   112-5#    112-9#
I$SUB    26-8#     119-5
I$TST    26-8#     119-5     119-5#    119-23    119-29    119-83    119-84    119-84#   119-84#
IBE      30-10#
ICONT    33-26#    116 63
IDU      30-10#
IER      30-10#
IFLAGS   46-31#    116-50*   116-56*   116-62*   116-63*
INFO     65-5      70-15#    71-14     72-14
INFOB    70-16     70-36#
INFOE    70-18     70-32#
INFOH    70-20     70-24#
INFOP    70-22     70-27#
```

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INFOX    70-28#    70-41
I.JITO  116-64    116-68    116-71#
INIT1   116-51    116-57    116-78#
INIT2   116-116#
INIT3   116-130#
INIT4   116-143#
INIT6   116-226#
INITQT  116-69#   116-86
INITXX  116-71    116-233#
IPADRS   47-34#    58-14    116-133   116-164   116-165   118-13
IREST    33-27#   116-56
ISR      30-10#
ISTRT    33-28#   116-50
ISTRTH   33-29#   116-62
IXE      30-10#
J$JMP    26-8#
KW.BRL   46-36#   116-102*
KW.CSR   46-35#    61-31     76-19    100-22    110-28    112-8*    113-13    116-97*   116-101*  116-107*
KW.EL    46-39#    61-33     61-36    100-24    100-27    104-26    104 27    104-28    110-30    110-33    112-6*    112-7*    113-16    113-17
        116-91*   116-92*
KW.HZ    46-38#   104 16    113-18    116-104*
KW.VEC   46-37#   116-103*  116-106
KW11I   112-5#    116-106
KWOUT.  112-8     116-89#   116-107
L$ACP    26-34#
L$APT    26-34#
L$AUT    26-34#
L$AUTO   26-34    117-10#
L$CCP    26-34#
L$CLEA   26-34    118-8#
L$CO     26-34#
L$DEPO   26-34#
L$DESC   26-34     48-16#
L$DESP   26-34#
L$DEVP   26-34#
L$DISP   26-34     27-9#
L$DLY    26-34#
L$DTP    26-34#
L$DTYP   26-34#
L$DUT    26-34#
L$DVTY   26-34     48-12#
L$EF     26-34#
L$ENVI   26-34#
L$ETP    26-34#
L$EXP1   26-34#
L$EXP4   26-34#
L$EXP5   26-34#
L$HARD   26-34    120-14    120-14#
L$HIME   26-34#
L$HPCP   26-34#
L$HPTP   26-34#
L$HW     26-34     28-10     28-10#
L$ICP    26-34#
L$INIT   26-34    116-45#
L$LADP   26-34#
L$LAST   26-34    124-8#    125-10
```

```
L$LOAD   26-34#
L$LUN    26-34#    59-24*    61-12*    75-14*
L$MREV   26-34#
L$NAME   26-34#
L$PRIO   26-34#
L$PROT   26-34    115-10#
L$PRT    26-34#
L$REPP   26-34#
L$REV    26-34#
L$SOFT   26-34    122-12    122-12#
L$SPC    26-34#
L$SPCP   26-34#
L$SPTP   26-34#
L$STA    26-34#
L$SW     26-34     29-10     29-10#
L$TEST   26-34#
L$TIML   26-34#
L$UNIT   26-34#    76-13    116-118   116-217   119-26
L10000   28-10     28-14#
L10001   29-10     29-14#
L10002   53-16#
L10003   53-20#
L10004   53-24#
L10005   53-28#
L10006   53-32#
L10007   53-36#
L10010   53-40#
L10011   53-44#
L10012   53-48#
L10013   53-60#
L10014   53-65#
L10015   53-77#
L10016   53-81#
L10017   53-85#
L10020   53-89#
L10021   53-93#
L10022   53-98#
L10023   53-102#
L10024   53-106#
L10025   53-110#
L10026   53-114#
L10027   53-118#
L10030   53-122#
L10031  102-14#
L10032  103-21#
L10033  112-9#
L10035  116-235   116-249#
L10036  117-12#
L10037  118-21#
L10040  119-23    119-29    119-83    119-84#
L10041  120-14    121-3#
L10042  122-12    123-10#
L10043  125-3#
L10045  125-3     125-8#
LDDM     59-22#    59-34
LDNEXT   59-26     59-30     59-32#
```

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LOADDM  59-29     62-30     94-13#
LOADE1  95-11     96-3#
LOADER  94-23     95-9      96 4#
LGE     30 10#
LOG     34-32#
LOT     30-10#
LPNT    70-40     92 6      92-8      92-10     92-12#    113-24    113 28    113-33
LPNTB   53-15     53-19     53-23     53-27     53-31     53-35     53-39     53-43     53-47     53-55     53-58     53-64     53-68     53-72
        53-76     53-80     53-84     53-88     53-92     53-96     53-109    53-113    53-117    53-121    53-124    53-130    53-137    53-141
        83-5      84-5      92-7#
LPNTF   76-15     77-41     79-23     82-4      92-5#     114-31    116-98    119-31    119-42
LPNTS   92-11#
LPNTX   92-9#     119-6     119-7
MD.CMP  37 4#
MD.CWB  37-22#
MD.ERR  37-6#
MD.EXP  37-5#
MD.FEU  37-16#
MD.IMF  37-20#
MD.NXU  37-18#
MD.PRI  37-23#
MD.RIP  37 19#
MD.SCH  37-7#
MD.SCL  37-8#
MD.SEC  37-9#
MD SEQ  37-14#
MD.SER  37-10#
MD.SPD  37-15#
MD.SSH  37-11#
MD.SWP  37-21#
MD.VOL  37-17#
MD.WBN  37-12#
MD WBV  37-13#
MESG    70-27     70-39     74-13#
MESSG   50-9#     76-15
MLDRER 116-203   116-238#
MODE    46-26#    69-53     69-59     116-87*   119-18    119-24
MON1   114-17#   114-30
MON2   114-19    114-21#
MON3   114-22    114-24#
MON4   114-25    114-27#
MON5   114-28    114-33#
MON6   114-36    114-39#
MONTHS  47-7#    114-16
MSCP    34-31#
MSGPKL  53-141#   53-144
MSGPKT  53-97     53-137#
NCONF   77-38     77-43#
NCONS   77-37#    77-40
NOCLOC  50-10#   116-98
NULL    46-43#
NXMAD   46-22#    58-10*    58-18     102-12*   107-26*   107-31
NXMI    58-11    102-10#   107-27     118-11
O$APTS  26-8#     26-34
O$AU    26-8#     26-34
O$6GNR  26-8#     26-34
```

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O$BGNS   26-8#     26-32#    26-34
O$DU     26-8#     26-34
O$ERRT   26-8#     26-34
O$GNSW   26-8#     26-32#    26-34
O$POIN   26-8#     26-32     26-32#    26-32#    26-32#    26-34
O$SETU   26-8#     26-32#    26-34    124-8
OP.ABO   36-3#
OP.ACC   36-4#
OP.AVA   36-22#
OP.AVL   36-5#
OP.CCD   36-6#
OP.CMP   36-7#
OP.DUP   36-23#
OP.ELP   36-30#
OP.END   36-20#    63-5      63-8      64-58
OP.ERS   36-8#
OP.ESP   36-29#    95-1
OP.FLU   36-9#
OP.GCS   36-10#
OP.GDS   36-27#    61-48     64-58
OP.GSS   36-28#
OP.GUS   36-11#
OP.MRD   36-18#
OP.MWR   36-19#    97-21
OP.ONL   36-12#
OP.RD    36-13#
OP.RLC   36-25#
OP.RPL   36-14#
OP.RSD   36-32#    63-8      64-43
OP.SCC   36-15#
OP.SEX   36-21#
OP.SHC   36-24#
OP.SSD   36-31#    63-5      64-13
OP.SUC   36-16#
OP.WR    36-17#
OSTRE    77-35     77-42     77-47#
OSTRNG   77-34#    77-46     85-6      86-6      87-6      92-17
P.BCNT   38-21#    39-9#     64-11     64-33*    95-4*     99-19*
P.BUFF   38-22#
P.CMST   39-14#
P.CNCL   39-48#
P.CNTF   38-40#    39-46#
P.CNTI   39-49#
P.CPSP   38-34#
P.CRF    38-17#    39-4#     63-19     98-17*
P.CTMO   39-47#
P.CYL    39-26#
P.DEXT   39-52#
P.DFLG   39-53#    64-60
P.DMDT   38-50#
P.DPI    39-54#    64-65     64-67     64-72     64-73
P.DTO    39-55#
P.ELGF   38-32#
P.FBBK   39-10#
P.FLGS   39-7#
P.GRP    39-25#
```

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P.HSTI   38-31#    39-19#    39-35#
P.HTMO   38-41#
P.LBN    38-24#
P.MEDI   39-21#    39-37#
P.MLUN   39-17#    39-33#
P.MOD    38-20#
P.OPCD   38-19#    39-6#     63-9      64-58     97-29*
P.OTRF   38-27#    39-13#
P.OVRL   38-51#    95-5*     95-6*
P.RBN    38-36#
P.RBNS   39-28#
P.RCTC   39-29#
P.RCTS   39-27#
P.RGID   38-46#
P.RGOF   38-47#
P.SHST   39-23#    39-39#
P.SHUN   38-33#    39-22#    39-38#
P.STS    39-8#     63-14     95-10
P.TIME   38-43#
P.TRCK   39-24#
P.UADR   38-23#    95-3*     99-18*
P.UNCL   39-40#
P.UNFL   38-30#    39-18#    39-34#
P.UNIT   38-18#    39-5#
P.UNSZ   39-41#
P.UNTI   39-20#    39-36#
P.USEF   38-42#
P.VRSN   38-39#    39-45#
P.VSER   39-42#
PB       91-14#    92-7
PF       46-41     91-12#    92-5
PNT      30-10#
PNT.CT   53-15     53-15     53-15#    53-15#    53-19     53-19     53-19#    53-19#    53-23     53-23     53-23#    53-23#    53-27     53-27#
         53-31     53-31     53-31#    53-31#    53-35     53-35#    53-39     53-39#    53-43     53-43     53-43#    53-43#    53-47     53-47#
         53-55     53-55     53-55#    53-55#    53-58     53-58     53-58#    53-58#    53-64     53-64     53-64     53-64#    53-64#    53-64#
         53-68     53-68     53-68     53-68#    53-68#    53-68#    53-72     53-72     53-72     53-72#    53-72#    53-72#    53-76     53-76#
         53-80     53-80     53-80#    53-80#    53-84     53-84     53-84     53-84#    53-84#    53-84#    53-88     53-88     53-88#    53-88#
         53-92     53-92#    53-96     53-96#    53-109    53-109#   53-113    53-113    53-113#   53-113#   53-117    53-117    53 117#   53-117#
         53-121    53-121#   53-124    53-124#   53-130    53-130    53-130    53-130    53-130    53-130#   53-130#   53-130#   53-130#   53-130#
         53-137    53-137#   53-141    53-141    53-141    53-141    53-141    53-141    53-141    53-141    53-141#   53-141#   53-141#   53-141#
         53-141#   53-141#   53-141#   53-141#   70-40     70-40#    76-15     76-15     76-15     76-15     76-15#    76-15#    76-15#    76-15#
         77-41     77-41#    79-23     79-23#    82-4      82-4#     83-5      83-5      83-5      83-5      83-5      83-5#     83-5#     83-5#
         83-5#     83-5#     84-5      84-5      84-5      84-5      84-5      84-5      84-5#     84-5#     84-5#     84-5#     84-5#     84 5#
        113-24    113-24    113-24#   113-24#   113-28    113-28    113-28#   113-28#   113-33    113-33    113-33#   113-33#   114-31    114-31#
        116-98    116-98#   119-6     119-6#    119-7     119-7#    119-31    119-31#   119-42    119-42    119-42    119-42    119-42#   119-42#
        119-42#   119-42#
PNTNUM   78-24     78-30     79-4      89-14#
PNTNUS   89-16#
PNTPKL   53-130#   53-134
PNTPKT   53-101    53-105    53-124#
PRI      30-10#
PRI00    30-10#   116-233
PRI01    30-10#
PRI02    30-10#
PRI03    30-10#
PRI04    30-10#
```

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PRIO5    30-10#
PRIO6    30-10#
PRIO7    26-34     30-10#    58-11     94-20     107-27    116-106   118-11
PS       91-18#    92-11
PTYPE    46-41#    83-8*     84-8*     91-11     92-5*     92-7*     92-9*     92-11*
PX       83-8      84-8      91-16#    92-9
QUEO     68-19     68-26#
QUE7     68-21     68-27#
QUEL     68-28#    68-30
QUEST    65-3      68-16#
RAFMT    46-15     46-16
RESET    58-9#     116-108
RESPCT   61-8#     62-4      62-7      62-31
RESPDM   61-6#     62-8      119-82
RG.FLG   34-4#     64-74     98-18
RG.OWN   34-3#     61-50     64-74     98-18     98-19
RNTIM    50-5#     113-24
RNTIM1   50-6#     113-28
RNTIM2   50-7#     113-33
RNTIME   76-22     83-6      84-6      113-13#
RNTIMX   113-14    113-35#
RSPDRP   61-25     62-12#    62-37     63-22     64-9      64-27
RSPDSP   64-26     65-3#     65-9
RSPERR   63-10     64-58#
RSPERW   63-15     63-21#    64-59
RSPIN    61-14     63-5#
RSPMWR   63-7      63-9#
RSPNTO   61-30     61-32     61-35     61-37     61-53#
RSPNXT   61-11     62-3#     62-33     64-57     64-75
RSPOU    63-27#
RSPOU2   64-41     64-50#
RSPOU3   64-48     64-51#
RSPOU4   61-52     64-53#
RSPOUT   61-17     63-27     64-34     64-39#
RSPPT2   64-3#
RSPPT3   64-7      64-11#
RSPPTW   63-20     63-26#
RSPTM    61-23     61-29#
RSPTMO   61-34     61-38#
RSPTOE   61-39     61-41     62-36#    64-61     64-76
RUNDM    59-15#    119-80
S$LSYM   26-8#     28-14#    29-14#    53-16#    53-20#    53-24#    53-28#    53-32#    53-36#    53-40#    53-44#    53-48#    53-60#    53-65#
         53-77#    53-81#    53-85#    53-89#    53-93#    53-98#    53-102#   53-106#   53-110#   53-114#   53-118#   53-122#   102-14#   103-21#
         112-9#    114-1     114-1     114-1     114-1#    116-249#  117-12#   118-21#   119-11    119-11    119-11    119-11#   119-32    119-32
         119-32    119-32#   119-45    119-45    119-45    119 45#   119-84#   121-3#    123-10#
S.CNS    123-5     123-19#
S.FMT    123-1     123-18#
S.NOF    123-9     123-23#
S.NRF    123-3     123-12#
S.RST    123-7     123-20#
SA.A2    32-21#
SA.BST   33-22#
SA.CM1   32-35#
SA.CMD   32-30#
SA.CME   32-40#
SA.CNT   33 16#    105-42
SA.CTP   32-43#
SA.DI    32-22#  109-13
SA.ERC   32-16#
SA.ERR   32-9#    53-63   110-19
SA.GO    33-20#  106-18
SA.INE   33-4#
SA.INT   32-28#
SA.LFC   33-21#
SA.MCV   33-15#
SA.MP    32-11#  109-14
SA.MS1   32-34#
SA.MSE   32-39#
SA.MSG   32-29#
SA.NV    32-20#
SA.NVE   33-5#
SA.PRG   32-47#
SA.QB    32-10#  109-14
SA.S1    32-5#   108-3    109-13
SA.S2    32-6#   109-23
SA.S3    32-7#   109-31
SA.S4    32-8#   108-13
SA.SM    32-12#  109-14
SA.STE   32-42#
SA.STP   32-32#  107-18
SA.TST   33-11#  109-8
SA.VCE   33-3#
SA.VEC   32-27#
SA.WRP   32-31#
SERNQ    49-5#   119-45
SERNUM   50-17#  119-42
SERNX    52-12#  119-65
SET00   104-17#  104-22
SET01   104-18   104-20#
SET02   104-26#  104-29
SETTO    64-56   100-15   104-14#  110-23
SFPTBL   29-10#  116-79   116-82   116-85
SNDCMD   64-52    95-7     98-14#
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SO.CNS  116 81   122 22#  123-5
SO.FM1  122-19#  122-21   123-1
SO.FM2  122-20#  122-21   123-3
SO.FMT   69-53   116-78   119-18   122-21#
SO.STR   69-59   119-24   122-23#  123-7
SPECL    65-8     73-14#   73-29
SPECLC   73-18#
SPECLE   73-25    73-31#
SPECLL   73-24#   73-27
SPECLR   73-16    73-22#
SPECLX   73-15    73-32#
ST.ABO   40-7#
ST.AVL   40-9#
ST.CMD   40-6#
ST.CMP   40-12#
ST.CNT   40-15#
ST.DAT   40-13#
ST.DIA   40-17#
ST.DRV  40-16#
ST.HST  40-14#
ST.MFE  40-10#
ST.MSK  40 3#     63-14     95-10
ST.OFL  40-8#
ST.SUB  40-4#
ST.SUC  40-5#
ST.WPR  40-11#
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        53-42     53-42     53-46     53-46     53-46     53-50     53-50     53-50     53-62     53-62     53-62     53-67     53-67     53-67
        53 79     53-79     53-79     53-83     53-83     53-83     53-87     53-87     53-87     53-91     53-91     53-91     53-95     53 95
        53-95     53-100    53-100    53-100    53-104    53-104    53-104    53-108    53-108    53-108    53-112    53-112    53-112    53-116
        53-116    53-116    53-120    53-120    53-120    54-4#     102-10    103-18    112-5     115-10    116-45    117-10    118-8     120-14
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       106-12    106-12    106-12    106-12    106-12    106-12    106-12    106-12    106-12    106-12    106-12    106-12    107-12    107-12
       107 12    107-27    107-27    107-27    107-27    107-27    107-27    107-27    107-27    107-27    107-27    107-27    107-27    107-27
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         53-44    53-48    53-48    53-48    53-60    53-60    53-60    53-65    53-65    53-65    53-77    53-77    53-77    53-81
         57-81    53-81    53-85    53-85    53-85    53-89    53-89    53-89    53-93    53-93    53-93    53-98    53-98    53-98
         53-102   53-102   53-102   53-106   53-106   53-106   53-110   53-110   53-110   53-114   53-114   53-114   53-118   53-118
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T$$CLE  118-8#   118-21
T$$DAT  125-3    125-3#   125-8
T$$HAR  120-14   120-14#  121-3
T$$HW    28-10    28-10#   28-14
T$$INI  116-45#  116-235  116-249
T$$MSG   53-14#   53-16    53-18#   53-20    53-22#   53-24    53-26#   53-28    53-30#   53-32    53-34#   53-36    53-38#   53-40
         53-42#   53-44    53-46#   53-48    53-50#   53-60    53-62#   53-65    53-67#   53-77    53-79#   53-81    53-83#   53-85
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T$$PTA 125-1#    125-3     125-3#
T$$SOF 122-12    122-12#   123-10
T$$SRV 102-10#   102-14    103-18#   103-21    112-5#    112-9
T$$SW   29-10     29-10#    29-14
T$$TES 119-5#    119-23    119-29    119-83    119-84
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       119-22#   119-28    119-28#
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       119-83#   119-83#
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T$GMAN  26-8#    114-1     114-1#    114-1#    119-32    119-32#   119-32#   119-45    119-45#   119-45#
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       103-21    112-9     116-249   117-12    118-21    119-84    121-3     123-10
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T$NEST  26-8#     26-26     26-26     26-26#    28-10     28-10     28-10#    28-14     28-14     28-14     28-14#    29-10     29-10     29-10#
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         123-5#    123-6     123-6#    123-7     123-7#    123-8     123-8#    123-9     123-9     123-9#    125-3     125-3#
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