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## IDENTIFICATION

PRODUCT CODE:   AC-S836C-MC

PRODUCT NAME:   CZUDECO  UDA DISK FORMATTER

PRODUCT DATE:   27-AUG-82

MAINTAINER:     DIAGNOSTIC ENGINEERING

AUTHOR:         MATT TEDONE

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## 1.0     GENERAL INFORMATION
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### 1.1     PROGRAM ABSTRACT
------------------

This program will format any disk drive connected to a UDA-50 disk
controller.  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 read 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 UDA-50 disk controller. The
host program simply downline loads the DUP program in the UDA-50 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 UDA-50 can only format one disk at a time, so each disk on
a UDA-50 will be selected sequentially. If the disk drives to be
formatted are connected to different UDA-50s, all UDA-50s 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 UDA-50 and unit 3 is connected to a different UDA-50 (Unibus
addresses are different). This program will automatically start
simultaneous 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 processor
        28K words of memory (minimum)
        Console terminal
        XXDP+ load media containing this program
        One or more UDA-50 subsystems
        XXDP+ load media containing this program and the ZUDGA0.PAK
                data file.

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.

The diagnostic program requires that the data file ZUDGA0.PAK be on
the XXDP+ system device.  This data file is ordered under the name
CZUDEB0.  The XXDP+ system device must remain on-line during the
execution of the this diagnostic.


## 2.0    OPERATING INSTRUCTIONS

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


## 2.1    COMMANDS

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

| COMMAND | EFFECT |
|---------|--------|
| START | Start the diagnostic from an initial state |
| RESTART | Start the diagnostic without initializing |
| CONTINUE | Continue at test that was interrupted (after ^C) |

|          |                                                         |
|----------|---------------------------------------------------------|
| PROCEED  | Continue from an error halt                             |
| EXIT     | Return to XXDP+ Monitor (XXDP+ OPERATION ONLY!)         |
| ADD      | Activate a unit for testing (all units are             |
|          | considered to be active at start time                  |
| DROP     | Deactivate a unit                                       |
| PRINT    | Print statistical information (see section 4.0)         |
| DISPLAY  | Type a list of all device information                   |
| FLAGS    | Type the state of all flags (see section 2.3)           |
| ZFLAGS   | Clear all flags (see section 2.3)                       |

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


2.2     SWITCHES
        --------

There are several switches which are used to modify supervisor
operation. These switches are 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 | P-SS | 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*  | Inhibit extended error reports (those           |
|       | called by PRINTX macro's)                       |
| PRI   | Direct messages to line printer                 |
| PNT   | Print test number as test executes              |
| BOE   | 'BELL'' on error                                |
| UAM   | Unattended mode (no manual intervention)        |
| IDU   | Inhibit program dropping of units               |
| LOT   | Loop on test                                    |

*Error messages are described in section 3.1

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

        /FLAGS:LOE:IER:BOE

## 2.4   HARDWARE QUESTIONS

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


UNIBUS ADDRESS OF UDA (O) 172150 ?

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

VECTOR (O) 154 ?

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

BR LEVEL (D) 5 ?

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

UNIBUS BURST RATE (D) 63 ?

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

DRIVE NUMBER (D) 0 ?

>       Answer with the drive number of the drive you wish to test.
>       This is the number which appears on the "unit plug" on the
>       front of the disk drive. On a multi-unit drive, each sub-unit
>       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 UDA at a time (UDA configuration limit).

## 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 diagnostic
> 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

Once the program is started, 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 followng question will be asked for each disk of be formatted before the format operation begins.

SERIAL NUMBER FOR UNIT xx LDA 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 t dious 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 (O) ?  160000<CR>
SUB-DEVICE # (O) ?  5<CR>
Q-FACTOR (O) 0 ?  <CR>

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

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

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

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

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

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

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

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

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

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

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

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

UNIT 1
CSR ADDRESS (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 this program:

      1. Boot XXDP+

      2. Give the date and answer the LSI and 50HZ (if there
         is a clock) questions

      3. Type 'R ZUDEBG''

      4. Type ''START''

      5. Answer the ''CHANGE HW'' question with ''Y''

      6. Answer all the hardware questions

      7. Answer the ''CHANGE SW'' question with ''N''

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

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

DR>STA

CHANGE HW (L)   ? Y

# UNITS (D)   ? 2

UNIT 0
UNIBUS ADDRESS OF UDA (O)   172150 ?
VECTOR (O)   154 ?
BR LEVEL (D) 5 ?
UNIBUS BURST RATE (D)   63 ?
DRIVF NUMBER (D)   0 ? 0,1

CHANGE SW (L)   ? N

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

                    UNIT 0 UDA AT 172150 DRIVE 0   RUNTIME 0:12:20
                    Format completed
                         2 Revectored LBNS
                         2 Primary revectored LBNS
                         0 Secondary/tertiary revectored LBNS
                         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 UDA AT 172150 DRIVE 1   RUNTIME 0:25:18
                    Format completed
                         6 Revectored LBNS
                         5 Primary revectored LBNS
                         1 Secondary/tertiary revectored LBNS
                         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
                         4 Blocks retried on the check pass
                    FCT used successfully
                    CZUDE 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

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

                      RUNTIME 0:12:45
                    Format completed
                         2 Revectored LBNS
                         2 Primary revectored LBNS
                         0 Secondary/tertiary revectored LBNS
                         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
                    CZUDE 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 a
diagnostic: general, basic and extended.  General error messages are
always printed unless the "IER" flag is set (section 2.3). The general
error message is of the form:

        NAME   TYPE   NUMBER   ON UNIT NUMBER   TST NUMBER FC:XXXXXX
        error message

where:  NAME = diagnostic 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 diagnostic program. The diagnostic stops and the
Runtime Services prompt is printed.

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

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 gocd/bad data.  These are always printed
unless the "IER", "IBE" or "IXE" flags are set (section 2.3). These
messages are printed after the associated general error message and
any associated basic error messages.

The general and basic error messages from this diagnostic are always
one line each. The basic message defines what program detected the
error, the UDA-50 being used and the time of the error:

HOST PROGRAM  UDA AT xxxxxx  RUNTIME hhh:mm:ss

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

Sample error message:

```
CZUDE DVC FTL ERR   00021 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx      - general message
HOST PROGRAM  UDA AT 172150   RUNTIME 0:00:12                        - basic message
UDA RESIDENT DIAGNOSTICS DETECTED FAILURE                          \
   UDASA CONTAINS 104041                                            !- extended message
REPLACE UDA MODULE M7161                                           /
```

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


```
00001    CZUDE SYS FTL ERR   00001 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
         HOST PROGRAM  UDA AT 172150   RUNTIME x:xx:xx
         I DON'T LIKE THE ANSWERS YOU GAVE TO THE HARDWARE QUESTIONS
         UDA HAS MORE THAN ONE VECTOR, BR LEVEL OR BURST RATE
```

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

```
00002    CZUDE SYS FTL ERR   00002 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
         HOST PROGRAM  UDA AT 172150   RUNTIME x:xx:xx
         I DON'T LIKE THE ANSWERS YOU GAVE TO THE HARDWARE QUESTIONS
         TWO UNITS SELECT THE SAME DRIVE
```

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

```
00003    CZUDE SYS FTL ERR  00003 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
         HOST PROGRAM  UDA AT 172150  RUNTIME x:xx:xx
         I DON'T LIKE THE ANSWERS YOU GAVE TO THE HARDWARE QUESTIONS
         MORE THAN EIGHT DRIVES SELECTED ON THIS UDA
```

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

```
00004    CZUDE 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 TEST THE UNITS SELECTED
         PLEASE START PROGRAM OVER AND TEST FEWER UNITS AT A TIME
```

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

```
00008    CZUDE SYS FTL ERR  00008 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
         HOST PROGRAM  UDA AT 172150  RUNTIME x:xx:xx
         I DON'T LIKE THE ANSWERS YOU GAVE TO THE HARDWARE QUESTIONS
         TWO UDA'S USE THE SAME VECTOR
```

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

```
00009    CZUDE 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    CZUDE 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 is used.

00011      CZUDE DVC FTL ERR  00011 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
           HOST PROGRAM  UDA AT 172150  RUNTIME x:xx:xx
           WRONG APT FORMATTER IS BEING USED WITH THIS CONTROLLER.
           USE CIUDx.

                    There are two APT compatible formatters.  CIUDK is used
                    for UDA-50s with the M7161-2 modules.  CIUDI is used for
                    UDA-50s with the M7485-6 modules.  If one formatter program
                    is used with the wrong UDA-50 module set, this error will
                    appear.  Use the other APT formatter program to successfully
                    format.

00020      CZUDE DVC FTL ERR  00020 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
           HOST PROGRAM  UDA AT 172150  RUNTIME x:xx:xx
           MEMORY ERROR TRYING TO READ UDA REGISTERS
           CHECK UNIBUS SELECTION SWITCHES ON UDA MODULE M7161 OR M7485
           OR UNIBUS
           OR REPLACE UDA MODULE M7161 OR M7485

                    A non-existant memory error occurred when the host program
                    tried to access the UDAIP and UDASA registers.  The UDA
                    is at another address (check the UNIBUS selection switches)
                    or module M7161 is broken or the UNIBUS is broken.

```
00021     CZUDE DVC FTL ERR 00021 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
          HOST PROGRAM  UDA AT 172150  RUNTIME x   :xx
          UDA RESIDENT DIAGNOSTICS DETECTED FAILL
            UDASA CONTAINS  105154
          REPLACE UDA MODULE M7162 OR M7486
```

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

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

Replace the board specified.  M7161 and M7485 are the Unibus
interface boards.  M7162 and M7486 are the SDI interface boards.
Module M7161 only works with the module M7182.  The same for
modules M7485 and M7486.  Do not intermix the two boards.  It
will not work!

```
00022    CZUDE DVC FTL ERR  00022 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
         HOST PROGRAM  UDA AT 172150  RUNTIME x:xx:xx
         STEP BIT DID NOT SET IN UDASA REGISTER DURING INITIALIZATION
         STEP BIT EXPECTED 004000
           UDASA CONTAINS  000000
         REPLACE UDA MODULE M7161 OR M7485
```

```
                    The UDA did not respond as expected during the
                    initialization sequence which communicates using data
                    in the UDASA register. A normal response from the UDA
                    contains either a STEP bit or an ERROR bit defined as
                    follows:
                            Bit 15 (100000)    Error bit
                            Bit 14 (040000)    Step 4 bit
                            Bit 13 (020000)    Step 3 bit
                            Bit 12 (010000)    Step 2 bit
                            bit 11 (004000)    Step 1 bit
                    The expected step bit nor the error bit set within the
                    expected time.
```

```
00023    CZUDE DVC FTL ERR  00023 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
         HOST PROGRAM  UDA AT 172150  RUNTIME x:xx:xx
         UDA DID NOT CLEAR RING STRUCTURE IN HOST MEMORY DURING INITIALIZATION
         6 WORDS WERE TO BE CLEARED STARTING AT ADDRESS 040644
         FIRST SEVERAL WORDS NOT CLEARED (UP TO 6):
                 ADDRESS      CONTENTS
                 040644        000010
                 040650        000010
                 040652        000010
         REPLACE UDA MODULE M7161 OR M7485
```

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

```
00024    CZUDE DVC FTL ERR  00024 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
         HOST PROGRAM  UDA AT 172150  RUNTIME x:xx:xx
         UDASA REGISTER DID NOT GO TO ZERO AFTER STEP 3 WRITE OF INITIALIZATION
         PURGE/POLE DIAGNOSTICS WERE REQUESTED
           UDASA CONTENTS  004400
```

```
                    For better testing, the host can test the PURGE and POLE
                    mechanism of the UDA.  To do so the host sets bit15 of the
                    step 3 data and sends the data to the UDA.  The UDA must
                    go to zero and wait for the purge and pole.  If the UDA
                    never went to zero, then error message 00024 is displayed.
                    The UDA may have a bad M7161 module or M7485 module
                    or the UNIBUS may be broken.
```

```
00025     CZUDE DVC FTL ERR  00025 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
          HOST PROGRAM  UDA AT 172150  RUNTIME x:xx:xx
          UDA DID NOT RETURN CORRECT DATA IN UDASA REGISTER DURING INITIALIZATION
            UDASA EXPECTED  004400
            UDASA CONTAINS  004000
          REPLACE UDA MODULE M7161 OR M7485
```

                    For each step of initialization, specific data is expected
                    to be displayed in the UDASA.  If the UDASA does not match
                    the expected data, then error message 00025 is displayed.
                    Replace UDA module M7161 or M7485.

```
00030     CZUDE DVC FTL ERR  00030 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
          HOST PROGRAM  UDA AT 172150  RUNTIME x:xx:xx
          UDA REPORTED FATAL ERROR IN UDASA REGISTER WHILE RUNNING DM PROGRAM
            UDASA CONTAINS  100004
```

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

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

```
00031     CZUDE DVC FTL ERR  00031 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
          HOST PROGRAM  UDA AT 172150  RUNTIME x:xx:xx
          NO INTERRUPT RECEIVED FROM DM PROGRAM FOR 3 MINUTES
          ASSUME PROGRAM IS HUNG
```

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

```
00032     CZUDE DVC FTL ERR  00032 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
          HOST PROGRAM  UDA AT 172150  RUNTIME x:xx:xx
          MESSAGE BUFFER RECEIVED FROM DM PROGRAM WITH UNKNOWN REQUEST NUMBER
          MESSAGE BUFFER CONTAINS:
            000001 000002 000003 000004 000005 000006 000007
            000008 000009 000010 000011 000012 000013 000014
            000015 000016 000017 000018 000019 000020 000021
            000022 000023 000024 000025 000026 000027 000028
            000029 000030 000031 000032 000033 000034 000035
```

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

```
00033     CZUDE DVC FTL ERR  00033 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
00034     HOST PROGRAM  UDA AT 172150  RUNTIME x:xx:xx
          RESPONSE PACKET FROM UDA DOES NOT CONTAIN EXPECTED DATA
          EITHER UDA RETURNED ERROR STATUS OR PACKET WAS NOT RECEIVED CORRECTLY
            COMMAND PACKET SENT         RESPONSE PACKET RECEIVED
              000000 000020               000000 000020
              000000 000000               000000 000000
              000000 000002               000000 000202
              000000 014336               000000 014336
              000000 034674               000000 034674
              000000 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 to UDA.  The response packet may have been in
error with one of the following points:

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

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

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

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

00037     CZUDE DVC FTL ERR  00037 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
           HOST PROGRAM  UDA AT 172150  RUNTIME x:xx:xx
           UDA REPORTED FATAL ERROR IN UDASA REGISTER WHILE LOADING DM PROGRAM
            UDASA CONTAINS  100004
           REPLACE UDA MODULE M7161 OR M7485

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

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

                  The DUP program 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     CZUDE DVC FTL ERR  00101 ON UNIT 00 TST 001 SUB 000 PC: xxxxxx
           HOST PROGRAM  UDA AT 172150  RUNTIME x:xx:xx
           DUP PROGRAM REJECTED ANSWER TO DATE OR SERIAL NUMBER QUESTION

                  After the cperator inputs the date/serial number, the
                  DUP program will ask the host program for them.  If for
                  some reason the date/serial number was unacceptable to
                  the DUP program, 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 UDA 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 UDA 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 UDA.  Again, there may be a cable/receiver/transmitter
> problem.


UNIBUS read error

> This is caused by one of two problems.  While trying to read an overlay
> into the UDA 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 UNIBUS or the UDA module
> M7161 or M7485.


Formatter initialization error

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


Nonexistent unit number

> The desired disk drive wasn't attached to the UDA.

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 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.

RC-T 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/write
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 information file
was larger than it really was.  There may be a UNIBUS or M7161 or
M7485 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.

An example of how the errors are presented is below:

        RUNTIME  0:00:18
        Nonexistant 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 in message #2 which were primary
> revectors.

n Secondary/teritary revectored LBNS

> Where n is the number of the LBNs in message #2 which were
> secondary or tertiary revectors.

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 0:24:57
Format completed
      5 Revectored LBNS
      5 Primary revectored LBNS
      0 Secondary/tertiary revectored LBNS
      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 UDA-50.

57
58
59

```
     1                                    .SBTTL  PROGRAM HEADER
    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  CZUDE,C,0,0,1,PRIO7       ;FIELD SERVICE
        002000                                                            LSNAME::
        002000      103                                                   .ASCII /C/
        002001      132                                                   .ASCII /Z/
        002002      125                                                   .ASCII /U/
        002003      104                                                   .ASCII /D/
        002004      105                                                   .ASCII /E/
        002005      000                                                   .BYTE  0
        002006      000                                                   .BYTE  0
        002007      000                                                   .BYTE  0
        002010                                                            LSREV::
        002010      103                                                   .ASCII /C/
        002011                                                            LSDEPO::
        002011      060                                                   .ASCII /0/
        002012                                                            LSUNIT::
        002012      000001                                                .WORD  TSPTHV
        002014                                                            LSTIML::
        002014      000000                                                .WORD  0
        002016                                                            LSHPCP::
        002016      022762                                                .WORD  LSHARD
        002020                                                            LSSPCP::
        002020      023150                                                .WORD  LSSOFT
        002022                                                            LSHPTP::
        002022      002130                                                .WORD  LSHW
        002024                                                            LSSPTP::
        002024      002144                                                .WORD  LSSW
        002026                                                            LSLADP::
        002026      000124'                                               .WORD  LSLAST
        002030                                                            LSSTA::
        002030      000000                                                .WORD  0
        002032                                                            LSCO::
        002032      000000                                                .WORD  0
        002034                                                            LSDTYP::
        002034      000001                                                .WORD  1
        002036                                                            LSAPT::
        002036      000000                                                .WORD  0
        002040                                                            LSDTP::
        002040      002124                                                .WORD  LSDISPATCH
        002042                                                            LSPRIO::
        002042      000340                                                .WORD  PRIO7
        002044                                                            LSENVI::
        002044      000000                                                .WORD  0
        002046                                                            LSEXP1::
        002046      000000                                                .WORD  0
        002050                                                            LSMREV::
        002050      003                                                   .BYTE  CSREVISION
        002051      003                                                   .BYTE  CSEDIT
```

```
        002052                          LSEF::
        002052  000000                          .WORD   0
        002054  000000                          .WORD   0
        002056                          LSSPC::
        002056  000000                          .WORD   0
        002060                          LSDEVP::
        002060  003514                          .WORD   LSDVTYP
        002062                          LSREPP::
        002062  000000                          .WORD   0
        002064                          LSEXP4::
        002064  000000                          .WORD   0
        002066                          LSEXP5::
        002066  000000                          .WORD   0
        002070                          LSAUT::
        002070  000000                          .WORD   0
        002072                          LSDUT::
        002072  000000                          .WORD   0
        002074                          LSLUN::
        002074  000000                          .WORD   0
        002076                          LSDESP::
        002076  003536                          .WORD   LSDESC
        002100                          LSLOAD::
        002100  104035                          EMT     ESLOAD
        002102                          LSETP::
        002102  000000                          .WORD   0
        002104                          LSICP::
        002104  020376                          .WORD   LSINIT
        002106                          LSCCP::
        002106  022072                          .WORD   LSCLEAN
        002110                          LSACP::
        002110  022070                          .WORD   LSAUTO
        002112                          LSPRT::
        002112  020370                          .WORD   LSPROT
        002114                          LSTEST::
        002114  000000                          .WORD   0
        002116                          LSDLY::
        002116  000000                          .WORD   0
        002120                          LSHIME::
        002120  000000                          .WORD   0
```

```
     1                                          .SBTTL   DISPATCH TABLE
     2
     3                                   ;++
     4                                   ; THE DISPATCH TABLE CONTAINS THE STARTING ADDRESS OF EACH TEST.
     5                                   ; IT IS USED BY THE SUPERVISOR TO DISPATCH TO EACH TEST.
     6                                   ;--
     7
     8
     9  002122                           DISPATCH 1
        002122  000001                                                                        .WORD   1
        002124                                                             L$DISPATCH::
        002124  022102                                                                        .WORD   T1
```

```
    1                                .SBTTL  DEFAULT HARDWARE P-TABLE
    2
    3                                ;++
    4                                ; THE DEFAULT HARDWARE P-TABLE CONTAINS DEFAULT VALUES OF
    5                                ; THE TEST-DEVICE PARAMETERS.  THE STRUCTURE OF THIS TABLE
    6                                ; IS IDENTICAL TO THE STRUCTURE OF THE HARDWARE P-TABLES,
    7                                ; AND IS USED AS A "TEMPLATE" FOR BUILDING THE P-TABLES.
    8                                ;--
    9
   10 002126                        BGNHW   DFPTBL
      002126  000005                                            .WORD   L10000-L$HW/2
      002130                                              L$HW::
      002130                                              DFPTBL::
   11
   12 002130  172150                        .WORD   172150      ; UNIBUS ADDRESS
   13 002132  000154                        .WORD   154         ; VECTOR ADDRESS
   14 002134  000005                        .WORD   5.          ; BR LEVEL
   15 002136  000077                        .WORD   63.         ; UNIBUS BURST RATE
   16 002140  000000                        .WORD   0.          ; LOGICAL DRIVE NUMBER
   17 002142                        ENDHW
      002142                                              L10000:
```

```
 1                                        .SBTTL  SOFTWARE P-TABLE
 2
 3                                        ;++
 4                                        ; THE SOFTWARE TABLE CONTAINS VARIOUS DATA USED BY THE
 5                                        ; PROGRAM AS OPERATIONAL PARAMETERS.  THESE PARAMETERS ARE
 6                                        ; SET UP AT ASSEMBLY TIME AND MAY BE VARIED BY THE OPERATOR
 7                                        ; AT RUN TIME.
 8                                        ;--
 9
10 002142                                 BGNSW   SFPTBL
   002142  000001                                         .WORD   L10001-L$SW/2
   002144                                                  L$SW::
   002144                                                  SFPTBL::
11
12                                                                  ;OFFSET         USE
13 002144  000007                         .WORD   7               ; 0.    YES/NO ANSWERS
14 002146                                 ENDSW
   002146                                                  L10001:
15
16 002146                                 ENDMOD
```

```
 1                                    .SBTTL   GLOBAL EQUATES SECTION
 2
 3 002146                                      BGNMOD
 4
 5                                    ;++
 6                                    ; THE GLOBAL EQUATES SECTION CONTAINS PROGRAM EQUATES THAT
 7                                    ; ARE USED IN MORE THAN ONE TEST.
 8                                    ;--
 9
10 002146                                      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                     BIT8==   BIT08
          000200                     BIT7==   BIT07
          000100                     BIT6==   BIT06
          000040                     BIT5==   BIT05
          000020                     BIT4==   BIT04
          000010                     BIT3==   BIT03
          000004                     BIT2==   BIT02
          000002                     BIT1==   BIT01
          000001                     BIT0==   BIT00

                                     ; EVENT FLAG DEFINITIONS
                                     ;   EF32:EF17 RESERVED FOR SUPERVISOR TO PROGRAM COMMUNICATION

          000040                     EF.START==      32.             ; START COMMAND WAS ISSUED
          000037                     EF.RESTART==    31.             ; RESTART COMMAND WAS ISSUED
          000036                     EF.CONTINUE==   30.             ; CONTINUE COMMAND WAS ISSUED
          000035                     EF.NEW==        29.             ; A NEW PASS HAS BEEN STARTED
          000034                     EF.PWR==        28.             ; A POWER-FAIL/POWER-UP OCCURRED

                                     ; PRIORITY LEVEL DEFINITIONS

          000340                     PRIO7== 340
          000300                     PRIO6== 300
          000240                     PRIO5== 240
          000200                     PRIO4== 200
```

```
         000140                    PRI03== 140
         000100                    PRI02== 100
         000040                    PRI01== 40
         000000                    PRI00== 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
   11
   12    000015                    CR=       15                    ;VALUE TO PASS TO PRINT MACRO TO END LINE
```

```
 1                              ;MACRO DEFINITIONS FOR GLOBAL EQUATES
 2
 3                              ;THESE MACROS ARE USED TO DEFINE INDEXES INTO A TABLE
 4                              ;
 5                              ;CALLING SEQUENCE MUST BE
 6                              ;
 7                              ;       TABLE
 8                              ;       ITEM     NAME     BYTES
 9                              ;       ITEM     NAME     BYTES
10                              ;       ITEM     NAME     BYTES
11                              ;       END      SIZE
12                              ;
13                              ;TABLE DEFINES THAT A TABLE IS ABOUT TO BE DEFINED AND END TERMINATES THE DEFINITION.
14                              ;ANY NUMBER OF ITEM LINES CAN APPEAR. NAME IS THE NAME OF THE SYMBOL BEING EQUATED TO
15                              ;THE INDEX. THE INDEX ALWAYS STARTS AT ZERO. BYTES SPECIFIES THE SIZE OF THE VALUE TO BE
16                              ;STORED AT THAT INDEX IN BYTES. THE SIZE ARGUMENT TO THE END STATEMENT IS OPTIONAL, IT
17                              ;BE EQUATED TO THE SIZE OF THE TABLE IN BYTES. THE SYMBOL TINDEX IS USED TO KEEP TRACK
18                              ;OF THE INDEX VALUE AND WILL BE EQUAL TO THE SIZE OF THE TABLE AFTER THE END STATEMENT.
19
20                              .MACRO TABLE
21                                      TINDEX=0
22                              .ENDM
23
24                              .MACRO ITEM NAME BYTES
25                                      NAME=TINDEX
26                                      TINDEX=TINDEX+BYTES
27                              .ENDM
28
29                              .MACRO END SIZE
30                                      .IF NB SIZE
31                                      SIZE=TINDEX
32                                      .ENDC
33                              .ENDM
```

```
 1                                          ;UDA BIT DEFINITIONS
 2
 3                                          ;UDASA REGISTER UNIVERSAL READ BITS
 4
 5          004000                  SA.S1=  004000                  ;STEP 1 STATUS BIT
 6          010000                  SA.S2=  010000                  ;STEP 2 STATUS BIT
 7          020000                  SA.S3=  020000                  ;STEP 3 STATUS BIT
 8          040000                  SA.S4=  040000                  ;STEP 4 STATUS BIT
 9          100000                  SA.ERR= 100000                  ;ERROR INDICATOR
10
11                                          ;UDASA REGISTER ERROR STATUS BITS
12
13          003777                  SA.ERC= 003777                  ;ERROR CODE
14
15                                          ;UDASA REGISTER STEP ONE READ BITS
16
17          002000                  SA.NV=  002000                  ;NON SETTABLE INTERRUPT VECTOR
18          001000                  SA.A2=  001000                  ;22 BIT ADDRESS BUS
19          000400                  SA.DI=  000400                  ;ENHANCED DIAGNOSTICS
20                                  ;       000377                  ;ALL BITS RESERVED
21
22                                          ;UDASA REGISTER STEP ONE WRITE BITS
23
24          000177                  SA.VEC= 000177                  ;INTERRUPT VECTOR (DIVIDED BY 4)
25          000200                  SA.INT= 000200                  ;INTERRUPT ENABLE DURING INITIALIZATION
26          003400                  SA.MSG= 003400                  ;MESSAGE RING LENGTH
27          034000                  SA.CMD= 034000                  ;COMMAND RING LENGTH
28          040000                  SA.WRP= 040000                  ;WRAP BIT
29          100000                  SA.STP= 100000                  ;STEP - MUST ALWAYS BE WRITTEN A ONE
30
31          000400                  SA.MS1= 000400                  ;LSB OF MESSAGE RING LENGTH
32          004000                  SA.CM1= 004000                  ;LSB OF COMMAND RING LENGTH
33
34                                          ;UDASA REGISTER STEP TWO READ BITS
35
36          000007                  SA.MSE= 000007                  ;MESSAGE RING LENGTH ECHO
37          000070                  SA.CME= 000070                  ;COMMAND RING LENGTH ECHO
38                                  ;       000100                  ;RESERVED
39          000200                  SA.STE= 000200                  ;STEP ECHO
40          003400                  SA.CTP= 003400                  ;CONTROLLER TYPE
41
42                                          ;UDASA REGISTER STEP TWO WRITE BITS
43
44          000001                  SA.PRG= 000001                  ;ENABLE VAX UNIBUS ADAPTER PURGE INTERRUPT
45                                  ;       177776                  ;LOW ORDER MESSAGE RING BYTE ADDRESS
```

```
 1                                  ;UDASA REGISTER STEP THREE READ BITS
 2
 3      000177                      SA.VCE= 000177                          ;INTERRUPT VECTOR ECHO
 4      000200                      SA.INE= 000200                          ;INTERRUPT ENABLE ECHO
 5      000400                      SA.NVE= 000400                          ;VECTOR NOT PROGRAMMABLE
 6                                  ;        003000                         ;RESERVED
 7
 8                                  ;UDASA REGISTER STEP THREE WRITE BITS
 9
10                                  ;        077777                         ;HIGH ORDER MESSAGE RING BYTE ADDRESS
11      100000                      SA.TST= 100000                          ;PURGE POLE TEST ENABLE
12
13                                  ;UDASA REGISTER STEP FOUR READ BITS
14
15      000017                      SA.MCV= 000017                          ;UDA MICROCODE VERSION
16      000360                      SA.CNT= 000360                          ;CONTROLLER MODEL
17                                  ;        003400                         ;RESERVED
18
19                                  ;UDASA REGISTER STEP FOUR WRITE BITS
20
21      000001                      SA.GO=  000001                          ;GO BIT TO START UDA FIRMWARE
22      000002                      SA.LFC= 000002                          ;LAST FAILURE CODE REQUEST
23      000374                      SA.BST= 000374                          ;BURST LEVEL
```

```
  1                                        ;COMMAND/MESSAGE DESCRIPTOR BIT DEFINITIONS
  2
  3        100000                          RG.OWN= 100000                              ;SET WHEN UDA OWNS RING
  4        040000                          RG.FLG= 040000                              ;FLAG BIT
  5
  6                                        ;OFFSETS INTO HOST COMMUNICATIONS AREA WITH ONE DESCRIPTOR TO EACH RING
  7                                        ;AND TWO PACKET AND BUFFER AREAS.
  8
  9        000004                          HC.ISZ=  4.                                 ;SIZE OF INTERRUPT INDICATOR WORDS
 10        000004                          HC.RSZ=  4.                                 ;SIZE OF RING IN BYTES
 11        000004                          HC.ESZ=  4.                                 ;SIZE OF ENVELOPE WORDS BEFORE PACKET
 12        000060                          HC.PSZ= 48.                                 ;SIZE OF COMMAND AND MESSAGE PACKETS
 13        000122                          HC.BSZ= 82.                                 ;SIZE OF BUFFER
 14
 15        000000                          HC.INT=  0.                                 ;INTERRUPT INDICATOR WORDS START
 16        000004                          HC.MSG= HC.INT+HC.ISZ                       ;MESSAGE RING START
 17        000006                          HC.MCT= HC.MSG+2.                           ;MESSAGE RING CONTROL WORD
 18        000010                          HC.CMD= HC.MSG+HC.RSZ                       ;COMMAND RING START
 19        000012                          HC.CCT= HC.CMD+2.                           ;COMMAND RING CONTROL WORDS
 20        000014                          HC.MEV= HC.CMD+HC.RSZ                       ;MESSAGE ENVELOPE START
 21        000020                          HC.MPK= HC.MEV+HC.ESZ                       ;MESSAGE PACKET START
 22        000100                          HC.CEV= HC.MPK+HC.PSZ                       ;COMMAND ENVELOPE START
 23        000104                          HC.CPK= HC.CEV+HC.ESZ                       ;COMMAND PACKET START
 24        000164                          HC.BF1= HC.CPK+HC.PSZ                       ;FIRST BUFFER
 25        000306                          HC.BF2= HC.BF1+HC.BSZ                       ;SECOND BUFFER
 26
 27        000430                          HC.SIZ= HC.BF2+HC.BSZ                       ;TOTAL SIZE OF HOST COMM AREA
 28
 29                                        ;VIRTUAL CIRCUIT IDENTIFIERS
 30
 31        000000                          MSCP=    0                                  ;MSCP CIRCUIT
 32        000001                          LOG=     1                                  ;LOG CIRCUIT
 33        177777                          DIAG=   -1                                  ;DIAGNOSTIC CIRCUIT
 34        001000                          DUP=  1000                                  ;DIAGNOSTIC AND UTILITIES PROTOCOL
```

```
 1
 2              :         +------------------------------------------+
 3              :  HC.INT !           INTERRUPT INDICATORS           !    4 BYTES
 4              :         +------------------------------------------+
 5              :  HC.MSG !             MESSAGE RING                 !    4 BYTES
 6              :  HC.MCT !                                          !
 7              :         +------------------------------------------+
 8              :  HC.CMD !             COMMAND RING                 !    4 BYTES
 9              :  HC.CCT !                                          !
10              :         +------------------------------------------+
11              :  HC.MEV !           MESSAGE ENVELOPE               !   52 BYTES
12              :  HC.MPK !                                          !
13              :         !                                          !
14              :         !                                          !
15              :         !                                          !
16              :         !                                          !
17              :         +------------------------------------------+
18              :  HC.CEV !           COMMAND ENVELOPE               !   52 BYTES
19              :  HC.CPK !                                          !
20              :         !                                          !
21              :         !                                          !
22              :         !                                          !
23              :         !                                          !
24              :         +------------------------------------------+
25              :  HC.BF1 !   BUFFER # 1 (RESPONSE TO DM PROGRAM)    !   82 BYTES
26              :         !                                          !
27              :         !                                          !
28              :         !                                          !
29              :         +------------------------------------------+
30              :  HC.BF2 !   BUFFER # 2 (REQUEST FROM DM PROGRAM)   !   82 BYTES
31              :         !                                          !
32              :         !                                          !
33              :         !                                          !
34              :         +------------------------------------------+
```

```
 1                                   ;COMMAND PACKET OPCODES
 2
 3              000001               OP.ABO=   1                          ;ABORT COMMAND
 4              000020               OP.ACC=  20                          ;ACCESS COMMAND
 5              000010               OP.AVL=  10                          ;AVAILABLE COMMAND
 6              000021               OP.CCD=  21                          ;COMPARE CONTROLLER DATA COMMAND
 7              000040               OP.CMP=  40                          ;COMPARE HOST DATA COMMAND
 8              000022               OP.ERS=  22                          ;ERASE COMMAND
 9              000023               OP.FLU=  23                          ;FLUSH COMMAND
10              000002               OP.GCS=   2                          ;GET COMMAND STATUS COMMAND
11              000003               OP.GUS=   3                          ;GET UNIT STATUS COMMAND
12              000011               OP.ONL=  11                          ;ONLINE COMMAND
13              000041               OP.RD=   41                          ;READ COMMAND
14              000024               OP.RPL=  24                          ;REPLACE COMMAND
15              000004               OP.SCC=   4                          ;SET CONTROLLER CHARACTERISTICS COMMAND
16              00C012               OP.SUC=  12                          ;SET UNIT CHARACTERISTICS COMMAND
17              000042               OP.WR=   42                          ;WRITE COMMAND
18              000030               OP.MRD=  30                          ;MAINTENANCE READ COMMAND
19              000031               OP.MWR=  31                          ;MAINTENANCE WRITE COMMAND
20              000200               OP.END= 200                          ;END PACKET FLAG
21              000007               OP.SEX=   7                          ;SERIOUS EXCEPTION END PACKET
22              000100               OP.AVA= 100                          ;AVAILABLE ATTENTION MESSAGE
23              000101               OP.DUP= 101                          ;DUPLICATE UNIT NUMBER ATTENTION MESSAGE
24              000102               OP.SHC= 102                          ;SHADOW COPY COMPLETE ATTENION MESSAGE
25              000103               OP.RLC= 103                          ;RESET COMMAND LIMIT ATTENTION MESSAGE
26
27              000001               OP.GDS=   1                          ;DUP GET DUST STATUS
28              000001               OP.GSS=   1                          ;DUP GET DUST STATUS
29              000002               OP.ESP=   2                          ;DUP EXECUTE SUPPLIED PROGRAM
30              000003               OP.ELP=   3                          ;DUP EXECUTE LOCAL PROGRAM
31              000004               OP.SSD=   4                          ;DUP SEND STUD DATA
32              000005               OP.RSD=   5                          ;DUP RECEIVE STUD DATA
33
34                                   ;NOTE: END PACKET OPCODES (ALSO CALLED ENDCODES) ARE FORMED BY ADDING THE END
35                                   ;PACKET FLAG TO THE COMMAND OPCODE. FOE EXAMPLE, A READ COMMAND'S END PACKET
36                                   ;CONTAINS THE VALUE OP.RD+OP.END IN ITS OPCODE FIELD. THE INVALID COMMAND END
37                                   ;PACKET CONTAINS JUST THE END PACKET FLAG (I.E., OP.END) IN ITS OPCODE FIELD.
38                                   ;THE SERIOUS EXCEPTION END PACKET CONTAINS THE SUM OF THE END PACKET FLAG
39                                   ;PLUS THE SERIOUS EXCEPTION OPCODE SHOWN ABOVE (I.E., OP.SEX+OP.END) IN ITS
40                                   ;OPCODE FIELD.
41                                   ;
42                                   ;COMMAND OPCODE BITS 3 THROUGH 5 INDICATE THE COMMAND CLASS, WHICH IS ENCODED
43                                   ;AS FOLLOWS:
44                                   ;    000   IMMEDIATE COMMANDS
45                                   ;    001   SEQUENTIAL COMMANDS
46                                   ;    010   NON-SEQUENTIAL COMMANDS THAT DO NOT INCLUDE A BUFFER DESCRIPTOR
47                                   ;    100   NON-SEQUENTIAL COMMANDS THAT DO INCLUDE A BUFFER DESCRIPTOR
```

```
 1                                    ;COMMAND MODIFIERS
 2
 3                                    .    = 020000            ;CLEAR SERIOUS EXCEPTION
 4          040000                    MD.CMP= 040000           ;COMPARE
 5          100000                    MD.EXP= 100000           ;EXPRESS REQUEST
 6          010000                    MD.ERR= 010000           ;FORCE ERROR
 7          004000                    MD.SCH= 004000           ;SUPPRESS CACHING (HIGH SPEED)
 8          002000                    MD.SCL= 002000           ;SUPPRESS CACHING (LOW SPEED)
 9          000100                    MD.SEC= 000100           ;SUPPRESS ERROR CORRECTION
10          000400                    MD.SER= 000400           ;SUPPRESS ERROR RECOVERY
11          000200                    MD.SSH= 000200           ;SUPPRESS SHADOWING
12          000100                    MD.WBN= 000100           ;WRITE-BACK (NON-VOLATILE)
13          000400                    MD.WBV= 000400           ;WRITE BACK (VOLATILE)
14          000020                    MD.SEQ= 000020           ;WRITE SHADOW SET ONE UNIT AT A TIME
15          000001                    MD.SPD= 000001           ;SPIN-DOWN
16          000001                    MD.FEU= 000001           ;FLUSH ENTIRE UNIT
17          000002                    MD.VOL= 000002           ;VOLATILE ONLY
18          000001                    MD.NXU= 000001           ;NEXT UNIT
19          000001                    MD.RIP= 000001           ;ALLOW SELF DESTRUCTION
20          000002                    MD.IMF= 000002           ;IGNORE MEDIA FORMAT ERROR
21          000004                    MD.SWP= 000004           ;SET WRITE PROTECT
22          000010                    MD.CWB= 000010           ;CLEAR WRITE-BACK DATA LOST
23          000001                    MD.PRI= 000001           ;PRIMARY REPLACEMENT BLOCK
24
25                                    ;END PACKET FLAGS
26
27          000200                    EF.BBR= 000200           ;BAD BLOCK REPORTED
28          000100                    EF.BBU= 000100           ;BAD BLOCK UNREPORTED
29          000040                    EF.LOG= 000040           ;ERROR LOG GENERATED
30          000020                    EF.SEX= 000020           ;SERIOUS EXCEPTION
31
32                                    ;CONTROLLER FLAGS
33
34          000200                    CF.ATN= 000200           ;ENABLE ATTENTION MESSAGES
35          000100                    CF.MSC= 000100           ;ENABLE MISCELLANEOUS ERROR LOG MESSAGES
36          000040                    CF.OTH= 000040           ;ENABLE OTHER HOST'S ERROR LOG MESSAGES
37          000020                    CF.THS= 000020           ;ENABLE THIS HOST'S ERROR LOG MESSAGES
38          000002                    CF.SHD= 000002           ;SHADOWING
39          000001                    CF.576= 000001           ;576 BYTE SECTORS
```

```
     1                              ;UNIT FLAGS
     2
     3       000001                 UF.CMR= 000001                              ;COMPARE READS
     4       000002                 UF.CMW= 000002                              ;COMPARE WRITES
     5       100000                 UF.RPL= 100000                              ;HOST INITIATED BAD BLOCK REPLACEMENT
     6       040000                 UF.INA= 040000                              ;INACTIVE SHADOW SET UNIT
     7       004000                 UF.SCH= 004000                              ;SUPPRESS CACHING (HIGH SPEED)
     8       002000                 UF.SCL= 002000                              ;SUPPRESS CACHING (LOW SPEED)
     9       000100                 UF.WBN= 000100                              ;WRITE-BACK (NON-VOLATILE)
    10       020000                 UF.WPH= 020000                              ;WRITE PROTECT (HARDWARE)
    11       001000                 UF.WPS= 001000                              ;WRITE PROTECT (SOFTWARE OR VOLUME)
    12       000004                 UF.576= 000004                              ;576 BYTE SECTORS
    13
    14                              ;COMMAND PACKET OFFSETS
    15
    16                              ;               GENERIC COMMAND PACKET OFFSETS:
    17       000000                 P.CRF=   0.                                 ;COMMAND REFERENCE NUMBER
    18       000004                 P.UNIT=  4.                                 ;UNIT NUMBER
    19       000010                 P.OPCD=  8.                                 ;OPCODE
    20       000012                 P.MOD=  10.                                 ;MODIFIERS
    21       000014                 P.BCNT= 12.                                 ;BYTE COUNT
    22       000020                 P.BUFF= 16.                                 ;BUFFER DESCRIPTOR
    23       000020                 P.UADR= 16.                                 ;UNIBUS ADDRESS OF BUFFER DESCRIPTOR
    24       000034                 P.LBN=  28.                                 ;LOGICAL BLOCK NUMBER
    25
    26                              ;               ABORT AND GET COMMAND STATUS COMMAND PACKET OFFSETS:
    27       000014                 P.OTRF= 12.                                 ;OUTSTANDING REFERENCE NUMBER
    28
    29                              ;               ONLINE AND SET UNIT CHARACTERISTICS COMMAND PACKET OFFSETS:
    30       000016                 P.UNFL= 14.                                 ;UNIT FLAGS
    31       000020                 P.HSTI= 16.                                 ;HOST IDENTIFIER / RESERVED
    32       000034                 P.ELGF= 28.                                 ;ERROR LOG FLAGS
    33       000040                 P.SHUN= 32.                                 ;SHADOW UNIT
    34       000042                 P.CPSP= 34.                                 ;COPY SPEED
    35                              ;               REPLACE COMMAND PACKET OFFSETS:
    36       000014                 P.RBN=  12.                                 ;REPLACEMENT BLOCK NUMBER
    37
    38                              ;               SET CONTROLLER CHARACTERISTICS COMMAND PACKET OFFSETS:
    39       000014                 P.VRSN= 12.                                 ;MSCP VERSION
    40       000016                 P.CNTF= 14.                                 ;CONTROLLER FLAGS
    41       000020                 P.HTMO= 16.                                 ;HOST TIMEOUT
    42       000022                 P.USEF= 18.                                 ;USE FRACTION
    43       000024                 P.TIME= 20.                                 ;QUAD-WORD TIME AND DATE
    44
    45                              ;               MAINTENANCE READ AND MAINTENANCE WRITE COMMAND PACKET OFFSETS:
    46       000034                 P.RGID= 28.                                 ;REGION ID
    47       000040                 P.RGOF= 32.                                 ;REGION OFFSET
    48
    49                              ;               EXECUTE SUPPLIED PROGRAM COMMAND PACKET OFFSETS:
    50       000024                 P.DMDT= 20.                                 ;DMDT TERMINAL ADDRESS (MAINT WRITE ONLY)
    51       000034                 P.OVRL= 28.                                 ;BUFFER DESCRIPTOR FOR OPERLAYS
```

```
   1                                      ;END PACKET OFFSETS
   2
   3                            ;                    GENERIC END PACKET OFFSETS:
   4      000000              P.CRF=   0.                      ;COMMAND REFERENCE NUMBER
   5      000004              P.UNIT=  4.                      ;UNIT NUMBER
   6      000010              P.OPCD=  8.                      ;OPCODE (ALSO CALLED ENDCODE)
   7      000011              P.FLGS=  9.                      ;END PACKET FLAGS
   8      000012              P.STS=  10.                      ;STATUS
   9      000014              P.BCNT= 12.                      ;BYTE COUNT
  10      000034              P.FBBK= 28.                      ;FIRST BAD BLOCK
  11
  12                            ;                    GET COMMAND STATUS END PACKET OFFSETS:
  13      000014              P.OTRF= 12.                      ;OUTSTANDING REFERENCE NUMBER
  14      000020              P.CMST= 16.                      ;COMMAND STATUS
  15
  16                            ;                    GET UNIT STATUS END PACKET OFFSETS:
  17      000014              P.MLUN= 12.                      ;MULTI-UNIT CODE
  18      000016              P.UNFL= 14.                      ;UNIT FLAGS
  19      000020              P.HSTI= 16.                      ;HOST IDENTIFIER
  20      000024              P.UNTI= 20.                      ;UNIT IDENTIFIER
  21      000034              P.MEDI= 28.                      ;MEDIA TYPE IDENTIFIER
  22      000040              P.SHUN= 32.                      ;SHADOW UNIT
  23      000042              P.SHST= 34.                      ;SHADOW STATUS
  24      000044              P.TRCK= 36.                      ;TRACK SIZE
  25      000046              P.GRP=  38.                      ;GROUP SIZE
  26      000050              P.CYL=  40.                      ;CYLINDER SIZE
  27      000054              P.RCTS= 44.                      ;RCT TABLE SIZE
  28      000056              P.RBNS= 46.                      ;RBNS / TRACK
  29      000057              P.RCTC= 47.                      ;RCT COPIES
  30
  31                            ;                    ONLINE AND SET UNIT CHARACTERISTICS END PACKET AND AVAILABLE
  32                            ;                    ATTENTION MESSAGE OFFSETS:
  33      000014              P.MLUN= 12.                      ;MULTI-UNIT CODE
  34      000016              P.UNFL= 14.                      ;UNIT FLAGS
  35      000020              P.HSTI= 16.                      ;HOST IDENTIFIER
  36      000024              P.UNTI= 20.                      ;UNIT IDENTIFIER
  37      000034              P.MEDI= 28.                      ;MEDIA TYPE IDENTIFIER
  38      000040              P.SHUN= 32.                      ;SHADOW UNIT
  39      000042              P.SHST= 34.                      ;SHADOW STATUS
  40      000044              P.UNCL= 36.                      ;UNIT COMMAND LIMIT
  41      000050              P.UNSZ= 40.                      ;UNIT SIZE
  42      000054              P.VSER= 44.                      ;VOLUME SERIAL NUMBER
  43
  44                            ;                    SET CONTROLLER CHARACTERISTICS END PACKET OFFSETS:
  45      000014              P.VRSN= 12.                      ;MSCP VERSION
  46      000016              P.CNTF= 14.                      ;CONTROLLER FLAGS
  47      000020              P.CTMO= 16.                      ;CONTROLLER TIMEOUT
  48      000022              P.CNCL= 18.                      ;CONTROLLER COMMAND LIMIT
  49      000024              P.CNTI= 20.                      ;CONTROLLER ID
  50
  51                            ;                    GET DUST STATUS END PACKET OFFSETS:
  52      000014              P.DEXT= 12.                      ;DUST PROGRAM EXTENSION
  53      000017              P.DFLG= 15.                      ;STATUS FLAGS
  54      000020              P.DPI=  16.                      ;PROGRESS INDICATOR
  55      000024              P.DTO=  20.                      ;TIMEOUT VALUE
```

```
 1                                        ;STATUS AND EVENT CODE DEFINITIONS
 2
 3      000037                            ST.MSK= 37                              ;STATUS / EVENT CODE MASK
 4      000040                            ST.SUB= 40                              ;SUB-CODE MULTIPLIER
 5      000000                            ST.SUC=  0                              ;SUCCESS
 6      000001                            ST.CMD=  1                              ;INVALID COMMAND
 7      000002                            ST.ABO=  2                              ;COMMAND ABORTED
 8      000003                            ST.OFL=  3                              ;UNIT-OFFLINE
 9      000004                            ST.AVL=  4                              ;UNIT-AVAILABLE
10      000005                            ST.MFE=  5                              ;MEDIA FORMAT ERROR
11      000006                            ST.WPR=  6                              ;WRITE PROTECTED
12      000007                            ST.CMP=  7                              ;COMPARE ERROR
13      000010                            ST.DAT= 10                              ;DATA ERROR
14      000011                            ST.HST= 11                              ;HOST BUFFER ACCESS ERROR
15      000012                            ST.CNT= 12                              ;CONTROLLER ERROR
16      000013                            ST.DRV= 13                              ;DRIVE ERROR
17      000037                            ST.DIA= 37                              ;MESSAGE FROM AN INTERNAL DIAGNOSTIC
18
19                                        ;GET DUST STATUS FLAGS
20
21      000010                            DF.ACT= 010                             ;SET IF THIS DUST CURRENTLY ACTIVE
22      000004                            DF.NES= 004                             ;SET IF THIS DUST WILL NOT ACCEPT THE EXECUTE
23                                                                                ;SUPPLIED PROGRAM COMMAND
24      000002                            DF.LCL= 002                             ;SET IF THIS DUST HAS A LOCAL LOAD MEDIA FOR LOADING
25                                                                                ;DIAGNOSTICS AND OTHER UTILITIES
26      000001                            DF.SA=  001                             ;SET IF ANY PROGRAM EXECUTION UNDER THIS DUST
27                                                                                ;DISABLES THE OPERATION OF ALL OTHER SERVERS IN THE
28                                                                                ;SAME SYSTEM AS THE DUST
29
30                                        ;DUP MESSAGE TYPES
31
32      010000                            DU.QUE = 10000                          ;QUESTION
33      020000                            DU.DFL = 20000                          ;DEFAULT QUESTION
34      030000                            DU.INF = 30000                          ;INFORMATION
35      040000                            DU.TER = 40000                          ;TERMINATOR
36      050000                            DU.FTL = 50000                          ;FATAL ERROR
37      060000                            DU.SPC = 60000                          ;SPECIAL
38
39      170000                            DU.TYP= 170000                          ;MESSAGE TYPE FIELD
40
41                                        ;DM PROGRAM HEADER DEFINITIONS
42
43      000000                            DMTRLN= 0                               ;OFFSET TO SIZE OF PROGRAM NEEDING DOWNLINE LOAD
44      000004                            DMOVRL= 4                               ;OFFSET TO SIZE OF OVERLAY
45      000021                            DMTMO=  21                              ;TIMEOUT VALUE IN SECONDS (ONE BYTE)
46      000040                            DMMAIN= 40                              ;OFFSET TO FIRST WORD OF MAIN PROGRAM
47      001000                            DMFRST= 1000                            ;ADDRESS IN DM FILE CONTAINING FIRST BYTE OF HEADER
```

```
 1                                          ;CONTROLLER TABLE DEFINITIONS
 2                                          ;
 3                                          ;ONE TABLE WILL BE SET UP BY INITIALIZE SECTION FOR EACH UDA SELECTED
 4                                          ;FOR TESTING.  TABLES ARE CONTIGUOUS.  THE END OF THE TABLES IS
 5                                          ;MARKED BY A WORD OF ZEROS.
 6                                          ;
 7                                          ;THE FIRST TABLE IS POINTED TO BY THE CONTENTS OF CTABS.
 8                                          ;THE NUMBER OF TABLES IS CONTAINED IN CTRLRS.
 9
10 002146                     TABLE                              ;START A TABLE DEFINITION
11
12 002146                     ITEM C.UADR      2                 ;UNIBUS ADDRESS OF UDAIP REGISTER
13 002146                     ITEM C.UNIT      2
14          000077                    CT.UNT= 000077             ; LOGICAL UNIT NUMBER (FIRST)
15          100000                    CT.AVL= BIT15              ; SET WHEN NOT AVAILABLE FOR TESTING
16 002146                     ITEM C.VEC       2
17          000777                    CT.VEC= 000777             ; VECTOR ADDRESS
18          007000                    CT.BRL= 007000             ; BR LEVEL
19 002146                     ITEM C.BST       2                 ; BURST LEVEL
20 002146                     ITEM C.JSR       2                 ;INTERRUPT SERVICE ROUTINE FOR CONTROLLER
21 002146                     ITEM C.JAD       2                 ;   THESE TWO WORDS LOADED WITH [JSR R0,UDASRV]
22 002146                     ITEM C.FLG       2                 ;FLAGS
23          000002                    CT.RN=  BIT1               ;DM PROGRAM RUNNING
24          000004                    CT.CMD= BIT2               ;COMMAND ISSUED, WAITING FOR RESPONSE
25          000010                    CT.MSG= BIT3               ;MESSAGE RESPONSE RECEIVED
26                                                               ;WHENEVER THIS BIT IS SET, CT.CMD IS CLEARED
27          000020                    CT.REQ= BIT4               ;BUFFER HAS BEEN GIVEN TO UDA FOR REQUEST
28                                                               ;SET WHENEVER READ STUD DATA COMMAND
29                                                               ;GIVEN TO UDA
30          000040                    CT.STA= BIT5               ;GET DUST STATUS COMMAND HAS BEEN SENT
31          000100                    CT.TM1= BIT6               ;ONE TIMEOUT PERIOD HAS EXPIRED BETWEEN SEND OR
32                                                               ;RECEIVE DATA RESPONSE
33          000200                    CT.TM2= BIT7               ;SECOND TIMEOUT HAS EXPIRED
34          000400                    CT.U52= BIT8               ; UDA52 BIT
35          001000                    CT.U50= BIT9               ; UDA50 BIT
36 002146                     ITEM C.RING      2                 ;RING BUFFER ADDRESS
37 002146                     ITEM C.DR0       2                 ;POINTER TO DRIVE TABLES
38 002146                     ITEM C.DR1       2                 ;   IF ZERO, NO DRIVE TABLE EXISTS
39 002146                     ITEM C.DR2       2
40 002146                     ITEM C.DR3       2
41 002146                     ITEM C.DR4       2
42 002146                     ITEM C.DR5       2
43 002146                     ITEM C.DR6       2
44 002146                     ITEM C.DR7       2
45 002146                     ITEM C.TO        2                 ;TIMEOUT COUNTER
46 002146                     ITEM C.TOH       2                 ;   (TWO WORDS)
47 002146                     ITEM C.TOT       2                 ;DUP PROGRAM TIMEOUT VALUE IN SECONDS
48 002146                     ITEM C.PRI       4                 ;DUP PROGRAM PROGRESS INDICATOR
49 002146                     ITEM C.REF       2                 ;COMMAND REFERENCE NUMBER
50
51 002146                     END C.SIZE                         ;SIZE OF CONTROLLER TABLE IN BYTES
```

```
 1                              ;DRIVE TABLE DEFINITIONS
 2                              ;
 3                              ;ONE DRIVE TABLE WILL BE SET UP BY THE INITIALIZE SECTION FOR EACH
 4                              ;DRIVE SELECTED FOR TESTING.  EACH TABLE IS POINTED TO BY A
 5                              ;WORD IN THE CONTROLLER TABLE ON WHICH THE DRIVE EXISTS.
 6
 7 002146                      TABLE                           ;START A TABLE DEFINITION
 8
 9 002146                      ITEM D.DRV      2                       ;DRIVE NUMBER
10 002146                      ITEM D.UNIT     2
11          000077                 DT.UNT= 000077               ; LOGICAL UNIT NUMBER OF DRIVE
12          100000                 DT.AVL= BIT15                ; SET WHEN NOT AVAILABLE FOR TESTING
13 002146                      ITEM D.SERN     22.              ;DISK SERIAL NUMBER
14
15 002146                      END D.SIZE                      ;SIZE OF DRIVE TABLE IN BYTES
```

```
 1                              ;USEFUL INSTRUCTION DEFINITIONS
 2
 3                              .MACRO  AND ARG,ADR                     ;LOGICAL AND INSTRUCTION
 4                                      .LIST
 5                                                                                  BIC #^C<ARG>,ADR
 6                                      .NLIST
 7                              .ENDM
 8
 9                              .MACRO  OR ARG,ADR                      ;LOGICAL OR INSTRUCTION
10                                      .LIST
11                                                                                  BIS #ARG,ADR
12                                      .NLIST
13                              .ENDM
14
15                              .MACRO  PUSH ARG                        ;PUSH INSTRUCTION
16                                      .IRP X,<ARG>
17                                      .LIST
18                                                                                  MOV X,-(SP)
19                                      .NLIST
20                                      .ENDM
21                              .ENDM
22
23                              .MACRO  POP ARG                         ;POP INSTRUCTION
24                                      .IRP X,<ARG>
25                                      .LIST
26                                                                                  MOV (SP)+,X
27                                      .NLIST
28                                      .ENDM
29                              .ENDM
30
31                              .MACRO  .BR ADR                         ;A BRANCH TO THE NEXT LOCATION
32                                      .IF P2
33                                          .IF NE .-ADR
34                                              .ERROR ;ILLEGAL .BR TO ADR
35                                          .ENDC
36                                      .ENDC
37                              .ENDM
38
39                              .MACRO  ASSUME FIRST CONDITION SECOND
40                                      .IF CONDITION <FIRST>-<SECOND>
41                                      .IFF
42                                          .ERROR ;BAD ASSUME OF <FIRST> CONDITION <SECOND>
43                                      .ENDC
44                              .ENDM
```

```
 1          ;PRINT CHARACTER
 2          ;   ARGUMENT MUST BE SOURCE STATEMENT TO MOVE CHARACTER TO PRINT (MOV ARG,R0)
 3          ;       EX: "PRINT R1" WILL PRINT THE CHARACTER IN R1
 4          ;  SPECIAL CASE: "PRINT #CR" WILL PRINT END OF LINE SEQUENCE
 5          ;  THE PRINTING IS DONE AT THE MODE OF THE LAST PRINT LINE CALL
 6          ;       IE., PNTX, PNTB, PNTX, PNTS
 7
 8          .MACRO PRINT ARG1
 9                  .IF DIF <ARG1>,R0
10                          .LIST
11                                                          MOVB ARG1,R0
12                          .NLIST
13                  .ENDC
14                  .LIST
15                                                          CALL CPNT
16                  .NLIST
17          .ENDM
18
19          ;PROCESSING MACRO FOR NEXT SET OF FORMATTED MESSAGE MACROS
20
21          .MACRO PNT... RTN,ADR,ARG1,ARG2,ARG3,ARG4,ARG5,ARG6,ARG7,ARG8
22                  PNT.CT=0
23                  .IRP AA,<ARG8,ARG7,ARG6,ARG5,ARG4,ARG3,ARG2,ARG1>
24                          .IF NB,<AA>
25                                  .LIST
26                                                          MOV AA,-(SP)
27                                  .NLIST
28                                  PNT.CT=PNT.CT+2
29                          .ENDC
30                  .ENDM
31                  .LIST
32                                                          JSR R1,RTN
33                                                          .WORD ADR
34                                                          .WORD PNT.CT
35                  .NLIST
36          .ENDM
```

```
 1                          ;PRINT FORMATTED MESSAGE MACROS
 2                          ;   USE THESE MACROS TO PRINT A FORMATTED MESSAGE
 3                          ;   FIRST ARGUMENT MUST BE ADDRESS OF FIRST CHARACTER OF MESSAGE STRING
 4                          ;       TO BE PUT INTO WORD (.WORD ARG)
 5                          ;   UP TO 8 SOURCE STATEMENTS MAY FOLLOW TO SPECIFY PARAMETERS TO BE
 6                          ;   USED BY THE FORMAT
 7
 8                          .MACRO PNTF ADR ARG1,ARG2,ARG3,ARG4,ARG5,ARG6,ARG7,ARG8
 9                                  PNT... LPNTF ADR ARG1,ARG2,ARG3,ARG4,ARG5,ARG6,ARG7,ARG8
10                          .ENDM
11                          .MACRO PNTB ADR ARG1,ARG2,ARG3,ARG4,ARG5,ARG6,ARG7,ARG8
12                                  PNT... LPNTB ADR ARG1,ARG2,ARG3,ARG4,ARG5,ARG6,ARG7,ARG8
13                          .ENDM
14                          .MACRO PNTX ADR ARG1,ARG2,ARG3,ARG4,ARG5,ARG6,ARG7,ARG8
15                                  PNT... LPNTX ADR ARG1,ARG2,ARG3,ARG4,ARG5,ARG6,ARG7,ARG8
16                          .ENDM
17                          .MACRO PNTS ADR ARG1,ARG2,ARG3,ARG4,ARG5,ARG6,ARG7,ARG8
18                                  PNT... LPNTS ADR ARG1,ARG2,ARG3,ARG4,ARG5,ARG6,ARG7,ARG8
19                          .ENDM
20                          .MACRO PNT ADR ARG1,ARG2,ARG3,ARG4,ARG5,ARG6,ARG7,ARG8
21                                  PNT... LPNT ADR ARG1,ARG2,ARG3,ARG4,ARG5,ARG6,ARG7,ARG8
22                          .ENDM
```

```
    1                                      .SBTTL   GLOBAL DATA SECTION
    2
    3                                      ;++
    4                                      ; THE GLOBAL DATA SECTION CONTAINS DATA THAT ARE USED
    5                                      ; IN MORE THAN ONE TEST.
    6                                      ;--
   10
   11 002146                      FFREE::  .BLKW 1                               ;FIRST FREE WORD IN MEMORY
   12 002150                      FSIZE::  .BLKW 1                               ;SIZE OF FREE MEMORY IN WORDS
   13 002152                      FMEM:    .BLKW 1                     ;COPY OF FFREE AT END OF INIT SECTION
   14 002154                      FMEMS:   .BLKW 1                     ;COPY OF FSIZE AT END OF INIT SECTION
   15 002156                      CTABS::  .BLKW 1                               ;START OF CONTROLLER TABLE STORAGE
   16 002160                      CTRLRS:  .BLKW 1                               ;COUNT OF UDA CONTROLLERS IN PTABLES
   17 002162                      TSTTAB:  .BLKW 1                               ;POINTER TO FIRST CONTROLLER TABLE UNDER TEST
   18                             ;        .GLOBL UDAFM
   19 002164  000000             DMPROG:  .WORD 0                               ;START ADDRESS OF DM PROGRAM
   20 002166  000000             DMSIZE:  .WORD 0                               ;SIZE OF DM PROGRAM
   21 002170                      DMEND:   .BLKW 1                               ;END ADDRESS OF DM PROGRAM(FIRST FREE MEMORY ADR)
   22 002172                      DMENDS:  .BLKW 1                               ;FREE MEMORY SIZE FROM END OF DM PROGRAM
   23 002174                      URUN:    .BLKW 1                               ;NUMBER OF UNITS TO RUN AT ONE TIME
   24 002176                      URNING:  .BLKW 1                               ;NUMBER OF UNITS STILL RUNNING
   25 002200                      UCNT:    .BLKW 1                               ;COUNTER OF UNITS UNDER TEST
   26 002202  000000             FILOPN:  .WORD 0                               ; FILE OPEN
   27 002204  000000             U50UNI:  .WORD    0                            ; KEEPS TRACK OF ANY UDA 50 CONTROLLERS
   28 002206     125   065   062 U52EXT:  .ASCII\U52\
   29                                      .EVEN
   30 002212  000000             TSTTYP:  .WORD 0                               ; CONTROLLER TYPE
   31 002214  000000             FNUM:    .WORD 0                               ; FILE NUMBER
   32 002216  000000             INMEM:   .WORD 0                               ; WHICH DM PROG IS IN MEMORY
   33 002220                      UFREEZ:  .BLKW 1                               ;FREEZE ON UNIT WHEN NOT ZERO
   34 002222                      NXMAD:   .BLKW 1                               ;SET TO ALL ONES BY NON-EXISTANT ADDRESS
   35 002224  000000             FDATA:   .WORD 0
   36 002226                      FCTBUF:  .BLKB 512.                  ;STORAGE FOR FCT BLOCK
   37 003226                      FCTNUM:  .BLKW 1          ;FCT BLOCK NUMBER
   38 003230                      MODE:    .BLKW 1 ;MODE WORD, SAME BIT DEFS AS SO.BIT
   39
   40                             ;CLOCK CONTROL
   41
   42 003232  000000             KW.CSR:  .WORD 0                               ;CSR OF CLOCK
   43 003234                      KW.BRL:  .BLKW 1                               ;BR LEVEL
   44 003236                      KW.VEC:  .BLKW 1                               ;VECTOR
   45 003240                      KW.HZ:   .BLKW 1                               ;HERTZ (50. OR 60.)
   46 003242                      KW.EL:   .BLKW 2                               ;ELAPSED TIME
   47
   48 003246  016106             PTYPE:   .WORD PF                              ;PRINT TYPE
   49 003250     000   000       ERRCHR:  .BYTE 0,0                             ;FIRST BYTE LOADED WITH OUTPUT CHARACTER
   50 00325:  000000             NULL:    .WORD 0                               ;USED TO PRINT A NULL CHARACTER
   51 003254                      FNAME2:  .BLKB 10.
   52 003266     132   125   104 FNAME:   .ASCIZ\ZUDGA0.PAK\
   53                                      .EVEN
```

```
 1 003302                      TEMP:   .BLKB 22.                    ;USED TO GET ANSWER FROM GMANID CALL
 2 003330    061    055    112 DATEI:  .ASCIZ\1-JAN-70\             ;DEFAULT DATE
 3 003341                              .BLKB 3
 4 003344 000000               DATEO:  .WORD 0 ;DATE STRING IN FORMATTER FORMAT
 5 003346                              .BLKB 10.         ;(FIRST WORD ZERO SAYS NO DATE HERE YET)
 6 003360    061    070    064 HIGHEST:.ASCIZ\18446744073709551615\    ;HIGHEST DISK SERIAL NUMBER
 7 003405    104    105    103 MONTHS: .ASCII\DEC\      ;NAME OF MONTHS
 8 003410    116    117    126         .ASCII\NOV\
 9 003413    117    103    124         .ASCII\OCT\
10 003416    123    105    120         .ASCII\SEP\
11 003421    101    125    107         .ASCII\AUG\
12 003424    112    125    114         .ASCII\JUL\
13 003427    112    125    116         .ASCII\JUN\
14 003432    115    101    131         .ASCII\MAY\
15 003435    101    120    122         .ASCII\APR\
16 003440    115    101    122         .ASCIi\MAR\
17 003443    106    105    102         .ASCII\FEB\
18 003446    112    101    116         .ASCII\JAN\
19 003451    037               DAYS:   .BYTE 31.         ;NUMBER OF DAYS IN EACH MONTH
20 003452    035                       .BYTE 29.
21 003453    037                       .BYTE 31.
22 003454    036                       .BYTE 30.
23 003455    037                       .BYTE 31.
24 003456    036                       .BYTE 30.
25 003457    037                       .BYTE 31.
26 003460    037                       .BYTE 31.
27 003461    036                       .BYTE 30.
28 003462    037                       .BYTE 31.
29 003463    036                       .BYTE 30.
30 003464    037                       .BYTE 31.
31 003465    061    071    000 YEAR19: .ASCIZ\19\
32 003470    062    060    000 YEAR20: .ASCIZ\20\
33                                     .EVEN
34 003474 000000               IPADRS: .WORD 0
35 003476 000000                       .WORD 0
36 003500 000000                       .WORD 0
37 003502 000000                       .WORD 0
38 003504 000000                       .WORD 0
39 003506 000000                       .WORD 0
40 003510 000000                       .WORD 0
41 003512 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 003514                               DEVTYP <UDA-50 CONTROLLER>
    003514                                                           L$DVTYP::
    003514     125   104   101                                              .ASCIZ   /UDA-50 CONTROLLER/
                                                                            .EVEN
 13
 14                               ; TEST DESCRIPTION
 15                               ;
 17 003536                               DESCRIPT <CZUDECO UDA-50 DISK DRV FORMATTER>
    003536                                                           L$DESC::
    003536     103   132   125                                              .ASCIZ   /CZUDECO UDA-50 DISK
                                                                            .EVEN
```

```
          1                                   ;UNFORMATTED MESSAGES
          2
          3 003600      105       116     124 DATEQ:  .ASCIZ\ENTER DATE AS DD-MMM-YY\
          4 003630      040       106     117 FILNAQ: .ASCIZ\ FOR DISK TO BE FORMATTED\
          5 003662      040       000         SERNQ:  .ASCIZ\ \
```

```
 1                                ; FORMAT STATEMENTS USED IN PRINT CALLS
 2
 3 003664    045    124    000    ERRONE: .ASCIZ\%T\
 4 003667    045    116    000    ERRNL:  .ASCIZ\%N\
 5 003672    042    040    040    RNTIM:  .ASCIZ\''  RUNTIME ''D16'':'\
 6 003715    104    071    042    RNTIM1: .ASCIZ\D9'':'\
 7 003723    104    071    000    RNTIM2: .ASCIZ\D9\
 8 003726    042    040    040    ERRME1: .ASCIZ\''  *  *  * ERROR PROCESSING MESSAGE STRING  *  *  *'N\
 9 004015    116    042    125    MESSG:  .ASCIZ\N'UNIT ''D6'' UDA AT ''O16'' DRIVE ''D9S\
10                                ;;NOCLOCK:.ASCIZ\'NO LINE CLOCK AVAILABLE'N\
11 004061    042    116    117    NOCLOCK:.ASCIZ\'NO LINE CLOCK AVAILABLE FOR TIMING EVENTS'N\
12 004136    042    ^10    117    BASNO:  .ASCIZ\'HOST PROGRAM''\
13 004155    042    040    040    BASL2:  .ASCIZ\''  UDA AT ''O16\
14 004174    042    040    040    BASL3:  .ASCIZ\''  DRIVE ''D9\
15 004211    000                  BAS:    .BYTE 0                        ;NULL TO PRINT NOTHING
16
17 004212    122    066    122    BASLN:  .ASCIZ\R6R6R6R6\               ;USED TO PRINT BASIC LINE OF ERROR MESSAGE
18 004223    116    042    123    SERNUM: .ASCIZ\N''SERIAL NUMBER FOR UNIT ''D6'' UDA AT ''O16'' DRIVE ''D9\
```

```
1 004310                        X1A:
2 004310                        X2A:
3 004310                        X3A:
4 004310    042  111  040       X8A:   .ASCIZ\''I DON'T LIKE THE ANSWERS YOU GAVE TO THE HARDWARE QUESTIONS'N\
5 004407    122  065  122       X1:    .ASCIZ\R5R6''UDA HAS MORE THAN ONE VECTOR, BR LEVEL OR BURST RATE'N\
6 004503    122  065  122       X2:    .ASCIZ\R5R6''TWO UNITS SELECT THE SAME DRIVE'N\
7 004552    122  065  122       X3:    .ASCIZ\R5R6''MORE THAN EIGHT DRIVES SELECTED ON THIS UDA'N\
8 004635    122  064  042       X4:    .ASCII\R4''NOT ENOUGH ROOM IN MEMORY TO TEST THE UNITS SELECTED'N\
9 004726    042  120  114              .ASCIZ\''PLEASE START PROGRAM OVER AND TEST FEWER UNITS AT A TIME'N\
10 005022   122  064  042       X5:    .ASCIZ\R4''CHECKSUM ERROR IN DM PROGRAM FILE 'N\
11 005072   122  064  042       X7:    .ASCIZ\R4''ERROR IN DM PROGRAM FILE. DM PROGRAM NOT FOUND'N\
12 005156   122  065  122       X8:    .ASCIZ\R5R6''TWO UDA'S USE THE SAME VECTOR'N\
13 005223   122  064  042       X9:    .ASCII\R4''ONLY ONE DISK CAN BE SELECTED IN HW QUESTIONS IN RESTORE MODE.'N\
14 005326   042  120  114              .ASCIZ\''PLEASE START PROGRAM OVER AND SELECT ONLY ONE DISK.'N\
15 005415   122  064  042       X10:   .ASCIZ\R4''THIS PROGRAM CAN ONLY REFORMAT A DISK IN UNATTENDED MODE.'N\
16 005514   122  065  042       X11:   .ASCII\R5''WRONG APT FORMATTER IS BEING USED WITH THIS CONTROLLER.'N\
23 005610   122  065  042       X20:   .ASCII\R5''MEMORY ERROR TRYING TO READ UDA REGISTERS'N\
24 005666   042  103  110              .ASCII\''CHECK UNIBUS SELECTION SWITCHES ON UDA MODULE M7161 OR M7485'N\
25 005765   042  117  122              .ASCII\''OR UNIBUS'N\
26 006001   042  117  122              .ASCIZ\''OR ''R7\
27 006011   122  065  042       X21:   .ASCII\R5''UDA RESIDENT DIAGNOSTICS DETECTED FAILURE'NR8\
28 006071   042  122  105              .ASCIZ\''REPLACE UDA MODULE M716''02'' OR M748''03N\
29 006142   122  065  042       X22:   .ASCII\R5''STEP BIT DID NOT SET IN UDASA REGISTER DURING INITIALIZATION'N\
30 006243   042  123  124              .ASCIZ\''STEP BIT EXPECTED ''016NR8R7\
31 006300   122  065  042       X23A:  .ASCII\R5''UDA DID NOT CLEAR RING STRUCTURE IN HOST MEMORY DURING INITIALIZATION'N\
32 006412   104  071  042              .ASCII\D9''WORDS WERE TO BE CLEARED STARTING AT ADDRESS ''016N\
33 006500   042  106  111              .ASCII\''FIRST SEVERAL WORDS NOT CLEARED (UP TO 6):'N\
34 006555   123  066  042              .ASCIZ\S6''ADDRESS''S4''CONTENTS'N\
35 006606   123  067  117       X23B:  .ASCIZ\S7016S5016N\
36 006622   122  065  042       X24:   .ASCII\R5''UDASA REGISTER DID NOT GO TO ZERO AFTER STEP 3 WRITE OF INITIALIZATION'N\
37 006735   042  120  125              .ASCIZ\''PURGE/POLE DIAGNOSTICS WERE REQUESTED'NR8R7\
38 007012   122  065  042       X25:   .ASCII\R5''UDA DID NOT RETURN CORRECT DATA IN UDASA REGISTER DURING INITIALIZATION'N\
39 007126   042  040  040              .ASCIZ\'' UDASA EXPECTED ''016NR8R7\
40 007163   122  065  042       X30:   .ASCIZ\R5''UDA REPORTED FATAL ERROR IN UDASA REGISTER WHILE RUNNING DM PROGRAM'NR8\
41 007276   122  065  042       X31:   .ASCIZ\R5''DUP PROGRAM IS HUNG'N\
42 007327   122  065  042       X32:   .ASCIZ\R5''MESSAGE BUFFER RECEIVED FROM DM PROGRAM WITH UNKNOWN REQUEST NUMBER'N\
43 007440   122  065  042       X36:   .ASCII\R5''NO INTERRUPT RECEIVED FROM UDA FOR 30 SECONDS'N\
44 007522   042  127  110              .ASCIZ\''WHILE LOADING DM PROGRAM'N\
45 007556   122  065  042       X37:   .ASCIZ\R5''UDA REPORTED FATAL ERROR IN UDASA REGISTER WHILE LOADING DM PROGRAM'NR8R7\
46 007673   122  065  042       X100:  .ASCIZ\R5''DUP PROGRAM ASKED UNEXPECTED QUESTION (''D12'')'N\
47 007756   122  065  042       X101:  .ASCIZ\R5''DUP PROGRAM REJECTED ANSWER TO DATE OR SERIAL NUMBER QUESTION'N\
```

```
 1 010061      042      115      105  XMSG1:  .ASCIZ\'MESSAGE BUFFER CONTAINS:'N\
 2 010115      123      063      117  XMSG2:  .ASCIZ\S3016S1016S1016S1016S1016S1016S1016N\
 3 010162      122      065      042  XPKT1:  .ASCII\R5'RESPONSE PACKET FROM UDA DOES NOT CONTAIN EXPECTED DATA'N\
 4 010256      042      105      111          .ASCII\'EITHER UDA RETURNED ERROR STATUS OR PACKET WAS NOT RECEIVED CORRECTLY'N\
 5 010366      123      063      042          .ASCIZ\S3'COMMAND PACKET SENT'S6'RESPONSE PACKET RECEIVED'N\
 6 010453      123      066      117  XPKT2:  .ASCIZ\S6016S1016S14016S1016N\
 7 010502      042      040      040  XSA:    .ASCIZ\' UDASA CONTAINS  '016N\
 8 010533      042      122      105  XFRU:   .ASCIZ\'REPLACE UDA MODULE M7161 OR M7485'N\
 9
10
11 010600      045      101      111  SERNX:  .ASCIZ\%AINPUT ERROR. ANSWER WITH DECIMAL NUMBER LO= 0  HI= %T\
12 010670      042      111      116  DATEX:  .ASCIZ\'INPUT ERROR.'\
13 010707      042      116      101  FILNAM: .ASCIZ\'NAME OF FILE CONTAINING BAD SECTOR INFORMATION'\
14                                            .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 010770                               BGNMSG ERR001
    15 010770                                      PNTB X1,#X1A
       010770  012746  004310                                                          MOV #X1A,-(SP)
       010774  004137  016240                                                          JSR R1,LPNTB
       011000  004407                                                                  .WORD X1
       011002  000002                                                                  .WORD PNT.CT
    16 011004                               ENDMSG
    17
    18 011006                               BGNMSG ERR002
    19 011006                                      PNTB X2,#X2A
       011006  012746  004310                                                          MOV #X2A,-(SP)
       011012  004137  016240                                                          JSR R1,LPNTB
       011016  004503                                                                  .WORD X2
       011020  000002                                                                  .WORD PNT.CT
    20 011022                               ENDMSG
    21
    22 011024                               BGNMSG ERR003
    23 011024                                      PNTB X3,#X3A
       011024  012746  004310                                                          MOV #X3A,-(SP)
       011030  004137  016240                                                          JSR R1,LPNTB
       011034  004552                                                                  .WORD X3
       011036  000002                                                                  .WORD PNT.CT
    24 011040                               ENDMSG
    25
    26 011042                               BGNMSG ERR004
    27 011042                                      PNTB X4
       011042  004137  016240                                                          JSR R1,LPNTB
       011046  004635                                                                  .WORD X4
       011050  000000                                                                  .WORD PNT.CT
    28 011052                               ENDMSG
    29
    30 011054                               BGNMSG ERR005
    31 011054                                      PNTB X5
       011054  004137  016240                                                          JSR R1,LPNTB
       011060  005022                                                                  .WORD X5
       011062  000000                                                                  .WORD PNT.CT
    32 011064                               ENDMSG
    33
    34 011066                               BGNMSG ERR007
    35 011066                                      PNTB X7
       011066  004137  016240                                                          JSR R1,LPNTB
       011072  005072                                                                  .WORD X7
       011074  000000                                                                  .WORD PNT.CT
    36 011076                               ENDMSG
```

```
37
38 011100                                  BGNMSG ERR008
39 011100                                      PNTB X8,#X8A
   011100   012746  004310                                          MOV #X8A,-(SP)
   011104   004137  016240                                          JSR R1,LPNTB
   011110   005156                                                  .WORD X8
   011112   000002                                                  .WORD PNT.CT
40 011114                                  ENDMSG
41
42 011116                                  BGNMSG ERR009
43 011116                                      PNTB X9
   011116   004137  016240                                          JSR R1,LPNTB
   011122   005223                                                  .WORD X9
   011124   000000                                                  .WORD PNT.CT
44 011126                                  ENDMSG
45
46 011130                                  BGNMSG ERR010
47 011130                                      PNTB X10
   011130   004137  016240                                          JSR R1,LPNTB
   011134   005415                                                  .WORD X10
   011136   000000                                                  .WORD PNT.CT
48 011140                                  ENDMSG
49
50 011142                                  BGNMSG ERR011
51 011142                                      PNTB X11
   011142   004137  016240                                          JSR R1,LPNTB
   011146   005514                                                  .WORD X11
   011150   000000                                                  .WORD PNT.CT
52 011152                                  ENDMSG
53
54 011154                                  BGNMSG ERR020
55 011154                                      PNTB X20
   011154   004137  016240                                          JSR R1,LPNTB
   011160   005610                                                  .WORD X20
   011162   000000                                                  .WORD PNT.CT
56 011164                                  ENDMSG
57
58 011166                                  BGNMSG ERR021
59 011166   010201                             MOV R2,R1
60 011170   000301                             SWAB R1
61 011172                                      AND 2,R1
   011172   042701  177775                                          BIC #^C<2>,R1
62 011176   006201                             ASR R1
63 011200   005201                             INC R1
64 011202                                      PNTB X21,R2,R1
   011202   010146                                                  MOV R1,-(SP)
   011204   010246                                                  MOV R2,-(SP)
   011206   004137  016240                                          JSR R1,LPNTB
   011212   006011                                                  .WORD X21
   011214   000004                                                  .WORD PNT.CT
65 011216                                  ENDMSG
66
67 011220                                  BGNMSG ERR022
68 011220   042737  100000  020152            BIC #SA.ERR,UDARSD
69 011226                                      PNTB X22,UDARSD,R2
   011226   010246                                                  MOV R2,-(SP)
   011230   013746  020152                                          MOV UDARSD,-(SP)
```

```
        011234  004137  016240                          JSR R1,LPNTB
        011240  006142                                  .WORD X22
        011242  000004                                  .WORD PNT.CT
     70 011244                          PRINTX #XFRU
     71 011264                  ENDMSG
     72
     73 011266                  BGNMSG ERR023
     74 011266                          PNTB X23A,R1,FFREE
        011266  013746  002146                          MOV FFREE,-(SP)
        011272  010146                                  MOV R1,-(SP)
        011274  004137  016240                          JSR R1,LPNTB
        011300  006300                                  .WORD X23A
        011302  000004                                  .WORD PNT.CT
     75 011304  005742          TST -(R2)
     76 011306  005712  ERR23A: TST (R2)
     77 011310  001410          BEQ ERR23B
     78 011312                  PNTB X23B,R2,(R2)
        011312  011246                                  MOV (R2),-(SP)
        011314  010246                                  MOV R2,-(SP)
        011316  004137  016240                          JSR R1,LPNTB
        011322  006606                                  .WORD X23B
        011324  000004                                  .WORD PNT.CT
     79 011326  005304          DEC R4
     80 011330  001403          BEQ ERR23C
     81 011332  005722  ERR23B: TST (R2)+
     82 011334  005303          DEC R3
     83 011336  001363          BNE ERR23A
     84 011340          ERR23C: PNTB XFRU
        011340  004137  016240                          JSR R1,LPNTB
        011344  010533                                  .WORD XFRU
        011346  000000                                  .WORD PNT.CT
     85 011350                  ENDMSG
     86
     87 011352                  BGNMSG ERR024
     88 011352                          PNTB X24,R2
        011352  010246                                  MOV R2,-(SP)
        011354  004137  016240                          JSR R1,LPNTB
        011360  006622                                  .WORD X24
        011362  000002                                  .WORD PNT.CT
     89 011364                  ENDMSG
     90
     91 011366                  BGNMSG ERR025
     92 011366                          PNTB X25,R1,R2
        011366  010246                                  MOV R2,-(SP)
        011370  010146                                  MOV R1,-(SP)
        011372  004137  016240                          JSR R1,LPNTB
        011376  007012                                  .WORD X25
        011400  000004                                  .WORD PNT.CT
     93 011402                  ENDMSG
     94
     95 011404                  BGNMSG ERR030
     96 011404                          PNTB X30,R1
        011404  010146                                  MOV R1,-(SP)
        011406  004137  016240                          JSR R1,LPNTB
        011412  007163                                  .WORD X30
        011414  000002                                  .WORD PNT.CT
     97 011416                  ENDMSG
```

```
  98
  99 011420                              BGNMSG ERR031
 100 011420                                     PNTB X31
     011420    004137  016240                          JSR R1,LPNTB
     011424    007276                                  .WORD X31
     011426    000000                                  .WORD PNT.CT
 101 011430                              ENDMSG
 102
 103 011432                              BGNMSG ERR032
 104 011432                                     PNTB X32
     011432    004137  016240                          JSR R1,LPNTB
     011436    007327                                  .WORD X32
     011440    000000                                  .WORD PNT.CT
 105 011442    004737  011632                    CALL MSGPKT
 106 011446                              ENDMSG
 107
 108 011450                              BGNMSG ERR033
 109 011450    004737  011540                    CALL PNTPKT
 110 011454                              ENDMSG
 111
 112 011456                              BGNMSG ERR034
 113 011456    004737  011540                    CALL PNTPKT
 114 011462                              ENDMSG
 115
 116 011464                              BGNMSG ERR036
 117 011464                                     PNTB X36
     011464    004137  016240                          JSR R1,LPNTB
     011470    007440                                  .WORD X36
     011472    000000                                  .WORD PNT.CT
 118 011474                              ENDMSG
 119
 120 011476                              BGNMSG ERR037
 121 011476                                     PNTB X37,R1
     011476    010146                                  MOV R1,-(SP)
     011500    004137  016240                          JSR R1,LPNTB
     011504    007556                                  .WORD X37
     011506    000002                                  .WORD PNT.CT
 122 011510                              ENDMSG
 123
 124 011512                              BGNMSG ERR100
 125 011512                                     PNTB X100,(R4)
     011512    011446                                  MOV (R4),-(SP)
     011514    004137  016240                          JSR R1,LPNTB
     011520    007673                                  .WORD X100
     011522    000002                                  .WORD PNT.CT
 126 011524                              ENDMSG
 127
 128 011526                              BGNMSG ERR101
 129 011526                                     PNTB X101
     011526    004137  016240                          JSR R1,LPNTB
     011532    007756                                  .WORD X101
     011534    000000                                  .WORD PNT.CT
 130 011536                              ENDMSG
 131
 132 011540                              PNTPKT: PNTB XPKT1
     011540    004137  016240                          JSR R1,LPNTB
     011544    010162                                  .WORD XPKT1
```

```
        011546  000000                                                      .WORD PNT.CT
133     011550  010401                      MOV R4,R1
134     011552  062701  000104              ADD #HC.CPK,R1
135     011556  010402                      MOV R4,R2
136     011560  062702  000020              ADD #HC.MPK,R2
137     011564  012703  000014              MOV #12.,R3
138     011570                  PNTPKL: PNTB XPKT2,2(R1),(R1),2(R2),(R2)
        011570  011246                                                      MOV (R2),-(SP)
        011572  016246  000002                                              MOV 2(R2),-(SP)
        011576  011146                                                      MOV (R1),-(SP)
        011600  016146  000002                                              MOV 2(R1),-(SP)
        011604  004137  016240                                              JSR R1,LPNTB
        011610  010453                                                      .WORD XPKT2
        011612  000010                                                      .WORD PNT.CT
139     011614  062701  000004              ADD #4,R1
140     011620  062702  000004              ADD #4,R2
141     011624  005303                      DEC R3
142     011626  001360                      BNE PNTPKL
143     011630  000207                      RETURN
144
145     011632                  MSGPKT: PNTB XMSG1
        011632  004137  016240                                              JSR R1,LPNTB
        011636  010061                                                      .WORD XMSG1
        011640  000000                                                      .WORD PNT.CT
146     011642  016504  000016              MOV C.RING(R5),R4
147     011646  062704  000306              ADD #HC.BF2,R4
148     011652  012703  000005              MOV #5,R3
149     011656                  MSGPKL: PNTB XMSG2,(R4),2(R4),4(R4),6(R4),8.(R4),10.(R4),12.(R4)
        011656  016446  000014                                              MOV 12.(R4),-(SP)
        011662  016446  000012                                              MOV 10.(R4),-(SP)
        011666  016446  000010                                              MOV 8.(R4),-(SP)
        011672  016446  000006                                              MOV 6(R4),-(SP)
        011676  016446  000004                                              MOV 4(R4),-(SP)
        011702  016446  000002                                              MOV 2(R4),-(SP)
        011706  011446                                                      MOV (R4),-(SP)
        011710  004137  016240                                              JSR R1,LPNTB
        011714  010115                                                      .WORD XMSG2
        011716  000016                                                      .WORD PNT.CT
150     011720  062704  000016              ADD #14.,R4
151     011724  005303                      DEC R3
152     011726  001353                      BNE MSGPKL
153     011730  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
```

```
 1                              .SBTTL   GLOBAL SUBROUTINES SECTION
 2                              ;MEMORY ALLOCATION ERROR
 3                              ;
 4                              ;THIS ROUTINE PRINTS A SYSTEM FATAL ERROR AND EXITS THE TEST
 5
 6
 7 011732                      FMERR:   ERRSF 4,,ERR004
   011732   104454                                                            TRAP     C$ERSF
   011734   000004                                                            .WORD    4
   011736   000000                                                            .WORD    0
   011740   011042                                                            .WORD    ERR004
 8 011742                                      DOCLN                 ;ABORT
   011742   104444                                                            TRAP     C$DCLN
```

```
    1                                        ;ALOCM
    2                                        ;
    3                                        ;ALLOCATE A BLOCK OF FREE MEMORY.  REPORT ERROR IF MEMORY EXHAUSTED.
    4                                        ;
    5                                        ;INPUTS:
    6                                        ;       R1 - NUMBER OF WORDS TO ALLOCATE
    7                                        ;       FFREE - FIRST FREE WORD IN MEMORY
    8                                        ;       FSIZE - SIZE OF FREE MEMORY AVAILABLE IN WORDS
    9                                        ;OUTPUTS:
   10                                        ;       R1 - ADDRESS OF FIRST WORD OF ALLOCATED MEMORY
   11                                        ;       FFREE - NEW FIRST FREE WORD IN MEMORY
   12                                        ;       FSIZE - SIZE OF FREE MEMORY LEFT AFTER ALLOCATION
   13                                        ;SYSTEM FATAL ERROR WILL BE REPORTED IF NOT ENOUGH MEMORY AVAILABLE
   14                                        ;AND ENTIRE PROGRAM WILL BE STOPPED.
   15
   16 011744                        ALOCM:  PUSH FFREE                       ;SAVE FFREE AT ENTRY
      011744  013746  002146                                                        MOV FFREE,-(SP)
   17 011750  160137  002150                SUB R1,FSIZE                     ;REDUCE SIZE OF FREE MEMORY
   18 011754  002766                        BLT FMERR                        ;REPORT ERROR IF NOT ENOUGH MEMORY
   19 011756  060101                        ADD R1,R1                        ;CHANGE WORDS TO BYTES
   20 011760  060137  002146                ADD R1,FFREE                     ;CALCULATE NEW START OF FREE MEMORY
   21 011764                                POP R1                           ;GET START OF ALLOCATED MEMORY
      011764  012601                                                                MOV (SP)+,R1
   22 011766  000207                        RETURN
```

```
    1                                      ;HCOMM
    2                                      ;
    3                                      ;ALLOCATES MEMORY FOR HOST COMM AREA AND PACKET BUFFERS WITH ONE
    4                                      ;DESCRIPTOR IN EACH RING. TO BE CALLED WHEN INITIALIZING
    5                                      ;A CONTROLLER WITH SA.MSG=0 AND SA.CMD=0.
    6                                      ;
    7                                      ;INPUTS:
    8                                      ;     R5 - ADDRESS OF CONTROLLER TABLE
    9                                      ;OUTPUTS:
   10                                      ;     CONTROLLER TABLE POINTING TO HOST COMM AREA
   11                                      ;     R4 - ADDRESS OF HOST COMM AREA
   12
   13 011770  012701  000214      HCOMM:  MOV #HC.SIZ/2,R1           ;GET SIZE OF AREA TO ALLOCATE
   14 011774  004737  011744              CALL ALOCM                ;ALLOCATE THE MEMORY
   15 012000  010165  000016              MOV R1,C.RING(R5)                ;GET ADDRESS OF HOST COMM AREA
   16                                                                ;PLACE IN CONTROLLER TABLE
   17 012004  000207              RETURN
```

```
 2                                        ;TINIT
 3                                        ;
 4                                        ;INITIALIZE VARIABLES FOR TEST
 5                                        ;
 6                                        ;INPUTS:
 7                                        ;     R1 - TEST NUMBER
 8                                        ;OUTPUTS:
 9                                        ;     LBUFS - CLEARED (DELETES ERROR LOG)
10                                        ;     FFREE - FROM FMEM
11                                        ;     FSIZE - FROM FMEMS
12                                        ;     TNUM - TEST NUMBER FROM R1
13                                        ;     ALL REGISTERS CLOBERED
14
15 012006  004737  012064                TINIT:  CALL RESET              ;RESET ALL DEVICES
16 012012  013737  002152  002146                MOV FMEM,FFREE          ;INIT FFREE
17 012020  013737  002154  002150                MOV FMEMS,FSIZE         ;INIT FSIZE
18 012026  020137  002214                        CMP R1,FNUM             ;SEE IF SAME TEST RUNNING
19 012032  001007                                BNE TINITR              ;IF NOT, GO TO READ DM PROGRAM
20 012034  013737  002170  002146                MOV DMEND,FFREE         ;CHANGE FREE MEMORY TO LEAVE
21 012042  013737  002172  002150                MOV DMENDS,FSIZE        ;   DM PROGRAM ALLOCATED
22 012050  000207                                RETURN
23
24 012052  004737  012210                TINITR: CALL READDM             ;READ DM PROGRAM
25 012056  010137  002214                        MOV R1,FNUM             ;STORE TEST NUMBER TO SHOW DM PROGRAM IN MEMORY
26 012062  000207                                RETURN
```

```
    1                           ;RESET
    2                           ; RESET ALL UDA-50S IN THE CONTROLLER TABLES
    3                           ;
    4                           ; INPUTS:
    5                           ;       IPADRS - CONTAINS ALL IP ADDRESSES
    6                           ; OUTPUTS:
    7                           ;       NONE
    8                           ;
    9  012064                   RESET:  PUSH  <R3,R4>
       012064  010346                                                              MOV  R3,-(SP)
       012066  010446                                                              MOV  R4,-(SP)
   10  012070  005037  002222           CLR     NXMAD
   11  012074                           SETVEC  #4,#NXMI,#PRI07
       012074  012746  000340                                                      MOV      #PRI07,-(SP)
       012100  012746  017152                                                      MOV      #NXMI,-(SP)
       012104  012746  000004                                                      MOV      #4,-(SP)
       012110  012746  000003                                                      MOV      #3,-(SP)
       012114  104437                                                              TRAP     C$SVEC
       012116  062706  000010                                                      ADD      #10,SP
   12  012122                           BREAK
       012122  104422                                                              TRAP     C$BRK
   13  012124  012703  000010           MOV     #8.,R3          ; R3 = COUNTER OF ENTRIES
   14  012130  012704  003474           MOV     #IPADRS,R4      ; R4 -> IP ADDRESS
   15  012134  005714            1$:    TST     (R4)            ; IS THERE AN ENTRY?
   16  012136  001406                   BEQ     2$              ; IF NOT, DONE
   17  012140  005034                   CLR     @(R4)+          ; INIT UDA
   18  012142  005737  002222           TST     NXMAD           ; WAS THERE AN ERROR?
   19  012146  001010                   BNE     3$              ; IF SO, EXIT
   20  012150  005303                   DEC     R3              ; MAKE SURE WE DO NOT EXTEND OVER AREA
   21  012152  001370                   BNE     1$              ; IF NOT DONE, BRANCH
   22  012154            2$:            CLRVEC  #4
       012154  012700  000004                                                      MOV      #4,R0
       012160  104436                                                              TRAP     C$CVEC
   23  012162                           POP     <R4,R3>
       012162  012604                                                              MOV (SP)+,R4
       012164  012603                                                              MOV (SP)+,R3
   24  012166  000207                   RETURN
   25
   26  012170  005744            3$:    TST     -(R4)           ; R4 -> UDAIP THAT FAILED
   27  012172  010405                   MOV     R4,R5           ; SAVE IN R5 FOR REPORT
   28  012174                           ERRDF   20,,ERR020
       012174  104455                                                              TRAP     C$ERDF
       012176  000024                                                              .WORD    20
       012200  000000                                                              .WORD    0
       012202  011154                                                              .WORD    ERR020
   29  012204  005014                   CLR     (R4)            ; DESTROY ENTRY SO NOT TO FALL INTO RESET ERROR LOOP
   30  012206                           DOCLN
       012206  104444                                                              TRAP     C$DCLN
```

```
 1                                      ;READDM
 2                                      ;
 3                                      ;READ A DM PROGRAM INTO FREE MEMORY
 4                                      ;
 5                                      ;INPUTS:
 6                                      ;     R1 - TEST NUMBER
 7                                      ;OUTPUTS:
 8                                      ;     DMPROG - POINTER TO START OF DM PROGRAM IN MEMORY
 9                                      ;     R1 - UNCHANGED
10                                      ;     CARRY CLEAR IF NO ERROR, CARRY SET IF PROGRAM NOT FOUND
11                                      ;ALL REGISTERS BUT R1 ARE USED AND PREVIOUS CONTENTS DESTROYED
12
13 012210  013737  002146  002164  READDM: MOV  FFREE,DMPROG              ;GET STORAGE ADDRESS
14 012216  004737  012516                  CALL RDREC
15 012222  103407                          BCS  README                   ;CHECK IF ERROR
16 012224  013737  002146  002170          MOV  FFREE,DMEND              ;SAVE END OF ADDRESS OF DM PROGRAM
17 012232  013737  002150  002172          MOV  FSIZE,DMENDS             ;   AND CURRENT SIZE OF FREE MEMORY
18 012240  000207                          RETURN
19
20 012242                          README: ERRSF 7,,ERR007               ;REPORT DM PROGRAM NOT FOUND
   012242  104454                                                                        TRAP    CSERSF
   012244  000007                                                                        .WORD   7
   012246  000000                                                                        .WORD   0
   012250  011066                                                                        .WORD   ERR007
21 012252                                  DOCLN
   012252  104444                                                                        TRAP    CSDCLN
```

```
         1                              ;GTDUST
         2                              ;
         3                              ;GET DUST STATUS
         4                              ;
         5  012254  016504  000004      GTDUST: MOV  C.VEC(R5),R4          ;GET VECTOR OF UDA
         6  012260                              AND  CT.VEC,R4
            012260  042704  177000                                                BIC    #^C<CT.VEC>,R4
         7  012264  010501                      MOV R5,R1                 ;GET INTERRUPT SERVICE LINK
         8  012266  062701  000010              ADD #C.JSR,R1
         9  012272                              SETVEC R4,R1,#PRI07        ;SET UP INTERRUPT VECTOR
            012272  012746  000340                                                MOV    #PRI07,-(SP)
            012276  010146                                                        MOV    R1,-(SP)
            012300  010446                                                        MOV    R4,-(SP)
            012302  012746  000003                                                MOV    #3,-(SP)
            012306  104437                                                        TRAP   C$SVEC
            012310  062706  000010                                                ADD    #10,SP
        10                                                                 ;INITIALIZE UDA WITH SMALLEST
        11  012314  006204                      ASR R4                    ;POSITION VECTOR FOR UDA
        12  012316  006204                      ASR R4
        13  012320  004737  011770              CALL HCOMM                ;ALLOCATE SPACE FOR HOST COMM AREA
        14  012324  004737  017254              CALL UDAINT               ; RING BUFFER AND INTERRUPTS ENABLED
        15  012330  001002                      BNE      1$
        16  012332  000137  016570              JMP LOADER                ;BRANCH IF AN ERROR
        17  012336  012700  000001      1$:     MOV      #OP.GSS,R0       ; R0 HAS OPCODE
        18  012342  004737  016574              CALL     BLDCMD
        19  012346  004737  016660              CALL     SNDCMD
        20  012352  004737  017000              CALL     WAITMS
        21  012356  000207                      RETURN
```

```
 1                                           ;RUNDM
 2                                           ;
 3                                           ;LOAD AND RUN A DM PROGRAM IN THE CONTROLLERS. RETURN WHEN ALL
 4                                           ;DM PROGRAMS HAVE TERMINATED.
 5                                           ;
 6                                           ;INPUTS:
 7                                           ;     TSTTAB - POINTER TO FIRST CONTROLLER TABLE
 8                                           ;     R1 - NUMBER OF CONTROLLERS TO TEST
 9                                           ;IMPLICIT INPUTS:
10                                           ;     DMPROG - POINTER TO START OF DM PROGRAM IN MEMORY
11                                           ;OUTPUTS:
12                                           ;     Z SET IF NO CONTROLLERS SUCCESSFULLY STARTED
13                                           ;ALL REGISTERS ARE USED AND PREVIOUS CONTENTS DESTROYED.
14
15 012360 010137 002174       RUNDM:  MOV R1,URUN                   ;SAVE NUMBER OF UNITS TO RUN
16 012364 005037 002176               CLR URNING                    ;CLEAR NUMBER OF UNITS RUNNING
17
18                                           ;LOAD DM PROGRAM INTO EACH CONTROLLER
19
20 012370 013737 002174 002200         MOV URUN,UCNT                ;SET COUNTER OF UNITS
21 012376 013705 002162                MOV TSTTAB,R5                ;GET FIRST CONTROLLER TABLE
22 012402                       LDDM:
23 012402 042765 176377 000014         BIC #^C<CT.U52+CT.U50>,C.FLG(R5) ;CLEAR ALL FLAGS
24 012410 116537 000002 002074         MOVB C.UNIT(R5),L$LUN        ;SEE IF UNIT TO BE TESTED
25 012416 005765 000002                TST C.UNIT(R5)
26 012422 100411                       BMI LDNEXT                   ;IF NOT, DON'T LOAD THIS UNIT
27 012424                                       ASSUME CT.AVL EQ BIT15
29 012424 033765 002212 000014         BIT     TSTTYP,C.FLG(R5)    ; DO WE TEST THIS TYPE?
30 012432 001405                       BEQ     LDNEXT              ; IF NOT, BRANCH
34 012434 004737 016372                CALL LOADDM                 ;LOAD THE DM PROGRAM
35 012440 001402                       BEQ LDNEXT                  ;IF ERROR, GO TO NEXT CONTROLLER
36 012442 005237 002176                INC URNING                  ;IF NO ERROR, COUNT UNIT RUNNING
37 012446 062705 000054       LDNEXT: ADD #C.SIZE,R5               ;MOVE TO NEXT CONTROLLER TABLE
38 012452 005337 002200                DEC UCNT                    ;CHECK IF MORE CONTROLLERS
39 012456 001351                       BNE LDDM                    ;LOAD NEXT
40 012460 005037 002220                CLR UFREEZ              ;CLEAR UNIT FREEZE FLAG
41 012464 012737 177777 003226         MOV #-1,FCTNUM  ;INVALIDATE FCT BLOCK NUMBER (BLOCK IN MEMORY)
42
43                                           ;CHECK IF ANY CONTROLLERS LOADED
44
45 012472 005737 002176                TST URNING                  ;ANY UNITS LOADED?
46
47                                           ;THE DM PROGRAMS ARE NOW IN CONTROL
48                                           ;RESPDM MUST BE CALLED TO RESPOND TO THEIR REQUESTS
49
50 012476 000207                       RETURN
```

```
 2                                     ;CLOSEF
 3                                     ;
 4                                     ;CLOSE DATA FILE FOR DM PROGRAMS
 5                                     ;
 6                                     ;INPUTS:
 7                                     ;      FILOPN - ZERO IF FILE NOT OPEN
 8                                     ;OUTPUTS:
 9                                     ;      NONE
10
11 012500  005737  002202      CLOSEF: TST FILOPN               ;SEE IF FILE CURRENTLY OPEN
12 012504  001403                      BEQ 1$
13 012506                              CLOSE                    ; IF SO, CLOSE IT
   012506  104435                                                                    TRAP    C$CLOS
14 012510  005037  002202              CLR FILOPN               ;AND MARK AS SO
15 012514  000207              1$:     RETURN
```

H 6

```
     1                                        ;RDREC
     2                                        ;
     3                                        ;READ A RECORD FROM THE INPUT FILE. PLACE DATA INTO FREE MEMORY.
     4                                        ;
     5                                        ;INPUTS:
     6                                        ;        R1 - FILE TYPE
     7                                        ;               1 - UDA52 FORMATTER
     8                                        ;               2 - UDA50 FORMATTER
     9                                        ;OUTPUTS:
    10                                        ;        DATA FROM RECORD IN MEMORY
    11                                        ;        CARRY CLEAR IF NO ERROR, CARRY SET IF ERROR
    12
    13 012516                        RDREC:   PUSH <R0,R1,R2,R3,R4,R5>
       012516  010046                                                              MOV R0,-(SP)
       012520  010146                                                              MOV R1,-(SP)
       012522  010246                                                              MOV R2,-(SP)
       012524  010346                                                              MOV R3,-(SP)
       012526  010446                                                              MOV R4,-(SP)
       012530  010546                                                              MOV R5,-(SP)
    14 012532  005737  002202             TST FILOPN           ;SEE IF FILE ALREADY OPEN
    15 012536  001005                      BNE RDSTS
    16 012540                              OPEN #FNAME          ;IF NOT, OPEN FILE NOW
       012540  012700  003266                                               MOV      #FNAME,R0
       012544  104434                                                       TRAP     C$OPEN
    17 012546  005237  002202             INC FILOPN           ;AND MARK AS OPEN
    18 012552  005005              RDSTS:  CLR R5               ;CLEAR LOAD ADDRESS (SEARCH MODE)
    19 012554              RDST:   BREAK                ;ALLOW PROGRAM TO BE INTERRUPTED
       012554  104422                                                       TRAP     C$BRK
    20                                     ;GETBYTE CALLS DON'T SEEM TO BREAK ON CONTROL-C!
    21 012556                              GETBYTE R4           ;GET A BYTE
       012556  104426                                                       TRAP     C$GETB
       012560  110004                                                       MOVB     R0,R4
    22 012562  005704                      TST R4               ;IF ZERO
    23 012564  001773                      BEQ RDST             ; KEEP READING
    24 012566  022704  000001             CMP #1,R4            ;WHEN NOT ZERO
    25 012572  001141                      BNE RWRDE1           ; IT BETTER BE A ONE
    26 012574                              GETBYTE R0           ; AND THE NEXT BYTE
       012574  104426                                                       TRAP     C$GETB
    27 012576  060004                      ADD R0,R4
    28 012600  005700                      TST R0               ; IF ZERO, PROCESS DATA
    29 012602  001420                      BEQ RDDAT
```

```
 1 012604  020001                    CMP R0,R1          ;CHECK IF TYPE OF FILE LOOKING FOR
 2 012606  103416                    BLO RDDAT          ;IF TOO SOON IN FILE, KEEP SEARCHING
 3 012610  101120                    BHI RDERR          ;IF PAST TYPE, GIVE ERROR RETURN
 4 012612  004737  013030            CALL FWORD         ;GET NEXT TWO WORDS
 5 012616  013702  002224            MOV FDATA,R2
 6 012622  004737  013030            CALL FWORD
 7 012626                            GETBYTE R0         ;GET CHECKSUM
   012626  104426                                                     TRAP    C$GETB
 8 012630  060004                    ADD R0,R4          ;ADD TO COMPUTED SUM
 9 012632  105704                    TSTB R4            ;SEE IF THIS SUM IS ZERO
10 012634  001120                    BNE RWRDE1         ;  IF NOT, REPORT CHECKSUM ERROR
11 012636  013705  002146            MOV FFREE,R5       ;GET STORAGE ADDRESS
12 012642  000744                    BR RDST            ;SWITCH FROM SEARCH TO STORE MODE
```

```
 1 012644 004737 013030         RDDAT:  CALL FWORD          ;READ BYTE COUNT
 2 012650 013703 002224                 MOV FDATA,R3        ;SAVE IN R3
 3 012654 004737 013030                 CALL FWORD          ;READ LOAD ADDRESS
 4 012660 162703 000006                 SUB #6,R3           ;SUBTRACT BYTES ALREADY READ FROM BYTE COUNT
 5 012664 001443                        BEQ RWORDT          ;IF RESULT IS ZERO, THIS IS A
 6                                                          ;TRANSFER BLOCK
 7 012666 005705                        TST R5              ;IF IN SEARCH MODE,
 8 012670 001425                        BEQ 3$              ;  BYPASS TRANSFER ADDRESS COMPUTATION
 9 012672 013701 002224                 MOV FDATA,R1        ;GET LOAD ADDRESS
10 012676 060301                        ADD R3,R1           ;ADD BYTES IN RECORD
11 012700 162701 001000                 SUB #DMFRST,R1
12 012704 060501                        ADD R5,R1           ;COMPUTE STORAGE ADDRESS
13 012706 032701 000001                 BIT #1,R1           ;CHECK IF ODD BYTE ADDRESS
14 012712 001401                        BEQ 1$              ;IF SO,
15 012714 005201                        INC R1              ;  INCREMENT
16 012716 163701 002146         1$:     SUB FFREE,R1        ;SEE IF MORE MEMORY NEEDS TO BE ALLOCATED
17 012722 101403                        BLOS 2$
18 012724 006001                        ROR R1              ;REDUCE TO WORDS
19 012726 004737 011744                 CALL ALOCM          ;ALLOCATE THE MEMORY
20 012732 013702 002224         2$:     MOV FDATA,R2        ;GET LOAD ADDRESS
21 012736 162702 001000                 SUB #DMFRST,R2
22 012742 060502                        ADD R5,R2
23 012744                       3$:     GETBYTE R0          ;GET DATA BYTE
   012744 104426                                TRAP   C$GETB
24 012746 005705                        TST R5              ;IF IN SEARCH MODE,
25 012750 001401                        BEQ 4$              ;  BYPASS DATA STORAGE
26 012752 110022                        MOVB R0,(R2)+       ;STORE IN MEMORY
27 012754 060004         4$:     ADD R0,R4           ;UPDATE CHECKSUM
28 012756 005303                        DEC R3              ;COUNT THE BYTE
29 012760 001371                        BNE 3$              ;GET THEM ALL
30 012762                                GETBYTE R0          ;GET CHECKSUM
   012762 104426                                TRAP   C$GETB
31 012764 060004                        ADD R0,R4           ;ADD
32 012766 105704                        TSTB R4             ;IF CHECKSUM CORRECT,
33 012770 001671                        BEQ RDST            ;  THEN GO READ NEXT RECORD
34 012772 000441                        BR RWRDE1           ;  ELSE REPORT ERROR
```

```
    1 012774                       RWORDT: GETBYTE R0           ;READ CHECKSUM BYTE
      012774  104426                                                      TRAP    C$GETB
    2 012776  060004                       ADD  R0,R4          ;ADD TO COMPUTED CHECKSUM
    3 013000  105704                       TSTB R4             ;CHECK LOW BYTE OF SUM
    4 013002  001035                       BNE  RWRDE1         ;BRANCH IF CHECKSUM ERROR
    5 013004  005705                       TST  R5             ;IF IN SEARCH MODE,
    6 013006  001662                       BEQ  RDST           ;  KEEP ON SEARCHING
    7 013010                                POP  <R5,R4,R3,R2,R1,R0>
      013010  012605                                                      MOV  (SP)+,R5
      013012  012604                                                      MOV  (SP)+,R4
      013014  012603                                                      MOV  (SP)+,R3
      013016  012602                                                      MOV  (SP)+,R2
      013020  012601                                                      MOV  (SP)+,R1
      013022  012600                                                      MOV  (SP)+,R0
    8 013024  000241                       CLC
    9 013026  000207                       RETURN
   10
   11 013030                       FWORD:  GETBYTE R0           ;READ A BYTE FROM FILE
      013030  104426                                                      TRAP    C$GETB
   12 013032  060004                       ADD  R0,R4          ;UPDATE CHECKSUM ERROR
   13 013034  110037  002224               MOVB R0,FDATA       ;START TO BUILD WORD
   14 013040                               GETBYTE R0           ;READ ANOTHER BYTE FROM FILE
      013040  104426                                                      TRAP    C$GETB
   15 013042  060004                       ADD  R0,R4          ;UPDATE CHECKSUM
   16 013044  110037  002225               MOVB R0,FDATA+1     ;COMPLETE WORD
   17 013050  000207                       RETURN
```

GLOBAL SUBROUTINES SECTION

```
     1 013052  004737  012500      RDERR:  CALL CLOSEF              ;CLOSE FILE AS POSITION IS LOST
     2 013056                              POP <R5,R4,R3,R2,R1,R0>
       013056  012605                                                       MOV  (SP)+,R5
       013060  012604                                                       MOV  (SP)+,R4
       013062  012603                                                       MOV  (SP)+,R3
       013064  012602                                                       MOV  (SP)+,R2
       013066  012601                                                       MOV  (SP)+,R1
       013070  012600                                                       MOV  (SP)+,R0
     3 013072  000261                      SEC                     ;ERROR RETURN, FILE NOT FOUND
     4 013074  000207                      RETURN
     5
     6 013076               RWRDE1: ERRSF 5,,ERR005
       013076  104454                                                       TRAP    C$ERSF
       013100  000005                                                       .WORD   5
       013102  000000                                                       .WORD   0
       013104  011054                                                       .WORD   ERR005
     7 013106                      DOCLN
       013106  104444                                                       TRAP    C$DCLN
```

```
 2                                              ;RESPDM
 3                                              ;
 4                                              ;RESPOND TO DM REQUESTS. RETURN WHEN ALL DM PROGRAMS
 5                                              ;HAVE TERMINATED.
 6
 7  013110  013705  002162            RESPDM: MOV TSTTAB,R5                    ;GET CONTROLLER TABLE ADDRESS
 8  013114  013737  002174  002200            MOV URUN,UCNT                   ;SET COUNTER OF UNITS
 9  013122                            RESPCT: BREAK    ;ALLOW DRS TO SEE TERMINAL INPUT
    013122  104422                                                                    TRAP      C$BRK
10  013124  016504  000016                    MOV C.RING(R5),R4               ;GET HOST COMM AREA ADDRESS
11  013130  032765  000002  000014            BIT #CT.RN,C.FLG(R5)            ;CHECK IF PROGRAM RUNNING
12  013136  001502                            BEQ RSPNXT                      ;IF NOT, LOOK AT NEXT
13  013140  116537  000002  002074            MOVB C.UNIT(R5),L$LUN          ;STORE UNIT NUMBER UNDER TEST
14  013146  032765  000010  000014            BIT #CT.MSG,C.FLG(R5)           ;SEE IF INTERRUPT RECEIVED
15  013154  001150                            BNE RSPIN                       ;IF SO, LOOK AT PACKET
16  013156  032765  000004  000014            BIT #CT.CMD,C.FLG(R5)           ;SEE IF COMMAND HAS BEEN SENT
17  013164  001002                            BNE 1$                          ;IF NOT, SEND ONE
18  013166  000137  013734                    JMP RSPOUT
19
20                                             ;CHECK IF UDA STILL RUNNING
21
22  013172  011503                    1$:     MOV (R5),R3                     ;GET ADDRESS OF UDAIP
23  013174  016301  000002                    MOV 2(R3),R1                    ;LOOK AT UDASA REGISTER
24  013200  001405                            BEQ RSPTM                       ;IF ZERO, UDA STILL RUNNING
25  013202                                    ERRDF 30,,ERRO30                ;REPORT UDA HAS FATAL ERROR
    013202  104455                                                                    TRAP      C$ERDF
    013204  000036                                                                    .WORD     30
    013206  000000                                                                    .WORD     0
    013210  011404                                                                    .WORD     ERRO30
26  013212  000465                            BR RSPDRP                       ;DROP CONTROLLER FROM TESTING
27
28                                             ;CHECK FOR TIMEOUT OF RESPONSE
29
30  013214  005765  000044            RSPTM:  TST C.TOT(R5)                   ;SEE IF DUP PROGRAM TO BE TIMED
31  013220  001451                            BEQ RSPNTO
32  013222  005737  003232                    TST KW.CSR                      ;SEE IF A CLOCK ON SYSTEM
33  013226  001446                            BEQ RSPNTO                      ;DON'T TIME IF NO CLOCK
34  013230  023765  003244  000042            CMP KW.EL+2,C.TOH(R5)           ;COMPARE TO TIMEOUT COUNTER
35  013236  101005                            BHI RSPTMO
36  013240  001041                            BNE RSPNTO
37  013242  023765  003242  000040            CMP KW.EL,C.TO(R5)
38  013250  103435                            BLO RSPNTO                      ;IF TOO MUCH TIME ELAPSED SINCE LAST INTERRUPT
39  013252  032765  000040  000014    RSPTMO: BIT #CT.STA,C.FLG(R5)           ;SEE IF A GET DUST STATUS COMMAND OUTSTANDING
40  013260  001101                            BNE RSPTOE                      ;REPORT ERROR IF SO
41  013262  005764  000012                    TST HC.CCT(R4)                  ;SEE IF UDA TOOK LAST COMMAND PACKET
42  013266  100476                            BMI RSPTOE                      ;REPORT ERROR IF NOT
43  013270  012700  000100                    MOV #CT.TM1,RO                  ;SEE IF FIRST TIMEOUT ALREADY HAPPENED
44  013274  032765  000100  000014            BIT #CT.TM1,C.FLG(R5)
45  013302  001401                            BEQ 1$                          ;IF SO,
46  013304  006300                            ASL RO                          ;SET SECOND TIME OUT FLAG
47  013306  052700  000040            1$:     BIS #CT.STA,RO                  ;SET THE PROPER TIMEOUT BIT
48  013312  050065  000014                    BIS RO,C.FLG(R5)               ;  AND STATUS REQUESTED BIT
49  013316  012700  000001                    MOV #OP.GDS,RO                  ;BUILD GET DUST STATUS COMMAND
50  013322  004737  016574                    CALL BLDCMD
51  013326  012764  100000  000012            MOV #RG.OWN,HC.CCT(R4)          ;MARK COMMAND TO UDA
52  013334  005775  000000                    TST @(R5)                       ;TELL UDA COMMAND IS THERE
53  013340  000137  014014                    JMP RSPOU4
```

54 013344                          RSPNTO:

```
 1                                              ;SWITCH TO NEXT CONTROLLER
 2
 3 013344   005737   002220         RSPNXT: TST UFREEZ         ;FROZEN TO ONE UNIT?
 4 013350   001264                          BNE RESPCT         ;STAY THERE IF SO
 5 013352   062705   000054                 ADD #C.SIZE,R5                    ;MOVE TO NEXT TABLE
 6 013356   005337   002200                 DEC UCNT                         ;CHECK IF MORE CONTROLLERS
 7 013362   001257                          BNE RESPCT                       ;LOOK AT NEXT CONTROLLER
 8 013364   000651                          BR RESPDM                        ;LOOK AT FIRST CONTROLLER AGAIN
 9
10                                              ;REMOVE A CONTROLLER FROM TESTING
11
12 013366   005065   000014         RSPDRP: CLR C.FLG(R5)     ;CLEAR PROGRAM RUNNING
13 013372   005037   002220                 CLR UFREEZ
14 013376   010504                          MOV R5,R4
15 013400   062704   000020                 ADD #C.DR0,R4
16 013404   012702   000010                 MOV #8.,R2
17 013410   012403                 1$:      MOV (R4)+,R3
18 013412   001420                          BEQ 3$
19 013414   005763   000002                 TST D.UNIT(R3)
20 013420                                    ASSUME DT.AVL EQ BIT15
21 013420   100003                          BPL 2$
22 013422   005302                          DEC R2
23 013424   001371                          BNE 1$
24 013426   000412                          BR 3$
25 013430   052763   100000   000002 2$:    BIS #DT.AVL,D.UNIT(R3)
26 013436   005302                          DEC R2
27 013440   001405                          BEQ 3$
28 013442   005714                          TST (R4)
29 013444   001403                          BEQ 3$
30 013446   004737   016372                 CALL LOADDM        ;START DM PROGRAM AGAIN
31 013452   001223                          BNE RESPCT
32 013454   005337   002176         3$:     DEC URNING                       ;REDUCE RUNNING CONTROLLERS COUNT
33 013460   001331                          BNE RSPNXT                       ;IF ANY STILL RUNNING, LOOK AT THEM
34 013462   000207                          RETURN                           ;ELSE RETURN TO TEST SECTION
35
36 013464                          RSPTOE: ERRDF 31,,ERR031                  ;REPORT TIMEOUT ERROR
   013464   104455                                                           TRAP    C$ERDF
   013466   000037                                                           .WORD   31
   013470   000000                                                           .WORD   0
   013472   011420                                                           .WORD   ERR031
37 013474   000734                          BR RSPDRP                        ;DROP CONTROLLER FROM TESTING
```

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

 2                                          ;CHECK FOR PROPER OPCODE IN END PACKET
 3
 4
 5 013476 012700 000204          RSPIN:  MOV  #OP.END+OP.SSD,R0            ;GET SEND DATA END PACKET OPCODE
 6 013502 032765 000020 000014           BIT  #CT.REQ,C.FLG(R5)           ;LOOK IF SEND DATA OR RECEIVE DATA
 7 013510 001402                          BEQ  RSPMWR
 8 013512 012700 000205                   MOV  #OP.END+OP.RSD,R0          ;CHANGE TO RECEIVE DATA END PACKET OPCODE
 9 013516 120064 000030          RSPMWR: CMPB RO,HC.MPK+P.OPCD(R4)        ;COMPARE TO OPCODE IN END PACKET
10 013522 001145                          BNE  RSPERR
11
12                                          ;LOOK AT STATUS CODE
13
14 013524 032764 000037 000032           BIT  #ST.MSK,HC.MPK+P.STS(R4)   ;CHECK FOR STATUS CODE ST.SUC (ZERO)
15 013532 001004                          BNE  RSPERW
16
17                                          ;CHECK FOR EXPECTED REFERENCE NUMBER
18
19 013534 026564 000052 000020           CMP  C.REF(R5),HC.MPK+P.CRF(R4) ;CHECK IF COPRECT REF NUMBER
20 013542 001405                          BEQ  RSPPTW
21 013544                         RSPERW: ERRDF 33,,ERR033
   013544 104455                                                          TRAP    C$ERDF
   013546 000041                                                          .WORD   33
   013550 000000                                                          .WORD   0
   013552 011450                                                          .WORD   ERR033
22 013554 000704                          BR   RSPDRP                     ;DROP UNIT FROM TESTING
23
24                                          ;CHECK IF RESPONSE FROM SEND OR RECEIVE DATA COMMAND
25
26 013556 032765 000020 000014  RSPPTW: BIT  #CT.REQ,C.FLG(R5)           ;CHECK IF RESPONSE FROM DM PROGRAM
27 013564 001463                 RSPOU:  BEQ  RSPOUT                      ;LOOK AT REQUEST NUMBER IF SO
```

```
   1                                    ;MAINTENANCE READ END PACKET RECEIVED, LOOK AT REQUEST FROM DM PROGRAM
   2
   3  013566  016401  000306    RSPPT2: MOV HC.BF2(R4),R1                 ;GET REQUEST NUMBER
   4  013572  042701  007777            BIC     #^C<DU.TYP>,R1           ;CHECK TYPE
   5  013576  001403                    BEQ 1$                           ;IF ZERO, ERROR
   6  013600  020127  060000            CMP R1,#DU.SPC                   ;CHECK IF IN EXPECTED RANGE
   7  013604  101405                    BLOS RSPPT3
   8  013606                    1$:     ERRDF 32,,ERRO32                 ;BAD REQUEST NUMBER
      013606  104455                                                                    TRAP    C$ERDF
      013610  000040                                                                    .WORD   32
      013612  000000                                                                    .WORD   0
      013614  011432                                                                    .WORD   ERRO32
   9  013616  000663                    BR RSPDRP                        ;DROP UNIT FROM TES_NG
  10
  11  013620  016403  000034    RSPPT3: MOV HC.MPK+P.BCNT(R4),R3         ;GET BYTE COUNT OF CHARACTERS RECEIVED IN R3
  12  013624  162703  000002            SUB #2,R3                        ;(FIRST TWO CHARACTERS ARE TYPE WORD)
  13  013630  012700  000004            MOV #OP.SSD,R0                   ;BUILD A SEND DATA COMMAND PACKET
  14  013634  004737  016574            CALL BLDCMD                      ;  FOR ANSWER TO DM PROGRAM
  15  013640  012700  000164            MOV #HC.BF1,R0                   ;POINT TO BUFFER IN PACKET
  16  013644  004737  016736            CALL CLRBUF                      ;  AND CLEAR BUFFER
  17  013650  010402                    MOV R4,R2                        ;R2 POINTS TO SEND BUFFER
  18  013652  062704  000122            ADD #HC.BSZ,R4          ;R4 POINTS TO CHARACTERS IN RECEIVE BUFFER
  19  013656  042724  170000            BIC #DU.TYP,(R4)+       ;CLEAR TYPE FIELD IN BUFFER
  20  013662  000301                    SWAB R1                          ;GET TYPE RIGHT JUSTIFIED
  21  013664  006201                    ASR R1                           ;TIMES TWO
  22  013666  006201                    ASR R1
  23  013670  006201                    ASR R1
  24  013672  010100                    MOV R1,R0                        ;COPY MESSAGE TYPE TO R0
  25  013674  005001                    CLR R1                           ;R1 CONTAINS ZERO SEND BYTE COUNT
  26  013676  004770  014162            CALL @RSPDSP-2(R0)               ;CALL REQUESTED ROUTINE
  27  013702  001231                    BNE RSPDRP                       ;ROUTINE RETURNS Z CLEAR TO DROP UNIT FROM TESTING
  28                                                                     ; Z SET IF UNIT TO CONTINUE RUNNING
  29  013704  016504  000016            MOV C.RING(R5),R4                ;GET RING ADDRESS
  30  013710  032701  000001            BIT #1,R1                        ;LOOK AT CHARACTER COUNT TO SEND TO DUP PROGRAM
  31  013714  001401                    BEQ 1$                           ;IF AN ODD COUNT
  32  013716  005201                    INC R1                           ;  INCREASE BY ONE
  33  013720  010164  000120    1$:     MOV R1,HC.CPK+P.BCNT(R4)         ;PUT CHARACTER COUNT IN COMMAND PACKET
  34  013724  100003                    BPL RSPOUT                       ;IF NEGATIVE BYTE COUNT RETURNED
  35  013726  042765  000020  000014    BIC #CT.REQ,C.FLG(R5)            ;  DON'T SEND ANY DATA TO UDA
  36
  37                                    ;SEND COMMAND BACK TO UDA
  38
  39  013734  042765  000350  000014 RSPOUT: BIC #CT.MSG+CT.STA+CT.TM1+CT.TM2,C.FLG(R5)     ;CLEAR MESSAGE RECEIVED FLAG
  40  013742  032765  000020  000014            BIT #CT.REQ,C.FLG(R5)            ;CHECK WHICH COMMAND TO SEND
  41  013750  001014                            BNE RSPOU2                       ;BRANCH IF RESPONSE TO REQUEST
  42
  43  013752  012700  000005            MOV #OP.RSD,R0                   ;BUILD RECEIVE DATA COMMAND
  44  013756  004737  016574            CALL BLDCMD
  45  013762  012700  000306            MOV #HC.BF2,R0                   ;POINT TO MESSAGE BUFFER
  46  013766  004737  016736            CALL CLRBUF                      ;  AND CLEAR IT
  47  013772  052765  000020  000014    BIS #CT.REQ,C.FLG(R5)            ;SET REQUEST BIT
  48  014000  000403                    BR RSPOU3
  49
  50  014002  042765  000020  000014 RSPOU2: BIC #CT.REQ,C.FLG(R5)            ;CLEAR REQUEST BIT
  51  014010                    RSPOU3:
  52  014010  004737  016660            CALL SNDCMD                      ;SEND COMMAND TO UDA
  53  014014  016500  000044    RSPOU4: MOV C.TOT(R5),R0                 ;SET TIMEOUT
```

```
54 014020  010501                        MOV R5,R1
55 014022  062701  000040                ADD #C.TO,R1                    ;PUT TIME IN CONTROLLER TABLE
56 014026  004737  017172                CALL SETTO
57 014032  000137  013344                JMP RSPNXT                      ;NOW WAIT FOR END PACKET
58 014036  122764  000201  000030 RSPERR: CMPB #OP.END+OP.GDS,HC.MPK+P.OPCD(R4)  ;SEE IF GET DUST STATUS OPCODE
59 014044  001237                        BNE RSPERW
60 014046  132764  000010  000037        BITB #DF.ACT,HC.MPK+P.DFLG(R4)  ;IF DUST NO LONGER RUNNING
61 014054  001603                        BEQ RSPTOE                      ;  REPORT ERROR
62 014056  042765  000050  000014        BIC #CT.STA+CT.MSG,C.FLG(R5)    ;CLEAR CONTROL BITS
63 014064  032765  000200  000014        BIT #CT.TM2,C.FLG(R5)           ;IF AT SECOND TIMEOUT
64 014072  001413                        BEQ 1$
65 014074  026465  000040  000046        CMP HC.MPK+P.DPI(R4),C.PRI(R5)  ;COMPARE PROGRESS INDICATOR
66 014102  001004                        BNE 2$
67 014104  026465  000042  000050        CMP HC.MPK+P.DPI+2(R4),C.PRI+2(R5)    ;COMPARE PROGRESS INDICATOR
68 014112  001422                        BEQ 4$                          ;REPORT ERROR IF NOT CHANGED
69 014114  042765  000200  000014 2$:    BIC #CT.TM2,C.FLG(R5)           ;CLEAR TIMEOUT 2 FLAG
70 014122  032765  000100  000014 1$:    BIT #CT.TM1,C.FLG(R5)           ;IF AT FIRST TIMEOUT
71 014130  001406                        BEQ 3$
72 014132  016465  000040  000046        MOV HC.MPK+P.DPI(R4),C.PRI(R5)  ;GET COPY OF PROGRESS INDICATOR
73 014140  016465  000042  000050        MOV HC.MPK+P.DPI+2(R4),C.PRI+2(R5)    ;GET COPY OF PROGRESS INDICATOR
74 014146  012764  140000  000006 3$:    MOV #RG.OWN+RG.FLG,HC.MCT(R4)   ;GIVE MESSAGE BUFFER BACK TO UDA
75 014154  000137  013344                JMP RSPNXT
76 014160  000137  013464          4$:   JMP RSPTOE
```

```
 1                              ;RESPONSE REQUEST DISPATCH TABLE
 2
 3 014164  014200       RSPDSP: .WORD QUEST              ;QUESTION
 4 014166  014252               .WORD DQUEST             ;QUESTION WITH DEFAULT ANSWER
 5 014170  014424               .WORD INFO               ;INFORMATION MESSAGE FOR OPERATOR
 6 014172  014514               .WORD TERM               ;NORMAL TERMINATION
 7 014174  014524               .WORD ERRTRM             ;FATAL ERROR TERMINATION
 8 014176  014534               .WORD SPECL              ;SPECIAL
 9         000006               DSPSIZ=<.-RSPDSP>/2      ;LEGAL NUMBERS ARE LOWER THAN THIS
```

```
 1                                   ;NORMAL DUP RECEIVE DATA BUFFER DESCRIPTION
 2
 3                                   ;BYTE OFFSET FROM
 4                                   ;START OF BUFFER      +-------------------------------+
 5                                            0            ! TYPE !   MESSAGE NUMBER      !   USED TO SELECT ROUTINE
 6                                                         +-------------------------------+
 7                                            2            !         DATA BYTES           !   R4 CONTAINS THIS ADDRESS
 8                                                         +-------------------------------+
 9                                            4            !         DATA BYTES           !
10                                                         +-------------------------------+
11                                            6            !         DATA BYTES           !
12                                                         +-------------------------------+
13                                            8            !         DATA BYTES           !
14                                                         +-------------------------------+
15                                           10            !         DATA BYTES           !
16                                                         +-------------------------------+
17                                           12            !         DATA BYTES           !
18                                                         +-------------------------------+
19                                           14            !         DATA BYTES           !
20                                                         +-------------------------------+
21                                           16            !         DATA BYTES           !
22                                                         +-------------------------------+
23                                           18            !         DATA BYTES           !
24                                                         +-------------------------------+
25                                           20            !         DATA BYTES           !
26                                                         +-------------------------------+
27                                           22            !         DATA BYTES           !
28                                                         +-------------------------------+
29
30                                            .                        .
31
32                                            .                        .
33
34                                            .                        .
35
36                                                         +-------------------------------+
37                                           80            !         DATA BYTES           !
38                                                         +-------------------------------+
```

```
 1                                        ;NORMAL DUP SEND DATA BUFFER DESCRIPTION GIVEN IN RESPONSE TO ABOVE PACKET
 2                                        ;BYTE OFFSET FROM
 3                                        ;START OF BUFFER     +----------------------------------+
 4                                        ;                    |                                  |
 5                                              0              |            DATA BYTES            |    R2 CONTAINS THIS ADDRESS
 6                                        ;                    +----------------------------------+
 7                                              2              |            DATA BYTES            |
 8                                        ;                    +----------------------------------+
 9                                              4              |            DATA BYTES            |
10                                        ;                    +----------------------------------+
11                                              6              |            DATA BYTES            |
12                                        ;                    +----------------------------------+
13                                              8              |            DATA BYTES            |
14                                        ;                    +----------------------------------+
15                                             10              |            DATA BYTES            |
16                                        ;                    +----------------------------------+
17                                             12              |            DATA BYTES            |
18                                        ;                    +----------------------------------+
19                                             14              |            DATA BYTES            |
20                                        ;                    +----------------------------------+
21                                             16              |            DATA BYTES            |
22                                        ;                    +----------------------------------+
23                                             18              |            DATA BYTES            |
24                                        ;                    +----------------------------------+
25                                             20              |            DATA BYTES            |
26                                        ;                    +----------------------------------+
27                                             22              |            DATA BYTES            |
28                                        ;                    +----------------------------------+
29                                        ;
30                                                 .                        .
31                                        ;
32                                                 .                        .
33                                        ;
34                                                 .                        .
35                                        ;                    +----------------------------------+
36                                        ;
37                                             80              |            DATA BYTES            |
38                                        ;                    +----------------------------------+
```
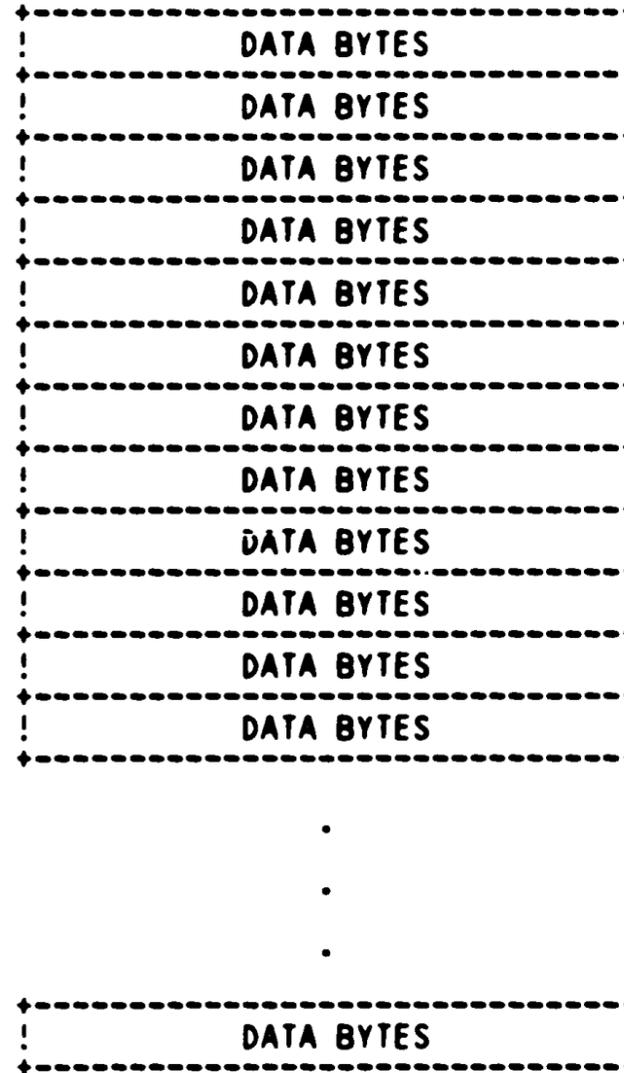
```
     1                                        ;MESSAGE TYPE 1
     2
     3                                        ;ANSWER QUESTION FOR DUP PROGRAM
     4
     5                                        ;INPUT:
     6                                        ;        R5 - ADDRESS OF CONTROLLER TABLE
     7                                        ;        R4 - POINTER TO DATA IN RECEIVE BUFFER
     8                                        ;        R3 - CHARACTER COUNT IN RECEIVE BUFFER
     9                                        ;        R2 - POINTER TO SEND BUFFER (BUFFER IS CLEARED)
    10                                        ;        R1 - ZERO
    11                                        ;OUTPUT:
    12                                        ;        R1 - COUNT OF CHARACTERS IN SEND BUFFER
    13                                        ;        Z SET TO CONTINUE RUNNING DUP PROGRAM
    14                                        ;        Z CLEAR TO STOP THE DUP PROGRAM
    15
    16 014200  004737  014666       QUEST:   CALL GTDRVT        ;GET POINTER TO DRIVE TABLE
    17 014204  062700  000004                ADD #D.SERN,R0     ;BUMP POINTER TO SERIAL NUMBER
    18 014210  014403                         MOV -(R4),R3       ;GET QUESTION NUMBER
    19 014212  001411                         BEQ QUE0           ;BRANCH IF QUESTION NUMBER 0
    20 014214  020327  000007                CMP R3,#7          ;IF NOT, SEE IF QUESTION NUMBER 7
    21 014220  001410                         BEQ QUE7
    22 014222                                 ERRDF 100,,ERR100         ;ANY OTHER NUMBER IS AN ERROR        TRAP    CSERDF
       014222  104455                                                                                       .WORD   100
       014224  000144                                                                                       .WORD   0
       014226  000000                                                                                       .WORD   ERR100
       014230  011512
    23 014232  000244                         CLZ      ;CLEAR Z TO STOP DUP PROGRAM
    24 014234  000207                         RETURN
    25
    26 014236  012700  003344       QUE0:    MOV #DATE0,R0     ;POINT TO DATE STRING
    27 014242                        QUE7:
    28 014242  005201                QUEL:    INC R1   ;COUNT THE CHARACTERS
    29 014244  112022                         MOVB (R0)+,(R2)+            ; AND PUT THEM IN OUTPUT BUFFER
    30 014246  001375                         BNE QUEL             ; UNTIL A NUL CHARACTER FOUND
    31 014250  000207                         RETURN   ;RETURN WITH Z SET
```

```
  1                                  ;MESSAGE TYPE 2
  2                                  ;
  3                                  ;ANSWER QUESTION FOR DUP PROGRAM WITH DEFAULT ANSWER
  4                                  ;
  5                                  ;INPUT:
  6                                  ;        R5 - ADDRESS OF CONTROLLER TABLE
  7                                  ;        R4 - POINTER TO DATA IN RECEIVE BUFFER
  8                                  ;        R3 - CHARACTER COUNT IN RECEIVE BUFFER
  9                                  ;        R2 - POINTER TO SEND BUFFER (BUFFER IS CLEARED)
 10                                  ;        R1 - ZERO
 11                                  ;OUTPUT:
 12                                  ;        R1 - COUNT OF CHARACTERS IN SEND BUFFER
 13                                  ;        Z SET TO CONTINUE RUNNING DUP PROGRAM
 14                                  ;        Z CLEAR TO STOP THE DUP PROGRAM
 15
 16 014252 004737 014666    DQUEST: CALL GTDRVT       ;GET DRIVE TABLE ADDRESS INTO R0
 17 014256 014403                   MOV -(R4),R3      ;GET QUESTION NUMBER
 18 014260 020327 000006            CMP R3,#DQUESZ
 19 014264 101035                   BHI DQUEX
 20 014266 006303                   ASL R3
 21 014270 000173 014274            JMP @DQUEJP(R3)
 22 014274 014360          DQUEJP:  .WORD DQUEX       ; 0  (NOT USED)
 23 014276 014312                   .WORD DQUNIT      ; 1  ENTER UNIT NUMBER TO FORMAT
 24 014300 014360                   .WORD DQUEX       ; 2  (NOT USED)
 25 014302 014360                   .WORD DQUEX       ; 3  (NOT USED)
 26 014304 014364                   .WORD DQRFMT      ; 4  USE EXISTING BAD SECTOR INFORMATION
 27 014306 014404                   .WORD DQRSTR      ; 5  DOWN-LINE LOAD BAD SECTOR BLOCK INFORMATION
 28 014310 014414                   .WORD DQCONT      ; 6  CONTINUE IF BAD BLOCK INFO INACCESSIBLE
 29        000006                             DQUESZ=<<.-DQUEJP>/2>-1
 30
 31                                  ;ENTER UNIT NUMBER TO FORMAT
 32
 33 014312                 DQUNIT:  PUSH R5
    014312 010546                                                                   MOV R5,-(SP)
 34 014314 005004                   CLR R4
 35 014316 011003                   MOV (R0),R3       ;GET DRIVE NUMBER
 36 014320                                   ASSUME D.DRV EQ 0
 37 014320 012700 000012            MOV #10.,R0       ;RADIX 10.
 38 014324 004737 016334   DQUNL1:  CALL DIVIDE
 39 014330                          PUSH R5
    014330 010546                                                                   MOV R5,-(SP)
 40 014332 005201                   INC R1
 41 014334 005703                   TST R3
 42 014336 001372                   BNE DQUNL1
 43 014340 010100                   MOV R1,R0
 44 014342                 DQUNL2:  POP R5
    014342 012605                                                                   MOV (SP)+,R5
 45 014344 062705 000060            ADD #'0,R5
 46 014350 110522                   MOVB R5,(R2)+
 47 014352 005300                   DEC R0
 48 014354 001372                   BNE DQUNL2
 49 014356                          POP R5
    014356 012605                                                                   MOV (SP)+,R5
 50 014360 000264          DQUEX:   SEZ
 51 014362 000207                   RETURN
 52
 53 014364 032737 000003 003230 DQRFMT: BIT #SO.FMT,MODE
```

```
54 014372 001410                       BEQ DQNO
55 014374 112712  000131      DQYES:   MOVB #'Y,(R2)
56 014400 005201                       INC R1
57 014402 000766                       BR DQUEX
58
59 014404 032737  000010  003230  DQRSTR: BIT #SO.STR,MODE
60 014412 001370                       BNE DQYES
61 014414                      DQCONT:
62 014414 112712  000116      DQNO:    MOVB #'N,(R2)
63 014420 005201                       INC R1
64 014422 000756                       BR DQUEX
```

```
    1                                      ;MESSAGE TYPE 3
    2                                      ;
    3                                      ;PRINT INFORMATION FROM DUP PROGRAM
    4                                      ;
    5                                      ;INPUT:
    6                                      ;       R5 - POINTER TO CONTROLLER TABLE
    7                                      ;       R4 - POINTER TO DATA IN RECEIVE BUFFER
    8                                      ;       R3 - CHARACTER COUNT IN RECEIVE BUFFER
    9                                      ;       R2 - POINTER TO SEND BUFFER (BUFFER IS CLEARED)
   10                                      ;       R1 - ZERO
   11                                      ;OUTPUT:
   12                                      ;       R1 - BIT 15 SET TO PREVENT SENDING DATA TO DUP PROGRAM
   13                                      ;       Z SET TO CONTINUE RUNNING DUP PROGRAM
   14
   15 014424  016400  177776     INFO:     MOV  -2(R4),R0   ;GET MESSAGE NUMBER
   16 014430  001417                       BEQ  INFOX       ;IF ZERO, IGNORE IT
   17 014432  020027  000100               CMP  R0,#100     ;IF OCTAL 100
   18 014436  001420                       BEQ  INFOE       ;   PRINT ERROR MESSAGE
   19 014440  005737  002220               TST  UFREEZ
   20 014444  001007                       BNE  INFOP
   21 014446  005237  002220               INC  UFREEZ
   22 014452  004737  014666               CALL GTDRVT
   23 014456  010002                       MOV  R0,R2
   24 014460  004737  014712               CALL HEADER
   25 014464  004737  014632     INFOP:    CALL MESG        ;PRINT THE MESSAGE
   26 014470  012701  100000     INFOX:    MOV  #BIT15,R1                   ;RETURN A NEGATIVE BYTE COUNT
   27 014474  000264                       SEZ
   28 014476  000207                       RETURN                          ;RETURN WITH Z SET
   29
   30 014500                      INFOE:    ERRDF 101,,ERR101       ;ANSWER WAS REJECTED BY DUP PROGRAM
      014500  104455                                                          TRAP    C$ERDF
      014502  000145                                                          .WORD   101
      014504  000000                                                          .WORD   0
      014506  011526                                                          .WORD   ERR101
   31 014510  000244                       CLZ      ;RETURN WITH Z CLEAR TO STOP DUP PROGRAM
   32 014512  000207                       RETURN
```

```
  1                                      ;MESSAGE TYPE 4
  2                                      ;
  3                                      ;TERMINATION MESSAGE
  4                                      ;
  5                                      ;INPUT:
  6                                      ;       R5 - POINTER TO CONTROLLER TABLE
  7                                      ;       R4 - POINTER TO DATA IN RECEIVE BUFFER
  8                                      ;       R3 - CHARACTER COUNT IN RECEIVE BUFFER
  9                                      ;       R2 - POINTER TO SEND BUFFER (BUFFER IS CLEARED)
 10                                      ;       R1 - ZERO
 11                                      ;OUTPUT:
 12                                      ;       Z CLEAR TO TERMINATE DUP PROGRAM
 13
 14 014514  004737  014424      TERM:    CALL INFO          ;PRINT THE MESSAGE
 15 014520  000244                       CLZ
 16 014522  000207                       RETURN                                    ;RETURN Z CLEAR TO TERMINATE DUP PROGRAM
```

```
   1                                     ;MESSAGE TYPE 5
   2                                     ;
   3                                     ;ERROR TERMINATION MESSAGE
   4                                     ;
   5                                     ;INPUT:
   6                                     ;       R5 - POINTER TO CONTROLLER TABLE
   7                                     ;       R4 - POINTER TO DATA IN RECEIVE BUFFER
   8                                     ;       R3 - CHARACTER COUNT IN RECEIVE BUFFER
   9                                     ;       R2 - POINTER TO SEND BUFFER (BUFFER IS CLEARED)
  10                                     ;       R1 - ZERO
  11                                     ;OUTPUT:
  12                                     ;       Z CLEAR TO TERMINATE DUP PROGRAM
  13
  14 014524  004737  014424     ERRTRM: CALL INFO
  15 014530  000244                     CLZ
  16 014532  000207                     RETURN                    ;RETURN Z CLEAR TO TERMINATE DUP PROGRAM
```

```
 1                                        ;MESSAGE TYPE 6
 2
 3                                        ;SPECIAL TYPE - READ FCT BLOCK FROM FILE
 4
 5                                        ;INPUT:
 6                                        ;       R5 - POINTER TO CONTROLLER TABLE
 7                                        ;       R4 - POINTER TO DATA IN RECEIVE BUFFER
 8                                        ;       R3 - CHARACTER COUNT IN RECEIVE BUFFER
 9                                        ;       R2 - POINTER TO SEND BUFFER (BUFFER IS CLEARED)
10                                        ;       R1 - ZERO
11                                        ;OUTPUT:
12                                        ;       Z SET TO SEND DATA TO PROGRAM
13
14 014534  023714  003226        SPECL:   CMP FCTNUM,(R4) ;SEE IF DESIRED BLOCK IS IN MEMORY
15 014540  001425                         BEQ SPECLX      ; IF SO, SEND TO DUP PROGRAM
16 014542  002407                         BLT SPECLR      ; IF LOWERED NUMBERED BLOCK IN MEMORY,
17                                        ;                  GO READ NEXT BLOCK
18 014544                        SPECLC:
20 014544                                 CLOSE    ;OTHERWISE, START READING FROM BEGINNING AGAIN    TRAP    C$CLOS
   014544  104435
21 014546                                 OPEN #FNAME2                                             MOV     #FNAME2,R0
   014546  012700  003254
   014552  104434                                                                                 TRAP    C$OPEN
23 014554  012737  177777  003226         MOV #-1,FCTNUM
24 014562  012703  001000        SPECLR:  MOV #512.,R3     ;GET BYTE COUNT IN A BLOCK
25 014566  012701  002226                 MOV #FCTBUF,R1   ;POINT TO STORAGE AREA
26 014572                        SPECLL:  GETBYTE (R1)+    ;READ THE FILE                          TRAP    C$GETB
   014572  104426
   014574  110021                                                                                 MOVB    R0,(R1)+
27 014576                                 BNCOMPLETE SPECLE        ;PRINT ERROR IF NO MORE BYTES IN FILE
   014576  103005                                                                                 BCC     SPECLE
28 014600  005303                         DEC R3  ;COUNT THE BYTES
29 014602  001373                         BNE SPECLL
30 014604  005237  003226                 INC FCTNUM       ;KEEP COUNT OF BLOCK IN MEMORY
31 014610  000751                         BR SPECL
32
33 014612  005212                SPECLE:  INC (R2)         ;TELL DUP PROGRAM DATA NOT AVAILABLE
34 014614  012762  002226  000002 SPECLX: MOV #FCTBUF,2(R2)        ;PUT ADDRESS OF DATA IN OUTPUT BUFFER
35 014622  012701  000006                 MOV #6,R1        ;SEND 3 WORDS TO DUP PROGRAM
36 014626  000264                         SEZ
37 014630  000207                         RETURN                           ;RETURN WITH Z SET TO SEND DATA TO DUP PROGRAM
```

```
 1                                      ;PRINT A MESSAGE IN THE RECEIVE BUFFER FROM THE DUP PROGRAM
 2                                      ;
 3                                      ;INPUT:
 4                                      ;       R4 - POINTER TO DATA IN RECEIVE BUFFER
 5                                      ;       R3 - CHARACTER COUNT IN RECEIVE BUFFER
 6                                      ;OUTPUT:
 7                                      ;       R4 - POINTER TO CHARACTER AFTER MESSAGE IN RECEIVE BUFFER
 8                                      ;       R3 - ZERO
 9                                      ;       R1 - BIT 15 SET TO PREVENT SENDING DATA TO DUP PROGRAM
10                                      ;       R0 - CONTENTS DESTROYED
11                                      ;       Z SET TO CONTINUE RUNNING DUP PROGRAM
12
13 014632                      MESG:    PRINT #CR
   014632  112700  000015                                                        MOVB #CR,R0
   014636  004737  016056                                                        CALL CPNT
14 014642  112400             1$:      MOVB (R4)+,R0           ;PRINT CHARACTERS FROM DUP PROGRAM
15 014644  001405                      BEQ 2$                  ;  DISCARDING LF AND NULL CHARACTERS
16 014646  020027  000012              CMP R0,#12
17 014652  001402                      BEQ 2$
18 014654                              PRINT R0
   014654  004737  016056                                                        CALL CPNT
19 014660  005303             2$:      DEC R3                  ;COUNT THE CHARACTERS
20 014662  003367                      BGT 1$
21 014664  000207                      RETURN
```

```
 1                                         ;GTDRVT
 2                                         ;
 3                                         ;GET DRIVE TABLE ADDRESS FROM CONTROLLER TABLE
 4                                         ;
 5                                         ;INPUTS:
 6                                         ;       R5 - CONTROLLER TABLE ADDRESS
 7                                         ;OUTPUTS:
 8                                         ;       R0 - ADDRESS OF FIRST DRIVE TABLE AVAILABLE FOR TESTING
 9                                         ;               (WITH DT.AVL BIT CLEAR)
10
11 014666                          GTDRVT: PUSH R5
   014666  010546                                                                          MOV R5,-(SP)
12 014670  062705  000020                  ADD #C.DR0,R5
13 014674  012500                  GTDRVL: MOV (R5)+,R0
14 014676  016037  000002  002074          MOV D.UNIT(R0),L$LUN
15 014704                                      ASSUME DT.AVL EQ BIT15
16 014704  100773                          BMI GTDRVL
17 014706                          POP R5
   014706  012605                                                                          MOV (SP)+,R5
18 014710  000207                          RETURN
```

```
    1                                        ;HEADER
    2                                        ;
    3                                        ;PRINT A HEADER IN FRONT OF EACH MESSAGE FROM DUP PROGRAM.
    4                                        ;A UDA ADDRESS IS PRINTED IF MORE THAN ONE UDA IS IN HARDWARE P-TABLE.
    5                                        ;A RUNTIME IS PRINTED IF A CLOCK IS BEING USED TO TIME PROGRAM EXECUTION.
    6                                        ;
    7                                        ;INPUT:
    8                                        ;      R5 - POINTER TO CONTROLLER TABLE
    9                                        ;OUTPUT:
   10                                        ;      R0 - POINTER TO DRIVE TABLE
   11                                        ;      PRINTED MESSAGE
   12                                        ;
   13 014712 022737 000001 002012  HEADER: CMP #1,L$UNIT                  ;IF MORE THAN ONE UNIT BEING TESTED
   14 014720 001411                         BEQ 1$
   15 014722                                PNTF MESSG,D.UNIT(R2),(R5),(R2)        ;PRINT UDA ADDRESS
      014722 011246                                                              MOV (R2),-(SP)
      014724 011546                                                              MOV (R5),-(SP)
      014726 016246 000002                                                      MOV D.UNIT(R2),-(SP)
      014732 004137 016230                                                      JSR R1,LPNTF
      014736 004015                                                             .WORD MESSG
      014740 000006                                                             .WORD PNT.CT
   16 014742                                        ASSUME C.UADR EQ 0
   17 014742                                        ASSUME D.DRV EQ 0
   18 014742 000407                         BR 2$
   19 014744 005737 003232          1$:    TST KW.CSR                    ;IF NO CLOCK BEING USED
   20 014750 001406                         BEQ 3$                       ;BYPASS RUNTIME MESSAGE
   21 014752                                PRINT #CR
      014752 112700 000015                                                      MOVB #CR,R0
      014756 004737 016056                                                      CALL CPNT
   22 014762 004737 020176          2$:    CALL RNTIME                   ;PRINT RUNTIME IF A CLOCK IN USE
   23 014766 000207               3$:    RETURN
```

```
 1                                      ;OSTRNG
 2                                      ;
 3                                      ;FORMAT OF THE ASCIZ STRING IS AS FOLLOWS:
 4                                      ;
 5                                      ;CHARACTERS ENCLOSED IN QUOTES ARE TO BE PRINTED AS THEY ARE.
 6                                      ;
 7                                      ;OTHERWISE CODE IS A SINGLE LETTER FOLLOWED BY AN OPTIONAL DECIMAL
 8                                      ;NUMBER:
 9                                      ;   ON - PRINT OCTAL NUMBER. N REPRESENTS SIZE OF BINARY NUMBER PASSED
10                                      ;           IN PARAMETER IN BITS. MAY BE IN RANGE 1 TO 32. IF N>16, TWO PARAMETER
11                                      ;           WORDS ARE USED, OTHERWISE ONLY ONE WORD. LEADING ZEROS ARE PRINTED.
12                                      ;           N IS ALWAYS SPECIFIED.
13                                      ;   DN - PRINT UNSIGNED DECIMAL NUMBER FROM N BIT PARAMETER. LEADING ZEROS
14                                      ;           ARE NOT PRINTED. A 16 BIT NUMBER EQUAL TO ZERO WILL PRINT '0'.
15                                      ;   HN - PRINT HEX NUMBER FROM PARAMETER OF N BITS. IF N>16 TWO PARAMETERS
16                                      ;           ARE USED, OTHERWISE ONLY ONE PARAMETER. LEADING ZEROS ARE PRINTED.
17                                      ;   SN - PRINT N SPACES. N ASSUMED TO BE 1.
18                                      ;   NN - START NEW LINE (CR-LF SEQUENCE). N ASSUMED TO BE 1.
19                                      ;   AN - PRINT N ASCII CHARACTERS FROM PARAMETERS, N ASSUMED TO BE 1.
20                                      ;           N/2 PARAMETER WORDS USED.
21                                      ;   RN - EXECUTE ROUTINE #N. N MUST BE GIVEN AND DEFINED IN HOST PROGRAM.
22                                      ;
23                                      ;A NULL CHARACTER MEANS END OF MESSAGE. A NULL AS FIRST CHARACTER IN STRING
24                                      ;MUST BE IGNORED.
25                                      ;
26                                      ;OUTPUT A MESSAGE ACCORDING TO A FORMAT STRING
27                                      ;
28                                      ;INPUTS:
29                                      ;       R2 - ADDRESS OF START OF FORMAT STRING
30                                      ;       R4 - ADDRESS OF PARAMETERS
31                                      ;OUTPUTS:
32                                      ;       R2 AND R4 UPDATED TO END OF STRING AND PARAMETERS
33
34 014770  112201            OSTRNG: MOVB (R2)+,R1              ;GET CONTROL CHARACTER
35 014772  001421                    BEQ OSTRE                 ;EXIT IF NULL CHARACTER
36 014774  012700   015270           MOV #ERRC,R0              ;GET POINTER TO CHARACTER TABLE
37 015000  120110            NCCNS:  CMPB R1,(R0)              ;COMPARE CHARACTER WITH TABLE ENTRY
38 015002  001407                    BEQ NCONF                 ;BRANCH IF MATCH FOUND
39 015004  105720                    TSTB (R0)+                ;INCREMENT POINTER
40 015006  001374                    BNE NCONS                 ;CONTINUE SEARCH IF NOT END OF TABLE
41 015010                            PNTF ERRME1               ;REPORT BAD CONTROL CHARACTER
   015010  004137   016230                                              JSR R1,LPNTF
   015014  003726                                                       .WORD ERRME1
   015016  000000                                                       .WORD PNT.CT
42 015020  000406                    BR OSTRE
43 015022  162700   015270   NCONF:  SUB #ERRC,R0              ;GET INCREMENT INTO TABLE
44 015026  006300                    ASL R0                    ;DOUBLE TO WORD COUNT
45 015030  004770   015302           CALL @ERRD(R0)            ;DISPATCH TO PRINT ROUTINE
46 015034  000755                    BR OSTRNG                 ;GET NEXT
47 015036  000207            OSTRE:  RETURN
```

```
 1                                      ;CONTROL CHARACTER WAS A QUOTE. PRINT ALL CHARACTERS TO THE NEXT QUOTE.
 2
 3 015040  112200                       CON.QU: MOVB (R2)+,R0                 ;GET CHARACTER
 4 015042  120027   000042                      CMPB R0,#'''                  ;CHECK IF ENDING QUOTE
 5 015046  001403                               BEQ CON.QX                    ;IF SO, GO GET NEXT CONTROL CHARACTER
 6 015050                                        PRINT R0                     ;PRINT THE CHARACTER
   015050  004737   016056                                                              CALL CPNT
 7 015054  000771                               BR CON.QU                     ;CONTINUE PRINTING
 8 015056  000207                       CON.QX: RETURN
 9
10                                      ;CONTROL CHARACTER WAS AN A. PRINT ASCII CHARACTERS FROM PARAMETERS.
11
12 015060  004737   015536             CON.A:  CALL GETCNT                    ;GET COUNT OF CHARACTERS
13 015064                              CON.A1: PRINT (R4)+                     ;PRINT THE CHARACTER
   015064  112400                                                                        MOVB (R4)+,R0
   015066  004737   016056                                                              CALL CPNT
14 015072  005301                               DEC R1                        ;COUNT THE CHARACTERS
15 015074  001373                               BNE CON.A1                    ;PRINT UNTIL COUNT REACHES ZERO
16 015076  032704   000001                      BIT #1,R4                     ;CHECK IF R4 NOW ODD
17 015102  001401                               BEQ CON.A2
18 015104  005204                               INC R4                        ;IF SO, INCREMENT TO NEXT EVEN ADDRESS
19 015106  000207                       CON.A2: RETURN                        ;NOW GET NEXT CONTROL CHARACTER
20
21                                      ;CONTROL CHARACTER WAS A D. PRINT DECIMAL NUMBER.
22
23 015110  012701   000012             CON.D:  MOV #10.,R1                    ;LOAD RADIX
24 015114  004737   015614                      CALL PNTNUM                   ;PRINT NUMBER
25 015120  000207                               RETURN                        ;NOW GET NEXT CONTROL CHARACTER
26
27                                      ;CONTROL CHARACTER WAS AN H. PRINT HEX NUMBER.
28
29 015122  012701   000020             CON.H:  MOV #16.,R1                    ;LOAD RADIX
30 015126  004737   015614                      CALL PNTNUM                   ;PRINT NUMBER
31 015132  000207                               RETURN                        ;NOW GET NEXT CONTROL CHARACTER
```

```
  1                                    ;CONTROL CHARACTER WAS AN O. PRINT OCTAL NUMBER.
  2
  3  015134  012701  000010   CON.O:   MOV #8.,R1                    ;LOAD RADIX
  4  015140  004737  015614            CALL PNTNUM                   ;PRINT NUMBER
  5  015144  000207                    RETURN                       ;NOW GET NEXT CONTROL CHARACTER
  6
  7                                    ;CONTROL CHARACTER WAS AN N. PRINT NEW LINE SEQUENCE.
  8
  9  015146  004737  015536   CON.N:   CALL GETCNT                   ;GET COUNT
 10  015152                   CON.N1:  PRINT #CR                     ;PRINT NEW LINE SEQUENCE
     015152  112700  000015                                                    MOVB #CR,R0
     015156  004737  016056                                                    CALL CPNT
 11  015162  005301                    DEC R1                       ;COUNT THE SEQUENCES
 12  015164  001372                    BNE CON.N1
 13  015166  000207                    RETURN                       ;NOW GET NEXT CONTROL CHARACTER
 14
 15                                    ;CONTROL CHARACTER WAS AN R. CALL A PRE-PROGRAMMED ROUTINE.
 16
 17  015170  004737  015536   CON.R:   CALL GETCNT                   ;GET ROUTINE NUMBER
 18  015174  020127  000010            CMP R1,#ERRRSZ                ;CHECK IF DEFINED ROUTINE NUMBER
 19  015200  101004                    BHI CON.R1
 20  015202  060101                    ADD R1,R1                    ;DOUBLE COUNT TO GET WORD INDEX
 21  015204  004771  015246            CALL @ERRRTB-2(R1)            ;CALL ROUTINE
 22  015210  000207                    RETURN                       ;NOW GET NEXT CONTROL CHARACTER
 23  015212                   CON.R1:  PNTF ERRME1                   ;REPORT BAD MESSAGE STRING
     015212  004137  016230                                                    JSR R1,LPNTF
     015216  003726                                                            .WORD ERRME1
     015220  000000                                                            .WORD PNT.CT
 24  015222                            POP R1                       ;FIX THE STACK
     015222  012601                                                            MOV (SP)+,R1
 25  015224  000207                    RETURN
 26
 27                                    ;CONTROL CHARACTER WAS AN S. PRINT SPACES.
 28
 29  015226  004737  015536   CON.S:   CALL GETCNT                   ;GET COUNT
 30  015232                   CON.S1:  PRINT <#' >                   ;PRINT A SPACE
     015232  112700  000040                                                    MOVB #' ,R0
     015236  004737  016056                                                    CALL CPNT
 31  015242  005301                    DEC R1                       ;COUNT THE SPACES
 32  015244  001372                    BNE CON.S1
 33  015246  000207                    RETURN                       ;NOW GET NEXT CONTROL CHARACTER
```

```
 1                                ;ERROR ROUTINE DISPATCH TABLE
 2
 3 015250  015322                 ERRRTB: .WORD CALRE              ;NOT USED
 4 015252  015322                         .WORD CALRE              ;NOT USED
 5 015254  015322                         .WORD CALRE              ;NOT USED
 6 015256  015334                         .WORD CALR4              ;PRINT BASIC LINE WITHOUT UDA ADDRESS
 7 015260  015410                         .WORD CALR5              ;PRINT BASIC LINE WITH UDA ADDRESS
 8 015262  015466                         .WORD CALR6              ;CALL ALTERNATE PRINT STRING IN PDP-11 MEMORY
 9 015264  015502                         .WORD CALR7              ;PRINT  'REPLACE UDA MODULE M7161 OR M7485''
10 015266  015520                         .WORD CALR8              ;PRINT  '' UDASA CONTAINS  XXXXXX''
11                                ;        .WORD CALR9             ;REPRINT LAST NUMBER
12          000010                         ERRRSZ=<.-ERRRTB>/2
13
14                                ;BUILD TWO TABLES
15                                ;       FIRST CONTAINING CONTROL CHARACTERS
16                                ;       SECOND CONTAINING ROUTINE ADDRESSES
17
18                                .MACRO BUILD
19                                        ENTRY '',CON.QU
20                                        ENTRY A,CON.A
21                                        ENTRY D,CON.D
22                                        ENTRY H,CON.H
23                                        ENTRY O,CON.O
24                                        ENTRY N,CON.N
25                                        ENTRY R,CON.R
26                                        ENTRY S,CON.S
27                                .ENDM
```

```
 1                                  ;HERE IS FIRST TABLE
 2
 3                                  .MACRO ENTRY ARG1,ARG2
 4                                          .LIST
 5                                          .BYTE ''ARG1
 6                                          .NLIST
 7                                  .ENDM
 8
 9 015270                          ERRC:   BUILD
   015270      042                         .BYTE '''
   015271      101                         .BYTE 'A
   015272      104                         .BYTE 'D
   015273      110                         .BYTE 'H
   015274      117                         .BYTE 'O
   015275      116                         .BYTE 'N
   015276      122                         .BYTE 'R
   015277      123                         .BYTE 'S
10 015300      000                         .BYTE 0            ;FOLLOW WITH A NULL BYTE
11                                         .EVEN
12
13                                  ;HERE IS SECOND TABLE
14
15                                  .MACRO ENTRY ARG1,ARG2
16                                          .LIST
17                                          .WORD ARG2
18                                          .NLIST
19                                  .ENDM
20
21 015302                          ERRD:   BUILD
   015302      015040                      .WORD CON.QU
   015304      015060                      .WORD CON.A
   015306      015110                      .WORD CON.D
   015310      015122                      .WORD CON.H
   015312      015134                      .WORD CON.O
   015314      015146                      .WORD CON.N
   015316      015170                      .WORD CON.R
   015320      015226                      .WORD CON.S
```

```
    1                              ;PRE-PROGRAMMED ROUTINES 1, 2 AND 3
    2                              ;NOT USED - PRINTS ERROR MESSAGE
    3
    4 015322           CALRE:  PNTF ERRME1                    ;PRINT ERROR MESSAGE
      015322  004137  016230                                          JSR R1,LPNTF
      015326  003726                                                  .WORD ERRME1
      015330  000000                                                  .WORD PNT.CT
    5 015332  000207                RETURN
```

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

    5 015334                       CALR4:  PNTB BASLN,#BASNO,#BAS,#BAS,#BAS
      015334  012746  004211                                                        MOV #BAS,-(SP)
      015340  012746  004211                                                        MOV #BAS,-(SP)
      015344  012746  004211                                                        MOV #BAS,-(SP)
      015350  012746  004136                                                        MOV #BASNO,-(SP)
      015354  004137  016240                                                        JSR R1,LPNTB
      015360  004212                                                                .WORD BASLN
      015362  000010                                                                .WORD PNT.CT
    6 015364  004737  020176                 CALL RNTIME
    7 015370                                  PRINT #CR
      015370  112700  000015                                                        MOVB #CR,R0
      015374  004737  016056                                                        CALL CPNT
    8 015400  012737  016156  003246          MOV #PX,PTYPE
    9 015406  000207                          RETURN
```

```
                                           ;PRE-PROGRAMMED ROUTINE 5
      2                                    ;PRINT BASIC LINE FOR HOST PROGRAM ERROR WITH UDA ADDRESS
      3                                    ;THEN SWITCH TO EXTENDED FORMAT
      4
      5 015410                             CALR5:  PNTB BASLN,#BASNO,#BASL2,(R5),#BAS,#BAS
        015410  012746  004211                                                                          MOV #BAS,-(SP)
        015414  012746  004211                                                                          MOV #BAS,-(SP)
        015420  011546                                                                                  MOV (R5),-(SP)
        015422  012746  004155                                                                          MOV #BASL2,-(SP)
        015426  012746  004136                                                                          MOV #BASNO,-(SP)
        015432  004137  016240                                                                          JSR R1,LPNTB
        015436  004212                                                                                  .WORD BASLN
        015440  000012                                                                                  .WORD PNT.CT
      6 015442  004737  020176                     CALL RNTIME
      7 015446                                      PRINT #CR
        015446  112700  000015                                                                          MOVB #CR,R0
        015452  004737  016056                                                                          CALL CPNT
      8 015456  012737  016156  003246             MOV #PX,PTYPE
      9 015464  000207                              RETURN
```

```
     1                                   ;PRE-PROGRAMMED ROUTINE 6
     2                                   ;CALL ALTERNATE PRINT ROUTINE IN PDP-11 MEMORY
     3
     4 015466                   CALR6:   PUSH R2                        ;SAVE CURRENT STRING POINTER
       015466  010246                                                          MOV R2,-(SP)
     5 015470  012402                    MOV (R4)+,R2                   ;GET NEW STRING POINTER
     6 015472  004737  014770            CALL OSTRNG                    ;OUTPUT USING THIS STRING
     7 015476                            POP R2                         ;GET OLD POINTER BACK
       015476  012602                                                          MOV (SP)+,R2
     8 015500  000207                    RETURN                         ;NOW CONTINUE THE OLD STRING
```

```
 1                                    ;PRE-PROGRAMMED ROUTINE 7
 2                                    ;PRINT ''REPLACE UDA MODULE M7161''
 3
 4 015502                   CALR7:    PUSH R2
   015502  010246                                                           MOV R2,-(SP)
 5 015504  012702  010533            MOV #XFRU,R2
 6 015510  004737  014770            CALL OSTRNG
 7 015514                            POP R2
   015514  012602                                                           MOV (SP)+,R2
 8 015516  000207                    RETURN
```

Y

```
 1                                    ;PRE-PROGRAMMED ROUTINE 8
 2                                    ;PRINT  '' UDASA CONTAINS  XXXXXX''
 3
 4 015520                     CALR8:  PUSH R2
   015520  010246                                                          MOV R2,-(SP)
 5 015522  012702  010502             MOV #XSA,R2
 6 015526  004737  014770             CALL OSTRNG
 7 015532                             POP R2
   015532  012602                                                          MOV (SP)+,R2
 8 015534  000207                     RETURN
```

```
1          ;          REPRINT LAST NUMBER
2          ;                    R4 -> TABLE
3          ;CALR9:  TST       -(R4)
4          ;          RETURN
```

```
 1                               ;GETCNT
 2                               ;
 3                               ;GET COUNT IN NEXT CHARACTERS OF STRING POINTED TO BY R2.
 4                               ;NUMBER WILL BE IN DECIMAL. IF NO NUMBER, RETURN A
 5                               ;DEFAULT OF 1.
 6                               ;
 7                               ;INPUTS:
 8                               ;       R2 - POINTER TO ASCII STRING
 9                               ;OUTPUTS:
10                               ;       R1 - NUMBER READ OR A ONE
11                               ;       R2 - POINTING TO CHARACTER AFTER NUMBER
12
13 015536                       GETCNT: PUSH R0
   015536  010046                                                                       MOV R0,-(SP)
14 015540  005001                       CLR R1                  ;START WITH ZERO COUNT
15 015542  121227  000060       GETCNX: CMPB (R2),#'0           ;CHECK IF CHARACTER A DIGIT
16 015546  103415                       BLO GETCDN              ;BRANCH IF LOWER THAN ZERO
17 015550  121227  000071               CMPB (R2),#'9
18 015554  101012                       BHI GETCDN              ;BRANCH IF HIGHER THAN NINE
19 015556  006301                       ASL R1                  ;MULTIPLY NUMBER BY 10
20 015560  010100                       MOV R1,R0               ; SAVE 2N
21 015562  006301                       ASL R1                  ; COMPUTE 4N
22 015564  006301                       ASL R1                  ; COMPUTE 8N
23 015566  060001                       ADD R0,R1               ; 8N + 2N = 10N
24 015570  112200                       MOVB (R2)+,R0           ;GET DIGIT FROM STING
25 015572  162700  000060               SUB #'0,R0              ;GET RID OF ASCII
26 015576  060001                       ADD R0,R1               ;ADD TO NUMBER
27 015600  000760                       BR GETCNX               ;GO TO NEXT CHARACTER
28 015602  005701               GETCDN: TST R1                  ;CHECK IF NUMBER IS ZERO
29 015604  001001                       BNE GETCXX              ;IF ZERO, CHANGE
30 015606  005201                       INC R1                  ; TO DEFAULT OF ONE
31 015610                       GETCXX: POP R0
   015610  012600                                                                       MOV (SP)+,R0
32 015612  000207                       RETURN
```

```
  1                              ;PNTNUM
  2                              ;
  3                              ;PRINT A NUMBER
  4                              ;
  5                              ;INPUTS:
  6                              ;       R1 - RADIX OF NUMBER
  7                              ;       R2 - ASCII STRING TO COUNT OF BITS IN NUMBER
  8                              ;       R4 - POINTER TO NUMBER (LOW WORD)
  9                              ;OUTPUTS:
 10                              ;       NUMBER IS PRINTED. LEADING ZEROS ARE PRINTED EXCEPT FOR
 11                              ;           DECIMAL NUMBERS.
 12                              ;       RO - CONTENTS DESTROYED
 13
 14 015614  010100              PNTNUM: MOV R1,R0             ;SAVE RADIX
 15 015616  004737  015536              CALL GETCNT           ;GET COUNT OF BITS
 16 015622                      PNTNUS: PUSH <R2,R3,R5>
    015622  010246                                                              MOV R2,-(SP)
    015624  010346                                                              MOV R3,-(SP)
    015626  010546                                                              MOV R5,-(SP)
 17 015630  012403              MOV (R4)+,R3                  ;GET ONE PARAMETER WORD
 18 015632  005005              CLR R5                        ;CLEAR STORAGE FOR OTHER
 19 015634  020127  000020      CMP R1,#16.                   ;MORE THAN 16 BITS IN NUMBER?
 20 015640  003401              BLE 1$
 21 015642  012405              MOV (R4)+,R5                  ;YES, GET SECOND PARAMETER WORD
 22 015644              1$:     PUSH R4
    015644  010446                                                              MOV R4,-(SP)
 23 015646  010504              MOV R5,R4                     ;PUT HIGH WORD IN R4
 24 015650  012702  000020      MOV #16.,R2                   ;COMPUTE BITS NOT WANTED
 25 015654  160102              SUB R1,R2                     ;BY SUBTRACTING BITS TO USE
 26 015656  002002              BGE 2$                        ;FROM 16.
 27 015660  062702  000020      ADD #16.,R2                   ;IF NEGATIVE, ADD 16 FOR FIRST WORD
 28 015664  001414      2$:     BEQ 6$                        ;IF ZERO, NO BITS NEED BE CLEARED
 29 015666  012705  100000      MOV #BIT15,R5                 ;START MASK WITH SIGN BIT SET
 30 015672  005302      3$:     DEC R2                        ;COUNT BITS IN MASK
 31 015674  001402              BEQ 4$
 32 015676  006205              ASR R5                        ;SHIFT MORE BITS TO RIGHT
 33 015700  000774              BR 3$
 34 015702  020127  000020  4$: CMP R1,#16.                   ;MORE THAN 16 BITS IN NUMBER?
 35 015706  003402              BLE 5$
 36 015710  040504              BIC R5,R4                     ;YES, CLEAR IN HIGH WORD
 37 015712  000401              BR 6$
 38 015714  040503      5$:     BIC R5,R3                     ;NO, CLEAR IN LOW WORD
 39 015716  004737  016334  6$: CALL DIVIDE                   ;DIVIDE BY RADIX IN R0
 40 015722              PUSH R5                               ;PUSH REMAINDER ON STACK
    015722  010546                                                              MOV R5,-(SP)
 41 015724  005202              INC R2                        ;COUNT DIGITS ON STACK
 42 015726  005703              TST R3                        ;CHECK IF QUOTIENT IS ZERO
 43 015730  001372              BNE 6$
 44 015732  005704              TST R4
 45 015734  001370              BNE 6$
```

```
 1 015736  020027  000012              CMP R0,#10.           ;IF RADIX IS DECIMAL
 2 015742  001423                      BEQ 10$               ; JUST GO PRINT DIGITS ON STACK
 3 015744  010103                      MOV R1,R3             ;OTHERWISE COMPUTE NUMBER OF LEADING ZEROS
 4 015746  162700  000014              SUB #12.,R0           ;DIVIDEND IS BITS IN NUMBER
 5 015752  003002                      BGT 7$                ;DIVISOR IS BITS PER DIGIT PRINTED
 6 015754  012700  000003              MOV #3,R0             ;   (3 OR 4)
 7 015760  004737  016334      7$:     CALL DIVIDE
 8 015764  005705                      TST R5                ;IF REMAINDER NOT ZERO
 9 015766  001401                      BEQ 8$                ;INCREMENT QUOTIENT
10 015770  005203                      INC R3
11 015772  160203              8$:     SUB R2,R3             ;SUBTRACT DIGITS ON STACK
12 015774  001406                      BEQ 10$               ;NO LEADING ZEROS IF ZERO
13 015776                      9$:     PRINT #'0             ;PRINT A ZERO
   015776  112700  000060                                                    MOVB #'0,R0
   016002  004737  016056                                                    CALL CPNT
14 016006  005303                      DEC R3
15 016010  001372                      BNE 9$                ;REPEAT UNTIL COUNT REACHES ZERO
16
17 016012                      10$:    POP R5                ;GET CHACACTER FROM STACK
   016012  012605                                                            MOV (SP)+,R5
18 016014  062705  000060              ADD #'0,R5            ;CNVERT TO ASCII DIGIT
19 016020  020527  000071              CMP R5,#'9            ;IF GREATER THAN A 9
20 016024  003402                      BLE 11$               ; CONVERT TO A OR HIGHER
21 016026  062705  000007              ADD #<'A-'9-1>,R5     ; FOR HEX DIGIT
22 016032                      11$:    PRINT R5              ;PRINT THE CHARACTER
   016032  110500                                                            MOVB R5,R0
   016034  004737  016056                                                    CALL CPNT
23 016040  005302                      DEC R2                ;REPEAT FOR ALL DIGITS
24 016042  001363                      BNE 10$               ; ON STACK
25 016044                              POP <R4,R5,R3,R2>
   016044  012604                                                            MOV (SP)+,R4
   016046  012605                                                            MOV (SP)+,R5
   016050  012603                                                            MOV (SP)+,R3
   016052  012602                                                            MOV (SP)+,R2
26 016054  000207                      RETURN
```

```
  1                                    ;PRINT ONE CHARACTER
  2                                    ;
  3                                    ;CALL WITH MACRO PRINT
  4
  5 016056   110037  003250   CPNT:    MOVB R0,ERRCHR
  6 016062                             PUSH R1
    016062   010146                                        MOV R1,-(SP)
  7 016064   012701  003664            MOV #ERRONE,R1
  8 016070   120027  000015            CMPB R0,#CR
  9 016074   001002                    BNE 1$
 10 016076   012701  003667            MOV #ERRNL,R1
 11 016102   000177  165140   1$:      JMP @PTYPE
 12 016106                    PF:      PRINTF R1,#ERRCHR
    016106   012746  003250                             MOV    #ERRCHR,-(SP)
    016112   010146                                     MOV    R1,-(SP)
    016114   012746  000002                             MOV    #2,-(SP)
    016120   010600                                     MOV    SP,R0
    016122   104417                                     TRAP   C$PNTF
    016124   062706  000006                             ADD    #6,SP
 13 016130   000435                    BR CPNTX
 14 016132                    PB:      PRINTB R1,#ERRCHR
    016132   012746  003250                             MOV    #ERRCHR,-(SP)
    016136   010146                                     MOV    R1,-(SP)
    016140   012746  000002                             MOV    #2,-(SP)
    016144   010600                                     MOV    SP,R0
    016146   104414                                     TRAP   C$PNTB
    016150   062706  000006                             ADD    #6,SP
 15 016154   000423                    BR CPNTX
 16 016156                    PX:      PRINTX R1,#ERRCHR
    016156   012746  003250                             MOV    #ERRCHR,-(SP)
    016162   010146                                     MOV    R1,-(SP)
    016164   012746  000002                             MOV    #2,-(SP)
    016170   010600                                     MOV    SP,R0
    016172   104415                                     TRAP   C$PNTX
    016174   062706  000006                             ADD    #6,SP
 17 016200   000411                    BR CPNTX
 18 016202                    PS:      PRINTS R1,#ERRCHR
    016202   012746  003250                             MOV    #ERRCHR,-(SP)
    016206   010146                                     MOV    R1,-(SP)
    016210   012746  000002                             MOV    #2,-(SP)
    016214   010600                                     MOV    SP,R0
    016216   104416                                     TRAP   C$PNTS
    016220   062706  000006                             ADD    #6,SP
 19 016224                    CPNTX:   POP R1
    016224   012601                                     MOV (SP)+,R1
 20 016226   000207                    RETURN
```

```
  1                                          ;PRINT FORMATTED MESSAGE
  2                                          ;
  3                                          ;CALL WITH MACRO PNT, PNTF, PNTB, PNTX, OR PNTS
  4
  5 016230  012737  016106  003246   LPNTF:  MOV #PF,PTYPE
  6 016236  000413                           BR LPNT
  7 016240  012737  016132  003246   LPNTB:  MOV #PB,PTYPE
  8 016246  000407                           BR LPNT
  9 016250  012737  016156  003246   LPNTX:  MOV #PX,PTYPE
 10 016256  000403                           BR LPNT
 11 016260  012737  016202  003246   LPNTS:  MOV #PS,PTYPE
 12 016266                           LPNT:   PUSH <R2,R3,R4,R5>
    016266  010246                                                        MOV R2,-(SP)
    016270  010346                                                        MOV R3,-(SP)
    016272  010446                                                        MOV R4,-(SP)
    016274  010546                                                        MOV R5,-(SP)
 13 016276  012102                           MOV (R1)+,R2         ;GET ADDRESS OF STRING
 14 016300  010604                           MOV SP,R4            ;COMPUTE ADDRESS OF ARGUMENTS
 15 016302  062704  000012                   ADD #10.,R4          ;  WHICH ARE NOW ON STACK (IF ANY)
 16 016306                           PUSH R1                      ;SAVE RETURN ADDRESS
    016306  010146                                                        MOV R1,-(SP)
 17 016310  004737  014770                   CALL OSTRNG          ;PRINT THE FORMATTED MESSAGE
 18 016314                           POP <R0,R5,R4,R3,R2,R1>      ;RESTORE ALL REGISTERS
    016314  012600                                                        MOV (SP)+,R0
    016316  012605                                                        MOV (SP)+,R5
    016320  012604                                                        MOV (SP)+,R4
    016322  012603                                                        MOV (SP)+,R3
    016324  012602                                                        MOV (SP)+,R2
    016326  012601                                                        MOV (SP)+,R1
 19 016330  062006                           ADD (R0)+,SP         ;ADJUST STACK POINTER OVER ARGUMENTS
 20 016332  000110                           JMP @R0              ;RETURN
```

```
 1                                    ;DIVIDE
 2                                    ;
 3                                    ;DIVIDE A 32 BIT UNSIGNED NUMBER BY A 16 BIT UNSIGNED NUMBER.
 4                                    ;REPLACE DIVIDEND WITH QUOTIENT AND RETURN REMAINDER.
 5                                    ;WILL NOT CHECK FOR DIVIDE BY ZERO.
 6                                    ;
 7                                    ;INPUTS:
 8                                    ;        R3 - LOW 16 BITS OF DIVIDEND
 9                                    ;        R4 - HIGH 16 BITS OF DIVIDEND
10                                    ;        R0 - DIVISOR
11                                    ;OUTPUTS:
12                                    ;        R3 - LOW 16 BITS OF QUOTIENT
13                                    ;        R4 - HIGH 16 BITS OF QUOTIENT
14                                    ;        R5 - REMAINDER
15
16 016334                    DIVIDE: PUSH R2
   016334  010246                                                         MOV R2,-(SP)
17 016336  012702  000040            MOV #32.,R2                 ;SET UP SHIFT COUNT
18 016342  005005            CLR R5                      ;START WITH ZERO REMAINDER
19 016344  006303            1$:     ASL R3              ;SHIFT LEFT INTO R5
20 016346  006104                    ROL R4
21 016350  006105                    ROL R5
22 016352  020005                    CMP R0,R5           ;WILL DIVISOR GO INTO REMAINDER
23 016354  101002                    BHI 2$              ;ONLY SUBTRACT IF IT WILL
24 016356  160005                    SUB R0,R5           ;SUBTRACT DIVISOR
25 016360  005203                    INC R3              ;PUT A ONE INTO QUOTIENT
26 016362  005302            2$:     DEC R2              ;COUNT THE SHIFTS
27 016364  001367                    BNE 1$
28 016366                            POP R2
   016366  012602                                                        MOV (SP)+,R2
29 016370  000207                    RETURN
```

```
         1                                    ;LOADDM
         2                                    ;
         3                                    ;LOAD AND START A DM PROGRAM INTO A CONTROLLER
         4                                    ;
         5                                    ;INPUTS:
         6                                    ;    R5 - CONTROLLER TABLE ADDRESS
         7                                    ;    DMPROG - POINTER TO START OF DM PROGRAM IN MEMORY
         8                                    ;OUTPUTS:
         9                                    ;    IF LOAD SUCCEEDS - Z CLEAR
        10                                    ;              CONTROLLER TABLE MARKED LOADED
        11                                    ;    IF ERROR - Z SET
        12
        13 016372  013701  002164    LOADDM: MOV DMPROG,R1            ;GET STORAGE ADDRESS OF DM PROGRAM
        14 016376  116165  000021  000044    MOVB DMTMO(R1),C.TOT(R5) ;GET TIMEOUT VALUE
        15 016404  105065  000045            CLRB C.TOT+1(R5)
        16 016410  016504  000004            MOV C.VEC(R5),R4         ;GET VECTOR OF UDA
        17 016414                            AND CT.VEC,R4
           016414  042704  177000                                              BIC #^C<CT.VEC>,R4
        18 016420  010501                    MOV R5,R1                ;GET INTERRUPT SERVICE LINK
        19 016422  062701  000010            ADD #C.JSR,R1
        20 016426                            SETVEC R4,R1,#PRIO7      ;SET UP INTERRUPT VECTOR
           016426  012746  000340                                    MOV     #PRIO7,-(SP)
           016432  010146                                            MOV     R1,-(SP)
           016434  010446                                            MOV     R4,-(SP)
           016436  012746  000003                                    MOV     #3,-(SP)
           016442  104437                                            TRAP    C$SVEC
           016444  062706  000010                                    ADD     #10,SP
        21                                                           ;INITIALIZE UDA WITH SMALLEST
        22 016450  004737  017254            CALL UDAINT             ; RING BUFFER AND INTERRUPTS ENABLED
        23 016454  001445                    BEQ LOADER             ;BRANCH IF AN ERROR
```

```
 1 016456 017701 163502              MOV @DMPROG,R1                    ;GET SIZE OF PROGRAM
 2 016462 012700 000002      LOADB:  MOV #OP.ESP,R0                    ;BUILD EXECUTE SUPPLIED PROGRAM COMMAND PACKET
 3 016466 004737 016574              CALL BLDCMD
 4 016472 013764 002164 000124       MOV DMPROG,HC.CPK+P.UADR(R4)      ;LOAD MAIN PROGRAM ADDRESS
 5 016500 010164 000120              MOV R1,HC.CPK+P.BCNT(R4)          ;  AND SIZE
 6 016504 013764 002164 000140       MOV DMPROG,HC.CPK+P.OVRL(R4)      ;LOAD OVERLAY ADDRESS
 7 016512 067764 163446 000140       ADD @DMPROG,HC.CPK+P.OVRL(R4)
 8 016520 004737 016660              CALL SNDCMD                       ;SEND COMMAND TO UDA
 9 016524 004737 017000              CALL WAITMS                       ;WAIT FOR MESSAGE RESPONSE
10 016530 001417                     BEQ LOADER       ;ABORT IF NO RESPONSE
11 016532 032764 000037 000032       BIT #ST.MSK,HC.MPK+P.STS(R4)      ;CHECK FOR ERRORS
12 016540 001007                     BNE LOADE1
13 016542 042765 000024 000014       BIC #CT.CMD+CT.REQ,C.FLG(R5)      ;CLEAR COMMAND OUTSTANDING FLAG
14 016550 052765 000002 000014       BIS #CT.RN,C.FLG(R5)             ;SET DM PROGRAM RUNNING FLAG
15 016556 000207                     RETURN
```

```
 1                              ;UDA FAILED TO DOWNLINE LOAD DM PROGRAM
 2
 3 016560            LOADE1: ERRDF  34,,ERRO34
   016560 104455                                          TRAP    C$ERDF
   016562 000042                                          .WORD   34
   016564 000000                                          .WORD   0
   016566 011456                                          .WORD   ERRO34
 4 016570 000264    LOADER: SEZ            ;SET Z TO INDICATE ERROR OCCURRED
 5 016572 000207            RETURN
```

```
         1                                   ;BLDCMD
         2                                   ;
         3                                   ;BUILD A COMMAND IN COMMAND PACKET
         4                                   ;
         5                                   ;INPUTS:
         6                                   ;       R5 - CONTROLLER TABLE ADDRESS
         7                                   ;       R0 - COMMAND CODE
         8                                   ;OUTPUTS:
         9                                   ;       R4 - ADDRESS OF HOST COMM AREA
        10                                   ;       COMMAND PACKET CONTAINING REF NUMBER AND OPCODE. ALL OTHER FIELDS CLEARED.
        11                                   ;       CMD REFERRENCE NUMBER IN CONTROLLER TABLE INCREMENTED AND RESULT
        12                                   ;       IN COMMAND PACKET.
        13                                   ;       R0 - CONTENTS DESTROYED
        14
        15 016574                            BLDCMD: PUSH <R1,R0>
           016574  010146                                                                         MOV R1,-(SP)
           016576  010046                                                                         MOV R0,-(SP)
        16 016600  016504  000016                    MOV C.RING(R5),R4        ;GET ADDRESS OF HOST COMM AREA
        17 016604  010400                            MOV R4,R0                ;COPY TO R0
        18 016606  062700  000100                    ADD #HC.CEV,R0           ;COMPUTE ADDRESS OF COMMAND ENVELOPE
        19 016612  012720  000060                    MOV #HC.PSZ,(R0)+        ;LOAD PACKET LENGTH
        20 016616  012701  001000                    MOV #DUP,R1              ;LOAD DIAG CIRCUIT IDENTIFIER
        21 016622  022716  000031                    CMP #OP.MWR,(SP)         ;IF CODE IS MAINTENANCE WRITE
        22 016626  001002                            BNE BLDCO                ;  GET OTHER CIRCUIT IDENTIFIER
        23 016630  012701  177777                    MOV #DIAG,R1
        24 016634  010120                    BLDCO:  MOV R1,(R0)+             ;PUT IDENTIFIER INTO PACKET
        25 016636  012701  000030                    MOV #<HC.PSZ>/2,R1       ;GET WORDS TO CLEAR
        26 016642  005020                    BLDC1:  CLR (R0)+                ;CLEAR PACKET
        27 016644  005301                            DEC R1
        28 016646  001375                            BNE BLDC1
        29 016650                                    POP HC.CPK+P.OPCD(R4)    ;PUT OPCODE IN PACKET
           016650  012664  000114                                                                 MOV (SP)+,HC.CPK+P.OPCD(R4)
        30 016654                                    POP R1                   ;RESTORE R1
           016654  012601                                                                         MOV (SP)+,R1
        31 016656  000207                            RETURN
```

```
     1                                    ;SNDCMD
     2                                    ;
     3                                    ;SEND A COMMAND TO THE UDA.
     4                                    ;MARK BOTH PACKETS AVAILABLE TO THE
     5                                    ;UDA. SET COMMAND ISSUED BIT IN CONTROLLER TABLE AND INITIALIZE
     6                                    ;TIMEOUT COUNTER.
     7                                    ;
     8                                    ;INPUTS:
     9                                    ;        R5 - CONTROLLER TABLE ADDRESS
    10                                    ;OUTPUTS:
    11                                    ;        R4 - ADDRESS OF HOST COMM AREA
    12
    13
    14 016660                    SNDCMD: PUSH <R0,R1>
       016660  010046                                                                 MOV R0,-(SP)
       016662  010146                                                                 MOV R1,-(SP)
    15 016664  016504  000016           MOV C.RING(R5),R4              ;LOAD R4 WITH HOST COMM AREA ADDRESS
    16 016670  005265  000052           INC C.REF(R5)                 ;INCREMENT CMD REFERENCE NUMBER
    17 016674  016564  000052  000104   MOV C.REF(R5),HC.CPK+P.CRF(R4) ;PUT IN PACKET
    18 016702  012764  140000  000006   MOV #RG.OWN+RG.FLG,HC.MCT(R4) ;MARK MESSAGE PACKET AVAILABLE
    19 016710  012764  100000  000012   MOV #RG.OWN,HC.CCT(R4)        ;MARK COMMAND TO UDA
    20 016716  005775  000000           TST @(R5)                    ;TELL UDA COMMAND IS THERE
    21 016722  052765  000004  000014   BIS #CT.CMD,C.FLG(R5)        ;MARK COMMAND ISSUED
    22 016730                           POP <R1,R0>
       016730  012601                                                                 MOV (SP)+,R1
       016732  012600                                                                 MOV (SP)+,R0
    23 016734  000207                   RETURN
```

```
 1                                  ;CLRBUF
 2                                  ;
 3                                  ;CLEAR THE SPECIFIED DATA BUFFER IN THE HOST COMM AREA
 4                                  ;AND LOAD BUFFER DESCRIPTOR IN COMMAND PACKET TO THE BUFFER
 5                                  ;
 6                                  ;INPUTS:
 7                                  ;       R5 - CONTROLLER TABLE ADDRESS
 8                                  ;       R4 - ADDRESS OF HOST COMM AREA
 9                                  ;       R0 - OFFSET INTO HOST COMM AREA TO DATA BUFFER
10                                  ;OUTPUTS:
11                                  ;       DATA BUFFER CLEARED
12                                  ;       COMMAND PACKET POINTING TO BUFFER
13                                  ;       BYTE COUNT SET TO SIZE OF BUFFER
14                                  ;       R4 - ADDRESS OF DATA BUFFER
15
16 016736                          CLRBUF: PUSH <R0,R1>
   016736  010046                                                          MOV R0,-(SP)
   016740  010146                                                          MOV R1,-(SP)
17 016742  060400                          ADD R4,R0                  ;ADD START OF HOST COMM AREA TO OFFSET
18 016744  010064  000124                  MOV R0,HC.CPK+P.UADR(R4)   ;PUT BUFFER ADDRESS IN COMMAND PACKET
19 016750  012764  000122  000120          MOV #HC.BSZ,HC.CPK+P.BCNT(R4) ;PUT SIZE OF BUFFER IN COMMAND PACKET
20 016756  010004                          MOV R0,R4                  ;PUT BUFFER ADDRESS IN R4
21 016760  012701  000051                  MOV #HC.BSZ/2,R1           ;GET SIZE OF BUFFER IN WORDS
22 016764  005020                  CLRBFL: CLR (R0)+                  ;CLEAR ALL THE WORDS
23 016766  005301                          DEC R1
24 016770  001375                          BNE CLRBFL
25 016772                          POP <R1,R0>
   016772  012601                                                          MOV (SP)+,R1
   016774  012600                                                          MOV (SP)+,R0
26 016776  000207                          RETURN
```

```
     1                              ;WAITMS
     2                              ;
     3                              ;WAIT FOR UDA TO RESPOND WITH A MESSAGE PACKET
     4                              ;
     5                              ;INPUTS:
     6                              ;       R5 - ADDRESS OF CONTROLLER TABLE
     7                              ;OUTPUTS:
     8                              ;       Z CLEAR IF NO ERROR
     9                              ;       Z SET IF ERROR, MESSAGE PRINTED
    10
    11 017000                      WAITMS: PUSH <R0,R1>
       017000  010046                                                              MOV R0,-(SP)
       017002  010146                                                              MOV R1,-(SP)
    12 017004  012700  000036              MOV #30.,R0          ;SET TIME OUT VALUE OF 30 SECONDS
    13 017010  010501              MOV R5,R1                    ;POINT TO TIME OUT COUNTER
    14 017012  062701  000040              ADD #C.TO,R1
    15 017016  004737  017172              CALL SETTO
    16 017022  011500          1$: MOV (R5),R0                  ;GET ADDRESS OF UDAIP REGISTER
    17 017024  032765  000010  000014      BIT #CT.MSG,C.FLG(R5) ;LOOK IF INTERRUPT OCCURRED
    18 017032  001030              BNE 3$                       ;BRANCH IF SO
    19 017034  016001  000002              MOV 2(R0),R1         ;LOOK AT UDASA REGISTER
    20 017040  001034              BNE 4$                       ;BRANCH IF ERROR CODE PRESENT
    21 017042                      BREAK
       017042  104422                                                              TRAP      C$BRK
    22 017044  005737  003232              TST KW.CSR           ;SEE IF A CLOCK ON SYSTEM
    23 017050  001764              BEQ 1$
    24 017052  023765  003244  000042      CMP KW.EL+2,C.TOH(R5) ;CHECK IF TIMEOUT HAS HAPPENED
    25 017060  101005              BHI 2$
    26 017062  001357              BNE 1$
    27 017064  023765  003242  000040      CMP KW.EL,C.TO(R5)
    28 017072  103753              BLO 1$
    29 017074                  2$: ERRDF 36.,ERRO36
       017074  104455                                                              TRAP      C$ERDF
       017076  000044                                                              .WORD     36
       017100  000000                                                              .WORD     0
       017102  011464                                                              .WORD     ERRO36
    30 017104                      POP <R1,R0>
       017104  012601                                                              MOV (SP)+,R1
       017106  012600                                                              MOV (SP)+,R0
    31 017110  000264              SEZ
    32 017112  000207              RETURN
```

```
 1 017114  042765  000010  000014  3$:     BIC  #CT.MSG,C.FLG(R5)        ;CLEAR MESSAGE RECEIVED FLAG
 2 017122                                   POP  <R1,R0>
   017122  012601                                                        MOV  (SP)+,R1
   017124  012600                                                        MOV  (SP)+,R0
 3 017126  000244                           CLZ                          ;GIVE NO ERROR RETURN
 4 017130  000207                           RETURN
 5 017132                           4$:      ERRDF 37,,ERR037
   017132  104455                                                        TRAP     C$ERDF
   017134  000045                                                        .WORD    37
   017136  000000                                                        .WORD    0
   017140  011476                                                        .WORD    ERR037
 6 017142                                    POP  <R1,R0>
   017142  012601                                                        MOV  (SP)+,R1
   017144  012600                                                        MOV  (SP)+,R0
 7 017146  000264                            SEZ
 8 017150  000207                            RETURN
```

```
 1                                      ;NXMI
 2                                      ;
 3                                      ;NON-EXISTANT MEMORY SERVICE ROUTINE
 4                                      ;
 5                                      ;INPUTS:
 6                                      ;     NXMAD SET TO ZERO
 7                                      ;OUTPUTS:
 8                                      ;     NXMAD SET TO ONES IF NON-EXISTANT TRAP OCCURED
 9
10 017152                              BGNSRV NXMI
   017152                                                                              NXMI::
11
12 017152  012737  177777  002222          MOV #-1,NXMAD
13
14 017160                              ENDSRV
   017160                                                                              L10033:
   017160  000002                                                                          RTI
```

```
     1                                    ;UDASRV
     2                                    ;
     3                                    ;UDA INTERRUPT SERVICE ROUTINE. MARKS UDA CONTROLLER TABLE THAT AN
     4                                    ;INTERRUPT HAS BEEN RECEIVED.
     5                                    ;
     6                                    ;THIS ROUTINE IS CALLED BY A [JSR R0,UDASRV] INSTRUCTION FROM WITHIN
     7                                    ;THE CONTROLLER TABLE. THE PC STORED IN R0 IS THE ADDRESS OF THE C.FLG
     8                                    ;WORD IN THE CONTROLLER TABLE. THE STACK CONTAINS THE SAVED CONTENTS
     9                                    ;OF R0 FOLLOWED BY THE INTERRUPTED PC AND PS.
    10                                    ;
    11                                    ;INPUTS:
    12                                    ;       R0 - ADDRESS OF C.FLG WORD IN CONTROLLER TABLE
    13                                    ;       STACK - SAVED CONTENTS OF R0
    14                                    ;OUTPUTS:
    15                                    ;       CT.CMD CLEARED AND CT.MSG SET IN C.FLG WORD OF CONTROLLER TABLE
    16                                    ;       R0 - RESTORED FROM STACK
    17
    18 017162                            BGNSRV UDASRV
       017162                                                                              UDASRV::
    19 017162  052710  000010                BIS #CT.MSG,(R0)         ;SET CT.MSG
    20 017166                                POP R0                   ;RESTORE R0
       017166  012600                                                                          MOV (SP)+,R0
    21 017170                            ENDSRV
       017170                                                                              L10034:
       017170  000002                                                                          RTI
```

```
 1                                      ;SETTO
 2                                      ;
 3                                      ;SET TIMEOUT COUNTER TO SOME NUMBER OF SECONDS FROM CURRENT TIME.
 4                                      ;
 5                                      ;INPUTS:
 6                                      ;       R0 - NUMBER OF SECONDS FOR TIMEOUT
 7                                      ;       R1 - ADDRESS WHERE TWO WORD TIME TO BE PUT
 8                                      ;OUTPUTS:
 9                                      ;       R0 - CONTENTS DESTROYED
10                                      ;       R1 - INCREMENTED BY 2
11
12                                      ;COMPUTE CLOCK TICKS TIL TIMEOUT
13
14 017172                      SETTO:  PUSH <R2,R3>                      MO  R2,-(SP)
   017172  010246                                                       MOV R3,-(SP)
   017174  010346
15 017176  005002                      CLR R2                   ;CLEAR PRODUCT
16 017200  013703  003240              MOV KW.HZ,R3             ;GET MULTIPLICAND
17 017204  006200              SET00:  ASR R0                   ;SHIFT MULTIPLIER TO RIGHT
18 017206  103001                      BCC SET01                ;IF A ONE BIT SHIFTED OUT
19 017210  060302                      ADD R3,R2                ;  ADD MULTIPLICAND TO PRODUCT
20 017212  006303              SET01:  ASL R3                   ;DOUBLE THE MULTIPLICAND
21 017214  005700                      TST R0
22 017216  001372                      BNE SET00                ;CONTINUE UNTIL MULTIPLIER IS ZERO
23
24                                      ;GET CURRENT TIME
25
26 017220  013700  003242      SET02:  MOV KW.EL,R0             ;GET TIME
27 017224  013703  003244              MOV KW.EL+2,R3
28 017230  020037  003242              CMP R0,KW.EL             ;IF CHANGED DURING RETRIEVAL
29 017234  001371                      BNE SET02                ;  GET IT AGAIN
30
31                                      ;ADD TIME TIL TIMEOUT
32
33 017236  060200                      ADD R2,R0                ;ADD
34 017240  005503                      ADC R3
35
36                                      ;PUT RESULT IN STORAGE
37
38 017242  010021                      MOV R0,(R1)+
39 017244  010311                      MOV R3,(R1)
40
41 017246                      POP <R3,R2>                      MOV (SP)+,R3
   017246  012603                                               MOV (SP)+,R2
   017250  012602
42 017252  000207                      RETURN
```

```
   1                                      ;UDAINT
   2                                      ;
   3                                      ;FUNCTIONAL DESCRIPTION:
   4                                      ;       SUBROUTINE TO INITIALIZE A UDA AND BRING IT ON-LINE.
   5                                      ;       ALL STEPS ARE CHECKED. AN ERROR MESSAGE IS REPORTED IF ANY ERROR
   6                                      ;       DETECTED.
   7                                      ;
   8                                      ;INPUTS:
   9                                      ;       R5 - ADDRESS OF CONTROLLER TABLE.
  10                                      ;IMPLICIT INPUTS:
  11                                      ;       C.RING(R5) - ADDRESS GIVEN TO UDA AS START OF RING BUFFER.
  12                                      ;       LENGTH OF RING STRUCTURE IS ONE ENTRY EACH.
  13                                      ;OUTPUTS:
  14                                      ;       CONDITION Z - SET IF ANY ERROR REPORTED. CLEAR IF NO ERROR.
  15                                      ;       R4 - ADDRESS OF UDAIP REGISTER IN UDA
  16                                      ;       R5 - UNCHANGED.
  17
  18                                      ;FILL HOST COMMUNICATION AREA WITH ALL ONES
  19
  20 017254 016502 000016         UDAINT: MOV C.RING(R5),R2                    ;GET FIRST ADDRESS OF RING BUFFER
  21 017260 012703 000006                 MOV #<HC.RSZ*2+HC.ISZ>/2,R3                  ;GET SIZE OF RING BUFFER
  22 017264 012722 177777         UDAI1L: MOV #-1,(R2)+                     ;WRITE ONES TO BUFFER
  23 017270 005303                        DEC R3                           ;COUNT THE WORDS IN BUFFER
  24 017272 003374                        BGT UDAI1L                       ;LOOP UNTIL ENTIRE BUFFER WRITTEN
  25
  26                                      ;DO THE INITIALIZATION
  27
  28 017274 004737 017470                 CALL UDAIST                      ;DO FIRST THREE STEPS
  29 017300 103471                        BCS UDAIEX                       ;GET OUT IF UDA MICROCODE REPORTED FAILURE
  30 017302 012364 000002                 MOV (R3)+,2(R4)                  ;WRITE NEXT WORD TO UDASA REGISTER
  31 017306 012703 000310                 MOV #200.,R3                     ;GET TRY COUNTER
  32 017312 016402 000002         UDAI1A: MOV 2(R4),R2                     ;LOOK AT UDASA
  33 017316 001410                        BEQ UDAI1C
  34 017320 100005                        BPL UDAI1B
  35 017322                                ERRDF 24,,ERR024
     017322 104455                                                                     TRAP     C$ERDF
     017324 000030                                                                     .WORD    24
     017326 000000                                                                     .WORD    0
     017330 011352                                                                     .WORD    ERR024
  36 017332 000454                        BR UDAIEX
  37 017334 005303             UDAI1B: DEC R3
  38 017336 001365                        BNE UDAI1A
  39 017340 010264 000002         UDAI1C: MOV R2,2(R4)                     ;WRITE 0 TO UDASA (PURGE)
  40 017344 011402                        MOV (R4),R2                      ;READ FROM UDAIP (POLL)
  41 017346 004737 020014                 CALL UDARSP                      ;WAIT FOR STEP OR ERROR BIT
  42 017352 103444                        BCS UDAIEX                       ;GET OUT IF UDA MICROCODE REPORTED FAILURE
```

```
 1                                      ;CHECK HOST COMMUNICATION AREA FOR ALL ZEROS
 2
 3 017354 016502 000016       UDAI2:   MOV C.RING(R5),R2              ;GET FIRST ADDRESS OF RING BUFFER
 4 017360 012703 000006                MOV #<HC.RSZ*2+HC.ISZ>/2,R3             ;GET SIZE OF RING BUFFER
 5 017364 005722              UDAI2L:  TST (R2)+             ;CHECK WORD IN BUFFER
 6 017366 001003                       BNE UDAI2E            ;GO TO ERROR REPORTER IF NOT ZERO
 7 017370 005303                       DEC R3               ;COUNT THE WORDS IN BUFFER
 8 017372 003374                       BGT UDAI2L           ;LOOP UNTIL ALL WORDS CHECKED
 9 017374 000405                       BR UDAI3
10
11 017376                     UDAI2E:  ERRDF 23,,ERR023     ;REPORT BUFFER NOT CLEARED
   017376 104455                                                      TRAP    C$ERDF
   017400 000027                                                      .WORD   23
   017402 000000                                                      .WORD   0
   017404 011266                                                      .WORD   ERR023
12 017406 000426                       BR UDAIEX
13
14                                      ;SEND GO BIT TO UDASA REGISTER TO END INITIALIZATION
15
16 017410                     UDAI3:
17 017410 016500 000006                MOV C.BST(R5),R0              ;GET BURST VALUE
18 017414 006300                       ASL R0                        ;SHIFT TO POSITION
19 017416 006300                       ASL R0
20 017420 052700 000001                BIS #SA.GO,R0                 ;SET THE GO BIT
21 017424 010064 000002                MOV R0,2(R4)                  ;SEND TO UDA
22 017430 016501 000016                MOV C.RING(R5),R1
23 017434 010161 000004                MOV R1,HC.MSG(R1)
24 017440 062761 000020 000004         ADD #HC.MPK,HC.MSG(R1)
25 017446 010161 000010                MOV R1,HC.CMD(R1)
26 017452 062761 000104 000010         ADD #HC.CPK,HC.CMD(R1)
27 017460 000244                       CLZ                           ;CLEAR Z AS NO ERROR INDICATION
28 017462 000207                       RETURN
29
30                                      ;ERROR RETURN
31
32 017464 000264              UDAIEX:  SEZ                           ;SET Z TO INDICATE ERROR OCCURRED
33 017466 000207                       RETURN
```

```
     1                              ;UDAIST
     2                              ;
     3                              ;START THE INITIALIZATION PROCESS ON THE SELECTED UDA.
     4                              ;STOP BEFORE WRITING THE THIRD WORD SO UDA DOES NOT
     5                              ;ATTEMPT ANY UNIBUS TRANSFERS.
     6                              ;
     7                              ;INPUTS:
     8                              ;        R5 - ADDRESS OF CONTROLLER TABLE
     9                              ;
    10                              ;LOAD TABLE OF DATA TO SEND TO UDASA REGISTER
    11
    12 017470                      UDAIST: BREAK
       017470  104422                                                           TRAP    C$BRK
    13 017472                              PUSH R1
       017472  010146                                                           MOV R1,-(SP)
    14 017474  016504  000004              MOV C.VEC(R5),R4
    15 017500                              AND CT.VEC,R4
       017500  042704  177000                                                   BIC #^C<CT.VEC>,R4
    16 017504  006204                      ASR R4
    17 017506  006204                      ASR R4
    18 017510  052704  100000              BIS #SA.STP,R4          ;SET STEP BIT IN DATA WORD
    19 017514  010437  017706              MOV R4,UDAID1           ;LOAD INTERRUPT VECTOR
    20 017520  016537  000016  017712      MOV C.RING(R5),UDAID2   ;LOAD MEMORY ADDRESS
    21 017526  062737  000004  017712      ADD #HC.MSG,UDAID2      ;  OF FIRST RESPONSE RING
    22
    23                              ;START THE INITIALIZATION BY WRITING TO UDAIP REGISTER
    24
    25 017534  016504  000000              MOV C.UADR(R5),R4       ;GET ADDRESS OF UDAIP REGISTER
    26 017540  005037  002222              CLR NXMAD               ;CLEAR MEMORY ERROR FLAG
    27 017544                              SETVEC #4,#NXMI,#PRIO7   ;SET UP VECTOR 4
       017544  012746  000340                                                   MOV     #PRIO7,-(SP)
       017550  012746  017152                                                   MOV     #NXMI,-(SP)
       017554  012746  000004                                                   MOV     #4,-(SP)
       017560  012746  000003                                                   MOV     #3,-(SP)
       017564  104437                                                           TRAP    C$SVEC
       017566  062706  000010                                                   ADD     #10,SP
    28 017572  005764  000002              TST 2(R4)               ;ACCESS UDASA REGISTER
    29 017576  005014                      CLR (R4)                ;WRITE TO UDAIP
    30 017600                              CLRVEC #4               ;GIVE UP THE VECTOR
       017600  012700  000004                                                   MOV     #4,R0
       017604  104436                                                           TRAP    C$CVEC
    31 017606  005737  002222              TST NXMAD               ;SEE IF A MEMORY ERROR OCCURRED
    32 017612  001406                      BEQ UDAISG
    33 017614                              ERRDF 20,,ERRO20
       017614  104455                                                           TRAP    C$ERDF
       017616  000024                                                           .WORD   20
       017620  000000                                                           .WORD   0
       017622  011154                                                           .WORD   ERRO20
    34 017624  000261                      SEC
    35 017626  000424                      BR UDAISE
```

```
 1                                              ;SET UP LOOP PARAMETERS TO EXECUTE THE FOUR STEPS OF INITIALIZATION
 2
 3 017630  012737  004000  020152  UDAISG:  MOV #SA.S1,UDARSD        ;STORE RESPONSE MASK
 4 017636  012703  017704                    MOV #UDAIDT,R3          ;AND INDEX TO TABLE
 5
 6                                              ;WAIT FOR AND CHECK RESPONSE DATA
 7
 8 017642  004737  020014          UDAISL:  CALL UDARSP             ;WAIT FOR STEP OR ERROR BITS
 9 017646  103414                            BCS UDAISE              ;EXIT IF ERROR
10 017650  004733                            CALL @(R3)+             ;CALL RESPONSE CHECKER FOR STEP
11 017652  103412                            BCS UDAISE              ;GET OUT IF ERROR
12 017654  006337  020152                    ASL UDARSD              ;SHIFT TO NEXT STEP BIT
13 017660  032737  040000  020152            BIT #SA.S4,UDARSD       ;CHECK IF NOW AT STEP 4
14 017666  001003                            BNE UDAISX              ;GET OUT IF SO
15 017670  012364  000002                    MOV (R3)+,2(R4)         ;WRITE DATA TO UDASA REGISTER
16 017674  000762                            BR UDAISL               ;STAY IN LOOP
17
18 017676  000241          UDAISX:  CLC                             ;CLEAR CARRY FOR NO ERROR INDICATION
19 017700                  UDAISE:  POP R1
   017700  012601                            MOV (SP)+,R1
20 017702  000207                            RETURN
```

```
    1                                         ;DATA TO BE SENT AND RECEIVED BY UDA INITIALIZATION
    2
    3 017704  017722                UDAIDT: .WORD UDAIR1                ;FIRST WORD RESPONSE CHECK ROUTINE
    4 017706  000000                UDAID1: .WORD 0                    ;FIRST WORD TO SEND TO UDASA
    5 017710  017730                        .WORD UDAIR2                ;SECOND WORD RESPONSE CHECK ROUTINE
    6 017712  000000                UDAID2: .WORD 0                    ;SECOND WORD TO SEND TO UDASA
    7 017714  017750                        .WORD UDAIR3                ;THIRD WORD RESPONSE CHECK ROUTINE
    8 017716  100000                UDAID3: .WORD SA.TST               ;THIRD WORD TO SEND TO UDASA
    9 017720  017766                        .WORD UDAIR4                ;FOURTH WORD RESPONSE CHECK ROUTINE
   10
   11                                         ;RESPONSE CHECK FOR FIRST WORD FROM UDASA
   12                                         ;CHECK FOR PROPER CONTROLLER TYPE
   13
   14 017722  012701  004400       UDAIR1: MOV #SA.S1+SA.DI,R1         ;SET STEP ONE BIT
   15 017726  000422                        BR UDAIRC                  ;NOW COMPARE
   16
   17                                         ;RESPONSE CHECK FOR SECOND WORD FROM UDASA
   18                                         ;CHECK FOR ECHO OF INTI AND VECTOR
   19
   20 017730  013701  017706       UDAIR2: MOV UDAID1,R1               ;GET WORD SENT TO UDASA
   21 017734  000301                        SWAB R1                    ;GET HIGH 8 BITS
   22 017736  042701  177400               BIC #177400,R1
   23 017742  052701  010000               BIS #SA.S2,R1              ;SET STEP 2 BIT
   24 017746  000412                        BR UDAIRC                  ;NOW COMPARE
   25
   26                                         ;RESPONSE CHECK FOR THIRD W 'D FROM UDASA
   27                                         ;CHECK FOR ECHO OF MESSAGE AND COMMAND RING LENGTHS
   28
   29 017750  013701  017706       UDAIR3: MOV UDAID1,R1               ;GET WORD SENT TO UDASA
   30 017754  042701  177400               BIC #177400,R1             ;JUST LOW 8 BITS
   31 017760  052701  020000               BIS #SA.S3,R1              ;SET STEP 3 BIT
   32 017764  000403                        BR UDAIRC                  ;NOW COMPARE
   33
   34                                         ;RESPONSE CHECK FOR FOURTH WORD FROM UDASA
   35                                         ;CHECK FOR ECHO OF PURGE AND LFAIL BITS
   36
   37 017766  010201                UDAIR4: MOV R2,R1                  ;GET RESPONSE FROM UDA
   38 017770  042701  137760               BIC #^C<SA.S4+SA.MCV>,R1    ;KEEP MICROCODE VERSION AND STEP 4
   39
   40                                         ;COMPARE EXPECTED DATA IN R1 WITH ACTUAL DATA IN R2
   41
   42 017774  020102                UDAIRC: CMP R1,R2                  ;COMPARE THE DATA
   43 017776  001405                        BEQ UDAIRX                 ;EXIT IF COMPARED CORRECTLY
   44 020000                                ERRDF 25,,ERR025           ;REPORT ERROR
      020000  104455                                                               TRAP    C$ERDF
      020002  000031                                                               .WORD   25
      020004  000000                                                               .WORD   0
      020006  011366                                                               .WORD   ERR025
   45 020010  000261                        SEC
   46 020012  000207                UDAIRX: RETURN
```

```
        1                                      ;UDARSP
        2                                      ;
        3                                      ;WAIT FOR UDA TO RESPOND WITH DATA IN UDASA REGISTER.
        4                                      ;EITHER STEP BIT FROM MASK IN LOCATION UDARSD OR ERROR BIT
        5                                      ;WILL CAUSE A TERMINATION.
        6                                      ;AN ERROR MESSAGE WILL BE PRINTED IF THE UDA DOES NOT RESPOND
        7                                      ;IN 10 SECONDS OR IF ERROR SETS.
        8                                      ;
        9                                      ;INPUTS:
       10                                      ;       UDASRD - MASK OF STEP BIT TO LOOK FOR
       11                                      ;       R5 - ADDRESS OF CONTROLLER TABLE
       12                                      ;       R4 - ADDRESS OF UDAIP REGISTER
       13                                      ;OUTPUTS:
       14                                      ;       ERROR MESSAGE IF TIME OUT ON RESPONSE OR ERROR BIT SETS
       15                                      ;       R2 - DATA FROM UDASA REGISTER
       16                                      ;       CARRY SET IF ERROR BIT SETS OR TIME OUT
       17
       18 020014                       UDARSP: PUSH R1
          020014 010146                                                        MOV R1,-(SP)
       19 020016 052737 100000 020152          BIS #SA.ERR,UDARSD              ;SET ERROR BIT IN MASK WORD
       20 020024 012700 000012                 MOV #10.,R0                     ;SET UP FOR 10 SECOND TIMEOUT
       21 020030 010501                         MOV R5,R1                      ;POINT TO COUNTER IN CONTROLLER TABLE
       22 020032 062701 000040                  ADD #C.TO,R1
       23 020036 004737 017172                  CALL SETTO
       24 020042                                POP R1
          020042 012601                                                       MOV (SP)+,R1
       25 020044 033764 020152 000002   UDARS1: BIT UDARSD,2(R4)              ;LOOK AT ERROR AND STEP BIT
       26 020052 001024                         BNE UDARS2                     ;BRANCH IF EITHER SET
       27 020054                                BREAK
          020054 104422                                                        TRAP    C$BRK
       28 020056 005737 003232                  TST KW.CSR                     ;SEE IF CLOCK ON SYSTEM
       29 020062 001770                         BEQ UDARS1
       30 020064 023765 003244 000042           CMP KW.EL+2,C.TOH(R5)          ;CHECK IF TIME OUT OCCURRED
       31 020072 101005                         BHI 1$
       32 020074 001363                         BNE UDARS1
       33 020076 023765 003242 000040           CMP KW.EL,C.TO(R5)
       34 020104 103757                         BLO UDARS1
       35 020106 016402 000002         1$:      MOV 2(R4),R2                   ;GET REGISTER CONTENTS
       36 020112                                ERRDF 22,,ERR022               ;REPORT TIME OUT ERROR
          020112 104455                                                        TRAP    C$ERDF
          020114 000026                                                        .WORD   22
          020116 000000                                                        .WORD   0
          020120 011220                                                        .WORD   ERR022
       37 020122 000407                         BR UDARSE
```

```
 1                                   ;CHECK IF ERROR BIT SET
 2
 3 020124  016402  000002   UDARS2: MOV 2(R4),R2           ;GET REGISTER CONTENTS
 4 020130  100006            BPL UDARSX             ;EXIT IF ERROR NOT SET
 5 020132                    ERRDF 21,,ERR021       ;REPORT ERROR INFO
   020132  104455                                                    TRAP     C$ERDF
   020134  000025                                                    .WORD    21
   020136  000000                                                    .WORD    0
   020140  011166                                                    .WORD    ERR021
 6 020142  000261   UDARSE: SEC
 7 020144  000207            RETURN
 8
 9                                   ;NORMAL EXIT
10
11 020146  000241   UDARSX: CLC                    ;CLEAR CARRY AS NO ERROR INDICATION
12 020150  000207            RETURN
13
14                                   ;LOCATION FOR STEP BIT MASK
15
16 020152  000000   UDARSD: .WORD 0                ;LOAD BY CALLING ROUTINE
```

```
 1              ;CLOG
 2              ;
 3              ;COMPUTE LOGARITHMIC VALUE OF NUMBER TO BASE 2.
 4              ;
 5              ;INPUTS:
 6              ;       R0 - LOGARITHM TO BE CONVERTED
 7              ;OUTPUTS:
 8              ;       R1 - VALUE OF 2 RAISED TO POWER OF INPUT NUMBER
 9              ;
10              ;CLOG:   PUSH R0
11              ;        CLR R1                      ;SET UP ZERO START VALUE
12              ;        SEC                         ;WITH CARRY READY TO SHIFT IN
13              ;CLOGLP:        ROL R1                       ;SHIFT TO LEFT
14              ;        DEC R0                      ; UNTIL R0
15              ;        BPL CLOGLP                  ; GOES NEGATIVE
16              ;        POP R0
17              ;        RETURN
```

```
     1                                      ;KW11I
     2                                      ;
     3                                      ;CLOCK INTERRUPT SERVICE ROUTINE
     4
     5  020154                      BGNSRV KW11I
        020154                                                              KW11I::
     6  020154  062737  000001  003242      ADD  ~1,KW.EL        ;COUNT THE INTERRUPT
     7  020162  005537  003244              ADC KW.EL+2
     8  020166  012777  000105  163036      MOV #KWOUT.,@KW.CSR  ;RESTART THE CLOCK
     9  020174                      ENDSRV
        020174                                                              L10035:
        020174  000002                                                            RTI
```

```
   1                                        ;RNTIME
   2                                        ;
   3                                        ;PRINT RUNTIME
   4                                        ;
   5                                        ;INPUTS:
   6                                        ;    KW.EL - CONTAINS ELAPSED TIME
   7                                        ;    KW.HZ - HERTZ OF CLOCK
   8                                        ;OUTPUTS:
   9                                        ;    IF CLOCK ON SYSTEM:
  10                                        ;      " RUNTIME HH:MM:SS " PRINTED
  11                                        ;    IF NO CLOCK: ONE SPACE IS PRINTED
  12
  13 020176  005737  003232       RNTIME:  TST KW.CSR              ;CHECK IF A CLOCK PRESENT
  14 020202  001465                        BEQ RNTIMX              ;BRANCH IF NOT
  15 020204                                PUSH <R0,R3,R4,R5>
     020204  010046                                                       MOV R0,-(SP)
     020206  010346                                                       MOV R3,-(SP)
     020210  010446                                                       MOV R4,-(SP)
     020212  010546                                                       MOV R5,-(SP)
  16 020214  013703  003242                MOV KW.EL,R3            ;GET ELAPSED TIME
  17 020220  013704  003244                MOV KW.EL+2,R4
  18 020224  013700  003240                MOV KW.HZ,R0           ;GET SPEED OF CLOCK
  19 020230  004737  016334                CALL DIVIDE            ;COMPUTE SECONDS OF ELAPSED TIME
  20 020234  012700  000074                MOV #60.,R0            ;NOW DIVIDE BY 60
  21 020240  004737  016334                CALL DIVIDE            ; TO COMPUTE MINUTES
  22 020244                                PUSH R5                ;SAVE REMAINDER AS SECONDS
     020244  010546                                                       MOV R5,-(SP)
  23 020246  004737  016334                CALL DIVIDE            ;DIVIDE BY 60 AGAIN
  24 020252                                PNT RNTIM,R3           ;PRINT HOURS
     020252  010346                                                       MOV R3,-(SP)
     020254  004137  016266                                                JSR R1,LPNT
     020260  003672                                                        .WORD RNTIM
     020262  000002                                                        .WORD PNT.CT
  25 020264  020527  000011                CMP R5,#9.             ;IF MINUTES 9 OR LESS
  26 020270  003004                        BGT 1$
  27 020272                                PRINT #'0              ;PRINT A LEADING ZERO
     020272  112700  000060                                                MOVB #'0,R0
     020276  004737  016056                                                CALL CPNT
  28 020302                         1$:    PNT RNTIM1,R5          ;NOW PRINT MINUTES
     020302  010546                                                       MOV R5,-(SP)
     020304  004137  016266                                                JSR R1,LPNT
     020310  003715                                                        .WORD RNTIM1
     020312  000002                                                        .WORD PNT.CT
  29 020314                                POP R5                 ;GET SECONDS
     020314  012605                                                       MOV (SP)+,R5
  30 020316  020527  000011                CMP R5,#9.             ;IF 9 OR LESS
  31 020322  003004                        BGT 2$
  32 020324                                PRINT #'0              ;PRINT A LEADING ZERO
     020324  112700  000060                                                MOVB #'0,R0
     020330  004737  016056                                                CALL CPNT
  33 020334                         2$:    PNT RNTIM2,R5          ;NOW PRINT SECONDS
     020334  010546                                                       MOV R5,-(SP)
     020336  004137  016266                                                JSR R1,LPNT
     020342  003723                                                        .WORD RNTIM2
     020344  000002                                                        .WORD PNT.CT
  34 020346                                POP <R5,R4,R3,R0>      ;HOURS IN R3
     020346  012605                                                       MOV (SP)+,R5
```

```
         020350  012604                                                              MOV (SP)+,R4
         020352  012603                                                              MOV (SP)+,R3
         020354  012600                                                              MOV (SP)+,R0
      35 020356                      RNTIMX: PRINT <#' >              ;PRINT A SPACE
         020356  112700  000040                                                      MOVB #' ,R0
         020362  004737  016056                                                      CALL CPNT
      36 020366  000207                      RETURN
      37
      38 020370                              ENDMOD
```

```
  1                                    .SBTTL   PROTECTION TABLE
  2
  3 020370                                      BGNMOD
  4
  5                                    ;++
  6                                    ; THIS TABLE IS USED BY THE RUNTIME SERVICES
  7                                    ; TO PROTECT THE LOAD MEDIA.
  8                                    ;--
  9
 10 020370                                      BGNPROT
    020370                                                              L$PROT::
 11
 12 020370  177777                              -1                      ;OFFSET INTO P-TABLE FOR CSR ADDRESS
 13 020372  177777                              -1                      ;OFFSET INTO P-TABLE FOR MASSBUS ADDRESS
 14 020374  177777                              -1                      ;OFFSET INTO P-TABLE FOR DRIVE NUMBER
 15
 16 020376                                      ENDPROT
 17
```

```
 1                                      .SBTTL   INITIALIZE SECTION
 2
 3                                  ;++
 4                                  ;  THE INITIALIZE SECTION CONTAINS THE CODING THAT IS PERFORMED
 5                                  ;  AT THE BEGINNING OF EACH PASS.
 6                                  ;--
 7
 8 020376                               BGNINIT
   020376                                                               LSINIT::
 9
10 020376                               READEF  #EF.START           ;CHECK IF STARTED BY OPERATOR
   020376   012700   000040                                               MOV     #EF.START,R0
   020402   104447                                                        TRAP    C$REFG
11 020404                               BCOMPLETE INIT0          ;   IF NOT,
   020404   103415                                                        BCS     INIT0
12 020406                               READEF  #EF.RESTART
   020406   012700   000037                                               MOV     #EF.RESTART,R0
   020412   104447                                                        TRAP    C$REFG
13 020414                               BCOMPLETE INIT1
   020414   103415                                                        BCS     INIT1
14 020416                               READEF  #EF.CONTINUE
   020416   012700   000036                                               MOV     #EF.CONTINUE,R0
   020422   104447                                                        TRAP    C$REFG
15 020424                               BCOMPLETE INIT1
   020424   103411                                                        BCS     INIT1
16 020426                               READEF  #EF.PWR
   020426   012700   000034                                               MOV     #EF.PWR,R0
   020432   104447                                                        TRAP    C$REFG
17 020434                               BCOMPLETE INIT1
   020434   103405                                                        BCS     INIT1
18 020436                       INITQT: DOCLN                        ;   ABORT PROGRAM
   020436   104444                                                        TRAP    C$DCLN
19 020440                       INIT0:
21 020440   004737   012500           CALL    CLOSEF  ; MAKE SURE  FILE IS CLOSED
22 020444   005037   002214           CLR     FNUM    ; NO FILE READ
24 020450   012700   000003   INIT1:  MOV #SO.FMT,R0   ;BUILD MODE WORD FROM SOFTWARE QUESTIONS
25 020454   030037   002144           BIT R0,SFPTBL    ;SEE IF REFORMAT
26 020460   001011                     BNE INIT2       ;   BRANCH IF SO
27 020462   012700   000004           MOV #SO.CNS,R0   ;SEE IF RECONSTRUCT
28 020466   030037   002144           BIT R0,SFPTBL
29 020472   001004                     BNE INIT2       ;   BRANCH IF SO
30 020474   006300                     ASL R0  ;SEE IF RESTORE
31 020476                              ASSUME SO.STR EQ SO.CNS*2
32 020476   030037   002144           BIT R0,SFPTBL
33 020502   001755                     BEQ INITQT       ;IF NOT, ABORT PROGRAM
34 020504   010037   003230   INIT2:  MOV R0,MODE      ;SAVE MODE FLAGS
35 020510   005737   003344           TST DATEQ        ;SEE IF ALREADY ASKED FOR DATE
36 020514   001002                     BNE INIT3
37 020516   004737   021430           CALL DATE        ;IF NOT, GET IT NOW
38 020522   004737   012064   INIT3:  CALL    RESET               ;RESET ALL UNITS
39 020526                              MEMORY FFREE                ;RESET START OF FREE MEMORY
   020526   104431                                                        TRAP    C$MEM
   020530   010037   002146                                               MOV     R0,FFREE
40 020534   017737   161406   002150  MOV @FFREE,FSIZE            ;RESET SIZE OF FREE MEMORY
41
42                                  ;INITIALIZE CLOCK
43
```

```
44          000105                          KWOUT.=105                  ;DATA TO SEND TO KW11 TO START CLOCK
45 020542   005037   003232                 CLR KW.CSR                  ;MARK CLOCK AS NOT ON SYSTEM
46 020546   005037   003242                 CLR KW.EL                   ;CLEAR ELAPSED TIME
47 020552   005037   003244                 CLR KW.EL+2
48 020556                                    CLOCK L,R0                  ;SEE IF AN L CLOCK PRESENT
   020556   012700   000114                                                             MOV     #'L,R0
   020562   104462                                                                      TRAP    CSCLCK
49 020564                                    BCOMPLETE KYES
   020564   103413                                                                      BCS     KYES
50 020566                                    CLOCK P,R0                  ;SEE IF A P CLOCK PRESENT
   020566   012700   000120                                                             MOV     #'P,R0
   020572   104462                                                                      TRAP    CSCLCK
51 020574                                    BCOMPLETE KYES
   020574   103407                                                                      BCS     KYES
52 020576   005037   003232                 CLR KW.CSR                  ;IF NEITHER, CLEAR CSR STORAGE WORD
53 020602                                    PNTF NOCLOCK
   020602   004137   016230                                                             JSR     R1,LPNTF
   020606   004061                                                                      .WORD   NOCLOCK
   020610   000000                                                                      .WORD   PNT.CT
54 020612   000426                           BR KNO
55 020614   012037   003232      KYES:       MOV (R0)+,KW.CSR            ;STORE DATA RETURNED
56 020620   012037   003234                  MOV (R0)+,KW.BRL
57 020624   012037   003236                  MOV (R0)+,KW.VEC
58 020630   012037   003240                  MOV (R0)+,KW.HZ
59 020634                                    SETVEC KW.VEC,#KW11I,KW.BRL ;SET THE VECTOR
   020634   013746   003234                                                             MOV     KW.BRL,-(SP)
   020640   012746   020154                                                             MOV     #KW11I,-(SP)
   020644   013746   003236                                                             MOV     KW.VEC,-(SP)
   020650   012746   000003                                                             MOV     #3,-(SP)
   020654   104437                                                                      TRAP    CSSVEC
   020656   062706   000010                                                             ADD     #10,SP
60 020662   012777   000105   162342         MOV #KWOUT.,@KW.CSR        ;START THE CLOCK
61 020670                       KNO:
```

```
 1                                          ;INITIALIZE CONTROLLER TABLE STORAGE WITH A WORD OF ZEROS
 2
 3 020670  013737  002146  002156            MOV FFREE,CTABS              ;STORE START OF CONTROLLER TABLES
 4 020676  005077  161254                     CLR @CTABS                  ;ZEROS MARKS END CONTROLLER TABLES
 5 020702  005037  002160                     CLR CTRLRS                  ;CLEAR CONTROLLER COUNT
 6 020706  012701  003474                     MOV     #IPADRS,R1          ; R1 -> IP ADDRESS
 7 020712  012702  000010                     MOV     #8.,R2              ; R2 IS A COUNTER
 8 020716  005021                     1$:     CLR     (R1)+               ; CLEAR ENTRY
 9 020720  005302                             DEC     R2                  ; DONE?
10 020722  001375                             BNE     1$                  ; IF NOT, BRANCH
11
12                                          ;GET A P-TABLE FROM DRS
13
14 020724  005002                             CLR R2                      ;LOGICAL UNIT NUMBER IN R2
15 020726                           INIT4:    GPHARD R2,R0                ;GET POINTER TO A P-TABLE
   020726  010200                                                                         MOV     R2,R0
   020730  104442                                                                         TRAP    C$GPHRD
16 020732                                     BNCOMPLETE NXTTAB           ;IGNORE IF NO TABLE RETURNED
   020732  103110                                                                         BCC     NXTTAB
17
18                                          ;SEE IF A CONTROLLER TABLE ALREADY EXISTS FOR CONTROLLER IN P-TABLE
19
20 020734  013703  002156                     MOV CTABS,R3                ;GET ADDRESS OF CONTROLLER TABLES
21 020740  005713                   INIT5:    TST (R3)                    ;CHECK IF ANY MORE TABLES
22 020742  001416                             BEQ NEWTAB                  ;BUILD NEW TABLE IF FOUND ZERO WORD
23 020744  021013                             CMP (R0),(R3)               ;CHECK IF SAME UNIBUS ADDRESS
24 020746                                         ASSUME C.UADR EQ 0
25 020746                                         ASSUME HO.UBA EQ 0
26 020746  001463                             BEQ SAMTAB                  ;CHECK TABLE IF ALREADY EXISTS
27 020750  016301  000004                     MOV C.VEC(R3),R1            ;GET VECTOR FROM EXISTING CONTROLLER TABLE
28 020754  042701  177000                     BIC #^C<CT.VEC>,R1
29 020760  026001  000002                     CMP HO.VEC(R0),R1           ;SEE IF DIFFERENT VECTOR
30 020764  001002                             BNE 1$
31 020766  000137  021414                     JMP SAMVEC                  ;ERROR, CAN'T HAVE TWO UDA'S WITH SAME VECTOR
32 020772  062703  000054           1$:       ADD #C.SIZE,R3              ;MOVE TO NEXT TABLE
33 020776  000760                             BR INIT5
```

```
 1                                          ;BUILD A CONTROLLER TABLE
 2
 3 021000  012703  000010    NEWTAB: MOV    #8.,R3           ;R3 IS A COUNTER
 4 021004  012704  003474            MOV    #IPADRS,R4       ;R4 -> IP ADDRESSES
 5 021010  005714              1$:   TST    (R4)             ; FOUND AN OPEN ENTRY?
 6 021012  001404                    BEQ    2$               ; IF SO, GO FILL ENTRY
 7 021014  005724                    TST    (R4)+            ; NEXT ENTRY
 8 021016  005303                    DEC    R3               ; SEARCH THROUGH ENTIRE TABLE?
 9 021020  001373                    BNE    1$               ; IF NOT, BRANCH
10 021022  000401                    BR     3$               ; ELSE, TABLE FULL
11 021024  011014              2$:   MOV    (R0),(R4)        ; STORE ENTRY INTO TABLE
12 021026  012701  000026      3$:   MOV #C.SIZE/2,R1        ;GET WORDS IN CONTROLLER TABLE
13 021032  004737  011744            CALL ALOCM             ;ALLOCATE SPACE FOR IT
14 021036  011021                    MOV (R0),(R1)+          ;STORE UNIBUS ADDRESS
15 021040  010221                    MOV R2,(R1)+            ;UNIT NUMBER
16 021042  016004  000004            MOV HO.BRL(R0),R4       ;GET BR LEVEL
17 021046  000304                    SWAB R4                 ;SWAP TO HIGH BYTE
18 021050  006104                    ROL R4                  ;SHIFT ONE MORE TO LEFT
19 021052  056004  000002            BIS HO.VEC(R0),R4       ;ADD VECTOR ADDRESS
20 021056  010421                    MOV R4,(R1)+            ;  TO TABLE
21 021060  016021  000006            MOV HO.BST(R0),(R1)+
22 021064  012721  004037            MOV #4037,(R1)+         ;PUT [JSR R0,UDASRV]
23 021070  012721  017162            MOV #UDASRV,(R1)+       ;  INTO TABLE
24 021074  012703  000020            MOV #16.,R3             ;CLEAR POINTERS TO DRIVE TABLES,
25                                                           ; TIMEOUT COUNTER, FLAGS, REF. NUMBER
26 021100  005021              INIT7: CLR (R1)+
27 021102  005303                    DEC R3
28 021104  001375                    BNE INIT7               ;LOOP TIL ALL CLEARED
29 021106  005237  002160            INC CTRLRS              ;COUNT THE CONTROLLER
30 021112  005011                    CLR (R1)                ;CLEAR TABLE END MARKER
31 021114  000417                    BR NXTTAB               ;NOW GO TO NEXT P-TABLE
```

```
 1                                                ;SHOULD BE SAME CONTROLLER, CHECK THAT OTHER PARAMETERS MATCH
 2
 3 021116  016004  000004            SAMTAB: MOV HO.BRL(R0),R4           ;GET BR LEVEL FROM P-TABLE
 4 021122  000304                            SWAB R4                    ;SWAP TO HIGH BYTE
 5 021124  006104                            ROL R4                     ;SHIFT ONE MORE TO LEFT
 6 021126  056004  000002                    BIS HO.VEC(R0),R4          ;ADD VECTOR ADDRESS
 7 021132  020463  000004                    CMP R4,C.VEC(R3)           ;COMPARE WITH CONTROLLER TABLE
 8 021136  001004                            BNE 1$
 9 021140  026063  000006  000006            CMP HO.BST(R0),C.BST(R3)   ;COMPARE BURST RATES
10 021146  001402                            BEQ NXTTAB
11 021150  000137  021344            1$:     JMP CTABER                 ;FATAL ERROR IF NOT SAME
12
13                                   ;GET NEXT P-TABLE
14
15 021154  005202                    NXTTAB: INC R2                     ;INCREMENT LOGICAL UNIT NUMBER
16 021156  023702  002012                    CMP L$UNIT,R2              ;CHECK IF GOT ALL TABLES
17 021162  003261                            BGT INIT4                  ;IF NOT, GO BACK FOR NEXT
18
19 021164  012701  000001                    MOV #1,R1                  ;ALLOCATE SPACE FOR ZERO END WORD
20 021170  004737  011744                    CALL ALOCM                 ;AFTER CONTROLLER TABLES
```

```
 1                                      ;NOW BUILD DRIVE TABLES
 2
 3 021174  005002                       CLR R2                          ;LOGICAL UNIT NUMBER IN R2
 4 021176                      INIT8:   GPHARD R2,R0                     ;GET POINTER TO A P-TABLE
   021176  010200                                                                           MOV     R2,R0
   021200  104442                                                                           TRAP    C$GPHRD
 5 021202                               BNCOMPLETE INIT14               ;IF NOT AVAILABLE, GO GET NEXT
   021202  103040                                                                           BCC     INIT14
 6
 7                                      ;FIND CONTROLLER TABLE
 8
 9 021204  013703  002156               MOV CTABS,R3                    ;GET ADDRESS OF CONTROLLER TABLES
10 021210  021013                INIT10: CMP (R0),(R3)             ;CHECK IF SAME UNIBUS ADDRESS
11 021212  001403                       BEQ INIT11                           ;BRANCH IF TABLE FOUND
12 021214  062703  000054               ADD #C.SIZE,R3                       ;MOVE TO NEXT TABLE
13 021220  000773                       BR INIT10
```

```
 1                                      ;BUILD DRIVE TABLE
 2
 3 021222  012701  000015      INIT11: MOV #D.SIZE/2,R1              ;GET SIZE OF DRIVE TABLE
 4 021226  004737  011744              CALL ALOCM                   ;ALLOCATE SPACE FROM FREE MEMORY
 5                                   ;  R0 POINTS TO P-TABLE
 6                                   ;  R1 POINTS TO DRIVE TABLE
 7                                   ;  R3 POINTS TO CONTROLLER TABLE
 8                                   ;  R2 IS UNIT NUMBER
 9 021232  010337  003302              MOV R3,TEMP                  ;SAVE CONTROLLER TABLE ADDRESS
10                                                                  ;IN CASE AN ERROR IS DETECTED
11 021236  062703  000020              ADD #C.DR0,R3                ;BUILD POINTER TO C DR ENTRY IN CONTROLLER TABLE
12 021242  012704  000010              MOV #8.,R4                   ;GET MAX COUNT OF DRIVES ON ONE CONTROLLER
13 021246  005713              INIT12: TST (R3)                     ;CHECK IF ENTRY CONTAINS POINTER TO DRIVE TABLE
14 021250  001411                      BEQ INIT13
15 021252  026033  000010              CMP HO.LDR(R0),@(R3)+        ;CHECK DRIVE NUMBER IN DRIVE TABLE
16 021256  001002                      BNE 1$
17 021260  000137  021360              JMP MLDRER                   ;IF SAME, TWO P-TABLES POINT TO SAME DRIVE
18 021264  005304              1$:     DEC R4                       ;COUNT DRIVES
19 021266  001367                      BNE INIT12                   ;IF EIGHT DRIVE TABLES EXIST,
20 021270  000137  021376              JMP TOOMER                   ;   THEN REPORT ERROR
21 021274  010113              INIT13: MOV R1,(R3)                  ;LOAD DRIVE TABLE POINTER
22 021276  016021  000010              MOV HO.LDR(R0),(R1)+         ;LOAD DRIVE NUMBER
23 021302  010221                      MOV R2,(R1)+                 ;LOAD UNIT NUMBER
```

```
 1                                        ;GO TO NEXT DRIVE TABLE
 2
 3  021304  005202            INIT14: INC R2                    ;INCREMENT LOGICAL UNIT NUMBER
 4  021306  023702  002012            CMP LSUNIT,R2                ;CHECK IF GOT ALL TABLES
 5  021312  003331                    BGT INIT8                    ;IF NOT, GET NEXT TABLE
 6
 7                                        ;SAVE CURRENT PARAMETERS TO FREE MEMORY
 8
 9  021314  013737  002146  002152  INIT15: MOV FFREE,FMEM       ;SAVE START ADDRESS
10  021322  013737  002150  002154          MOV FSIZE,FMEMS        ;SAVE SIZE
11
12  021330                    INITXX: SETPRI  #PRI00            ; SET RUNNING PRIORITY TO ZERO
    021330  012700  000000                                          MOV   #PRI00,R0
    021334  104441                                                  TRAP  CSSPRI
14  021336                            CLOSE                     ;MAKE SURE DATA FILE IS CLOSED
    021336  104435                                                  TRAP  CSCLOS
16  021340                            EXIT INIT
    021340  104432                                                  TRAP  CSEXIT
    021342  000524                                                  .WORD L10037-.
```

```
  1                                    ;DIFFERENT VECTORS, BR LEVELS OR BURST RATES FOR ONE CONTROLLER
  2 021344 010305                      CTABFR: MOV R3,R5                    ;GET CONTROLLER ADDRESS
  3 021346                                     ERRSF 1,,ERR001
    021346 104454                                                                     TRAP    C$ERSF
    021350 000001                                                                     .WORD   1
    021352 000000                                                                     .WORD   0
    021354 010770                                                                     .WORD   ERR001
  4 021356                                     DOCLN
    021356 104444                                                                     TRAP    C$DCLN

  5
  6                                    ;TWO P-TABLES FOR SAME DRIVE
  7 021360 013705 003302               MLDRER: MOV TEMP,R5                  ;GET CONTROLLER ADDRESS
  8 021364                                     ERRSF 2,,ERR002
    021364 104454                                                                     TRAP    C$ERSF
    021366 000002                                                                     .WORD   2
    021370 000000                                                                     .WORD   0
    021372 011006                                                                     .WORD   ERR002
  9 021374                                     DOCLN
    021374 104444                                                                     TRAP    C$DCLN

 10
 11                                    ;MORE THAN EIGHT DRIVES SELECTED ON ONE CONTROLLER
 12
 13 021376 013705 003302               TOOMER: MOV TEMP,R5                  ;GET CONTROLLER ADDRESS
 14 021402                                     ERRSF 3,,ERR003
    021402 104454                                                                     TRAP    C$ERSF
    021404 000003                                                                     .WORD   3
    021406 000000                                                                     .WORD   0
    021410 011024                                                                     .WORD   ERR003
 15 021412                                     DOCLN
    021412 104444                                                                     TRAP    C$DCLN

 16
 17                                    ;TWO UDA'S USE THE SAME VECTOR
 18
 19 021414 010305                      SAMVEC: MOV R3,R5                    ;GET CONTROLLER ADDRESS
 20 021416                                     ERRSF 8,ERR008
    021416 104454                                                                     TRAP    C$ERSF
    021420 000010                                                                     .WORD   8
    021422 011100                                                                     .WORD   ERR008
    021424 000000                                                                     .WORD   0
 21 021426                                     DOCLN
    021426 104444                                                                     TRAP    C$DCLN
```

```
  1 021430                         DATE:   GMANID DATEQ,DATEI,A,-1,1,11.,YES      ;GET DATE
    021430  104443                                                                            TRAP    CSGMAN
    021432  000406                                                                            BR      10000$
    021434  003330                                                                            .WORD   DATEI
    021436  000152                                                                            .WORD   TSCODE
    021440  003600                                                                            .WORD   DATEQ
    021442  177777                                                                            .WORD   -1
    021444  000001                                                                            .WORD   TSLOLIM
    021446  000013                                                                            .WORD   TSHILIM
    021450                                                                        10000$:
  2 021450  012705  003330                  MOV #DATEI,R5    ;GET POINTER TO ANSWER
  3 021454  121527  000060                  CMPB (R5),#'0
  4 021460  103443                          BLO DERR
  5 021462  122527  000071        DAY:      CMPB (R5)+,#'9
  6 021466  101040                          BHI DERR
  7 021470  121527  000055                  CMPB (R5),#'-
  8 021474  001406                          BEQ DAS1
  9 021476  121527  000060                  CMPB (R5),#'0
 10 021502  103432                          BLO DERR
 11 021504  122527  000071                  CMPB (R5)+,#'9
 12 021510  101027                          BHI DERR
 13 021512  122527  000055        DAS1:     CMPB (R5)+,#'-
 14 021516  001024                          BNE DERR
 15 021520  012704  000014                  MOV #12.,R4      ;GET NUMBER OF MONTH
 16 021524  012703  003405                  MOV #MONTHS,R3   ;GET POINTER TO MONTH NAMES
 17 021530  005000        MON1:     CLR R0
 18 021532  121523                          CMPB (R5),(R3)+
 19 021534  001401                          BEQ MON2
 20 021536  005200                          INC R0
 21 021540  126523  000001        MON2:     CMPB 1(R5),(R3)+
 22 021544  001401                          BEQ MON3
 23 021546  005200                          INC R0
 24 021550  126523  000002        MON3:     CMPB 2(R5),(R3)+
 25 021554  001401                          BEQ MON4
 26 021556  005200                          INC R0
 27 021560  005700        MON4:     TST R0
 28 021562  001407                          BEQ MON5
 29 021564  005304                          DEC R4
 30 021566  001360                          BNE MON1
 31 021570                         DERR:     PNTF DATEX
    021570  004137  016230                                                                    JSR R1,LPNTF
    021574  010670                                                                            .WORD DATEX
    021576  000000                                                                            .WORD PNT.CT
 32 021600  000713                           BR DATE
 33 021602  012701  003344        MON5:     MOV #DATEO,R1    ;GET POINTER TO DATE FOR FORMATTER
 34 021606  010403                          MOV R4,R3        ;GET COPY OF MONTH NUMBER
 35 021610  020327  000012                  CMP R3,#10.      ;  IF 10 OR GREATER
 36 021614  103404                          BLO MON6
 37 021616  112721  000061                  MOVB #'1,(R1)+   ;PUT A "1" IN OUTPUT
 38 021622  162703  000012                  SUB #10.,R3
 39 021626  062703  000060        MON6:     ADD #'0,R3       ;CONVERT MONTH NUMBER TO ASCII
 40 021632  110321                          MOVB R3,(R1)+    ;PUT A NUMBER IN OUTPUT
 41 021634  112721  000055                  MOVB #'-,(R1)+   ;PUT A "-" IN OUTPUT
 42 021640  062704  003450                  ADD #DAYS-1,R4   ;GET POINTER TO DAYS IN MONTH
 43                                                          ;INDEXED BY NUMBER OF MONTH
 44 021644  012703  003330                  MOV #DATEI,R3    ;GET POINTER TO DATE INPUT
 45 021650  005000                          CLR R0
```

```
 46 021652 121327  000055      DAY1:   CMPB (R3),#'-
 47 021656 001413                      BEQ DAY2
 48 021660 111321                      MOVB (R3),(R1)+ ;PUT DAY CHARACTER IN OUTPUT
 49 021662 006300                      ASL R0
 50 021664 010002                      MOV R0,R2
 51 021666 006300                      ASL R0
 52 021670 006300                      ASL R0
 53 021672 060200                      ADD R2,R0
 54 021674 112302                      MOVB (R3)+,R2
 55 021676 162702  000060              SUB #'0,R2
 56 021702 060200                      ADD R2,R0
 57 021704 000762                      BR DAY1
 58 021706 120014              DAY2:   CMPB R0,(R4)
 59 021710 101327                      BHI DERR
 60 021712 005700                      TST R0  ;SEE IF DATE IS ZERO
 61 021714 001725                      BEQ DERR          ;ERROR IF SO
 62 021716 062705  000003              ADD #3,R5
 63 021722 121527  000055              CMPB (R5),#'-   ;CHECK FOR "-" BETWEEN DAY
 64 021726 001320                      BNE DERR       ;   AND YEAR IN OUTPUT
 65 021730 112521                      MOVB (R5)+,(R1)+        ;PUT "-" IN OUTPUT
 66 021732 010504                      MOV R5,R4           ;GET COPY OF INPUT STRING POINTER
 67 021734 005000                      CLR R0
 68 021736 005002                      CLR R2
 69 021740 121427  000060      YER1:   CMPB (R4),#'0
 70 021744 103416                      BLO YER2
 71 021746 121427  000071              CMPB (R4),#'9
 72 021752 101013                      BHI YER2
 73 021754 006300                      ASL R0
 74 021756 010003                      MOV R0,R3
 75 021760 006300                      ASL R0
 76 021762 006300                      ASL R0
 77 021764 060300                      ADD R3,R0
 78 021766 112403                      MOVB (R4)+,R3
 79 021770 162703  000060              SUB #'0,R3
 80 021774 060300                      ADD R3,R0
 81 021776 005202                      INC R2
 82 022000 000757                      BR YER1
 83 022002 105714              YER2:   TSTB (R4)
 84 022004 001271                      BNE DERR
 85 022006 020227  000002              CMP R2,#2
 86 022012 001407                      BEQ YER3
 87 022014 020227  000004              CMP R2,#4
 88 022020 001263                      BNE DERR
 89 022022 020027  003554              CMP R0,#1900.
 90 022026 103660                      BLO DERR
 91 022030 000413                      BR YER5
 92 022032 012702  003465      YER3:   MOV #YEAR19,R2
 93 022036 020027  000106              CMP R0,#70.
 94 022042 103002                      BHIS YER4
 95 022044 012702  003470              MOV #YEAR20,R2
 96 022050 105712              YER4:   TSTB (R2)
 97 022052 001402                      BEQ YER5
 98 022054 112221                      MOVB (R2)+,(R1)+
 99 022056 000774                      BR YER4
100 022060 112521              YER5:   MOVB (R5)+,(R1)+
101 022062 001376                      BNE YER5
102 022064 000207                      RETURN
```

```
103
104 022066                                    ENDINIT
    022066                                                      L10037:
    022066  104411                                                      TRAP    CSINIT
```

```
     1                                    .SBTTL  AUTODROP SECTION
     2
     3                                    ;++
     4                                    ; THIS CODE IS EXECUTED IMMEDIATELY AFTER THE INITIALIZE CODE IF
     5                                    ; THE "ADR" FLAG WAS SET.  THE UNIT(S) UNDER TEST ARE CHECKED TO
     6                                    ; SEE IF THEY WILL RESPOND.  THOSE THAT DON'T ARE IMMEDIATELY
     7                                    ; DROPPED FROM TESTING.
     8                                    ;--
     9
    10 022070                                    BGNAUTO
       022070                                                                    L$AUTO::
    11
    12 022070                                    ENDAUTO
       022070                                                                    L10040:
       022070  104461                                                                   TRAP    C$AUTO
```

```
  1                                   .SBTTL  CLEANUP CODING SECTION
  2
  3                                   ;++
  4                                   ; THE CLEANUP CODING SECTION CONTAINS THE CODING THAT IS PERFORMED
  5                                   ; AFTER THE HARDWARE TESTS HAVE BEEN PERFORMED.
  6                                   ;--
  7
  8 022072                            BGNCLN
    022072                                                                        LSCLEAN::
  9
 11 022072                            CLOSE                          ;CLOSE DATA FILE
    022072  104435                                                             TRAP    CSCLOS
 13 022074  004737  012064            CALL    RESET                  ;RESET ALL UDAS
 14
 15 022100                            ENDCLN
    022100                                                                        L10041:
    022100  104412                                                             TRAP    CSCLEAN
 16
 17 022102                            ENDMOD
```

```
    1                                              .SBTTL   TEST 1: DUP PROGRAM DRIVER
    2
    3 022102                                       BGNMOD
    4
    5 022102                                       BGNTST
      022102                                                                              T1::
    6 022102  032737  000003  003230               BIT #SO.FMT,MODE
    7 022110  001157                                BNE T1FMT
    8 022112                                        MANUAL
      022112  104450                                                                      TRAP     CSMANI
    9 022114                                        BCOMPLETE T1GO
      022114  103406                                                                      BCS      T1GO
   10 022116                                        ERRSF 10,,ERR010
      022116  104454                                                                      TRAP     CSERSF
      022120  000012                                                                      .WORD    10
      022122  000000                                                                      .WORD    0
      022124  011130                                                                      .WORD    ERR010
   11 022126                                        EXIT TST
      022126  104432                                                                      TRAP     CSEXIT
      022130  000626                                                                      .WORD    L10042-.
   12 022132  032737  000010  003230  T1GO:        BIT #SO.STR,MODE
   13 022140  001432                                BEQ T1CNS
   14 022142  023727  002012  000001               CMP LSUNIT,#1
   15 022150  001406                                BEQ T1RST
   16 022152                                        ERRSF 9,,ERR009
      022152  104454                                                                      TRAP     CSERSF
      022154  000011                                                                      .WORD    9
      022156  000000                                                                      .WORD    0
      022160  011116                                                                      .WORD    ERR009
   17 022162                                        EXIT TST
      022162  104432                                                                      TRAP     CSEXIT
      022164  000572                                                                      .WORD    L10042-.
   18
   19 022166                            T1RST:     PNTF FILNAM
      022166  004137  016230                                                              JSR R1,LPNTF
      022172  010707                                                                      .WORD FILNAM
      022174  000000                                                                      .WORD PNT.CT
   20 022176                                        GMANID FILNAQ,FNAME2,A,-1,1,10.,NO        ;GET FILE NAME
      022176  104443                                                                      TRAP     CSGMAN
      022200  000406                                                                      BR       10000$
      022202  003254                                                                      .WORD    FNAME2
      022204  000142                                                                      .WORD    TSCODE
      022206  003630                                                                      .WORD    FILNAQ
      022210  177777                                                                      .WORD    -1
      022212  000001                                                                      .WORD    TSLOLIM
      022214  000012                                                                      .WORD    TSHILIM
      022216                                                                      10000$:
   22 022216                                        OPEN #FNAME2
      022216  012700  003254                                                              MOV      #FNAME2,R0
      022222  104434                                                                      TRAP     CSOPEN
   24 022224  000511                                BR T1FMT
   25 022226  013705  002156            T1CNS:     MOV CTABS,R5
   26 022232  010504                    T1SER1:    MOV R5,R4
   27 022234  062704  000020                       ADD #C.DR0,R4
   28 022240  012703  000010                       MOV #8.,R3
   29 022244  011402                    T1SER2:    MOV (R4),R2           ;GET DRIVE TABLE POINTER
   30 022246  001474                                BEQ T1SERN
```

```
 31 022250                                 PNTF SERNUM,D.UNIT(R2),(R5),(R2)
    022250 011246                                                                       MOV     (R2),-(SP)
    022252 011546                                                                       MOV     (R5),-(SP)
    022254 016246  000002                                                               MOV     D.UNIT(R2),-(SP)
    022260 004137  016230                                                               JSR     R1,LPNTF
    022264 004223                                                                       .WORD   SERNUM
    022266 000006                                                                       .WORD   PNT.CT
 32 022270                                      ASSUME C.UADR EQ 0
 33 022270                                      ASSUME D.DRV EQ 0
 34 022270                              T1SER3: GMANID SERNQ,TEMP,A,-1,1,20.,NO ;GET SERIAL NUMBER
    022270 104443                                                                       TRAP    C$GMAN
    022272 000406                                                                       BR      10001$
    022274 003302                                                                       .WORD   TEMP
    022276 000142                                                                       .WORD   T$CODE
    022300 003662                                                                       .WORD   SERNQ
    022302 177777                                                                       .WORD   -1
    022304 000001                                                                       .WORD   T$LOLIM
    022306 000024                                                                       .WORD   T$HILIM
    022310                                                                      10001$:
 35 022310 012701  003302                        MOV #TEMP,R1
 36 022314 005000                                CLR R0
 37 022316 105711                        T1SER4: TSTB (R1)
 38 022320 001410                                BEQ T1SER5
 39 022322 005200                                INC R0
 40 022324 121127  000060                        CMPB (R1),#'0
 41 022330 103416                                BLO T1SER7
 42 022332 122127  000071                        CMPB (R1)+,#'9
 43 022336 101767                                BLOS T1SER4
 44 022340 000412                                BR T1SER7
 45 022342 020027  000024                T1SER5: CMP R0,#20.
 46 022346 103422                                BLO T1SER8
 47 022350 012701  003302                        MOV #TEMP,R1
 48 022354 012700  003360                        MOV #HIGHEST,R0
 49 022360 122120                        T1SER6: CMPB (R1)+,(R0)+
 50 022362 001776                                BEQ T1SER6
 51 022364 103413                                BLO T1SER8
 52 022366                               T1SER7: PRINTF #SERNX,#HIGHEST
    022366 012746  003360                                                              MOV     #HIGHEST,-(SP)
    022372 012746  010600                                                              MOV     #SERNX,-(SP)
    022376 012746  000002                                                              MOV     #2,-(SP)
    022402 010600                                                                      MOV     SP,R0
    022404 104417                                                                      TRAP    C$PNTF
    022406 062706  000006                                                              ADD     #6,SP
 53 022412 000726                                BR T1SER3
 54 022414 062702  000004                T1SER8: ADD #D.SERN,R2  ;PUT ANSWER INTO DRIVE TABLE
 55 022420 012701  003302                        MOV #TEMP,R1
 56 022424 112122                        T1SER9: MOVB (R1)+,(R2)+
 57 022426 001376                                BNE T1SER9
 58 022430 005303                                DEC R3
 59 022432 001402                                BEQ T1SERN
 60 022434 005724                                TST (R4)+
 61 022436 000702                                BR T1SER2
 62 022440 062705  000054                T1SERN: ADD #C.SIZE,R5
 63 022444 005715                                TST (R5)
 64 022446 001271                                BNE T1SER1
 65 022450 013737  002156  002162        T1FMT:  MOV CTABS,TSTTAB       ;GET FIRST TABLE ADDRESS
 66 022456 013701  002160                        MOV CTRLRS,R1          ;RUN DM PROGRAM ON ALL CONTROLLERS
```

```
 67                                            ; FIND OUT WHICH CONTROLLER IS WHICH
 68 022462  010137  002174              MOV     R1,URUN
 70 022466  013737  002146  002164      MOV     FFREE,DMPROG
 71 022474  012701  000001              MOV     #1,R1                          ; MUST READ AT LEAST ON DMPROG
 72 022500  004737  012006              CALL    TINIT                          ; READ DMCODE
 76 022504  013737  002174  002200      MOV     URUN,UCNT
 77 022512  013705  002162              MOV     TSTTAB,R5                      ; POINT TO CONTROLLER TABLE
 78 022516  005037  002204              CLR     U50UNI                        ; CLEAR NUMBER OF UDA50'S
 79 022522  005765  000002      TSTCNT: TST     C.UNIT(R5)
 80 022526  100425                      BMI     2$                            ; IF UNIT DROPPED, BRANCH
 81 022530  004737  012254              CALL    GTDUST                        ; GET DUST STATUS
 82 022534  023764  002206  000034      CMP     U52EXT,HC.MPK+P.DEXT(R4)      ; IS IT A 52?
 83 022542  001007                      BNE     1$                            ; IF NOT, BRANCH
 85 022544  052765  000400  000014      BIS     #CT.U52,C.FLG(R5)            ; SET FOR 52
 86 022552  042765  001000  000014      BIC     #CT.U50,C.FLG(R5)
 92 022560  000410                      BR      2$
 93 022562                      1$:
 95 022562  042765  000400  000014      BIC     #CT.U52,C.FLG(R5)            ; SET FOR 50
 96 022570  052765  001000  000014      BIS     #CT.U50,C.FLG(R5)
 97 022576  005237  002204              INC     U50UNI                        ; KEEP TRACK IF WE NEED TO READ UDA50 FORMATTER
103 022602  005075  000000      2$:     CLR     @(R5)                         ; INIT CONTROLLER
104 022606  062705  000054              ADD     #C.SIZE,R5                    ; POINT TO NEXT CONTROLLER
105 022612  005337  002200              DEC     UCNT                          ; CONTINUE UNTIL DONE
106 022616  001341                      BNE     TSTCNT
107                                      ;
109 022620  012737  000400  002212      MOV     #CT.U52,TSTTYP               ;INIT CONTROLLER TYPE
110 022626  013737  002160  002200  3$: MOV     CTRLRS,UCNT                  ; GET COMM AREA FOR EACH CONTROLLER
111 022634  013705  002156              MOV     CTABS,R5
112 022640  013701  002164              MOV     DMPROG,R1                    ; GET DMSIZE
113 022644  011137  002166              MOV     (R1),DMSIZE
114 022650  066137  000004  002166      ADD     4(R1),DMSIZE
115 022656  013737  002156  002162      MOV     CTABS,TSTTAB                 ; INIT PARAMETERS FOR RUNDM
116 022664  013701  002160              MOV     CTRLRS,R1
117 022670  004737  012360              CALL RUNDM                           ;  RUN ALL CONTROLLERS OF ONE TYPE AT ONCE
118 022674  001402                      BEQ 6$
119 022676  004737  013110              CALL RESPDM
120 022702  006337  002212      6$:     ASL     TSTTYP                       ; NEXT CONTROLLER TYPE
121 022706  013737  002152  002146      MOV     FMEM,FFREE                   ; RESTORE FREE MEMORY
122 022714  013737  002154  002150      MOV     FMEMS,FSIZE
123 022722  032737  001000  002212      BIT     #CT.U50,TSTTYP              ; ALL DONE?
124 022730  001410                      BEQ     7$                          ; IF SO, EXIT
125 022732  005737  002204              TST     U50UNI                      ; DO WE CONTINUE FOR UDA50?
126 022736  001405                      BEQ     7$                          ; IF NOT, EXIT
127 022740  012701  000002              MOV     #2,R1
128 022744  004737  012006              CALL    TINIT                       ; ELSE READ IN UDA50 FORMATTER
129 022750  000726                      BR      3$
137 022752                      7$:     EXIT TST
    022752  104432                              TRAP    C$EXIT
    022754  000002                              .WORD   L10042-.
138 022756                      ENDTST
    022756                              L10042:
    022756  104401                              TRAP    C$ETST
139 022760                      ENDMOD
```

```
 1                              .SBTTL   HARDWARE PARAMETER CODING SECTION
 2
 3 022760                          BGNMOD
 4
 5                           ;++
 6                           ; THE HARDWARE PARAMETER CODING SECTION CONTAINS MACROS
 7                           ; THAT ARE USED BY THE SUPERVISOR TO BUILD P-TABLES.  THE
 8                           ; MACROS ARE NOT EXECUTED AS MACHINE INSTRUCTIONS BUT ARE
 9                           ; INTERPRETED BY THE SUPERVISOR AS DATA STRUCTURES.  THE
10                           ; MACROS ALLOW THE SUPERVISOR TO ESTABLISH COMMUNICATIONS
11                           ; WITH THE OPERATOR.
12                           ;--
13
14 022760                       BGNHRD
   022760   000027                                                 .WORD L10043-L$HARD/2
   022762                                            L$HARD::
15
16                           ;FORMAT OF HARDWARE P-TABLE IS AS FOLLOWS:
17
18 022762                    TABLE                        ;START A TEBLE DEFINITION
19
20 022762                    ITEM HO.UBA      2           ; UNIBUS ADDRESS
21 022762                    ITEM HO.VEC      2           ; UDA VECTOR
22 022762                    ITEM HO.BRL      2           ; BR LEVEL
23 022762                    ITEM HO.BST      2           ; BURST RATE
24 022762                    ITEM HO.LDR      2           ; DRIVE NUMBER
25 022762                    END
```

```
   1 022762                          GPRMA   H.UBA,HO.UBA,0,160000,177774,YES      ;BUS ADDRESS
     022762  000031                                                       .WORD   T$CODE
     022764  023040                                                       .WORD   H.UBA
     022766  160000                                                       .WORD   T$LOLIM
     022770  177774                                                       .WORD   T$HILIM
   2 022772                          GPRMA   H.VEC,HO.VEC,0,4,774,YES     ; VECTOR
     022772  001031                                                       .WORD   T$CODE
     022774  023066                                                       .WORD   H.VEC
     022776  000004                                                       .WORD   T$LOLIM
     023000  000774                                                       .WORD   T$HILIM
   3 023002                          GPRMD   H.BRL,HO.BRL,D,-1,4.,7.,YES  ; BR LEVEL
     023002  002052                                                       .WORD   T$CODE
     023004  023075                                                       .WORD   H.BRL
     023006  177777                                                       .WORD   -1
     023010  000004                                                       .WORD   T$LOLIM
     023012  000007                                                       .WORD   T$HILIM
   4 023014                          GPRMD   H.BST,HO.BST,D,-1,0.,63.,YES ; BURST RATE
     023014  003052                                                       .WORD   T$CODE
     023016  023106                                                       .WORD   H.BST
     023020  177777                                                       .WORD   -1
     023022  000000                                                       .WORD   T$LOLIM
     023024  000077                                                       .WORD   T$HILIM
   5 023026                          GPRMD   H.LDR,HO.LDR,D,-1,0.,255.,YES ; DRIVE SELECT NUMBER
     023026  004052                                                       .WORD   T$CODE
     023030  023130                                                       .WORD   H.LDR
     023032  177777                                                       .WORD   -1
     023034  000000                                                       .WORD   T$LOLIM
     023036  000377                                                       .WORD   T$HILIM
   6 023040                          ENDHRD
                                                                          .EVEN
     023040                                                       L10043:
   7
   8 023040  125  116  111  H.UBA:   .ASCIZ  \UNIBUS ADDRESS OF UDA\
   9 023066  126  105  103  H.VEC:   .ASCIZ  \VECTOR\
  10 023075  102  122  040  H.BRL:   .ASCIZ  \BR LEVEL\
  11 023106  125  116  111  H BST:   .ASCIZ  \UNIBUS BURST RATE\
  12 023130  104  122  111  H.LDR:   .ASCIZ  \DRIVE NUMBER\
  13                                 .EVEN
```

```
 1                              .SBTTL   SOFTWARE PARAMETER CODING SECTION
 2
 3                              ;++
 4                              ; THE SOFTWARE PARAMETER CODING SECTION CONTAINS MACROS
 5                              ; THAT ARE USED BY THE SUPERVISOR TO BUILD P-TABLES.   THE
 6                              ; MACROS ARE NOT EXECUTED AS MACHINE INSTRUCTIONS BUT ARE
 7                              ; INTERPRETED BY THE SUPERVISOR AS DATA STRUCTURES.   THE
 8                              ; MACROS ALLOW THE SUPERVISOR TO ESTABLISH COMMUNICATIONS
 9                              ; WITH THE OPERATOR.
10                              ;--
11
12 023146                              BGNSFT
   023146  000022                                                    .WORD L10044-L$SOFT/2
   023150                                                  L$SOFT::
13
14                              ;FORMAT OF SOFTWARE P-TABLE IS AS FOLLOWS:
15
16 023150                      TABLE                           ;START A TABLE DEFINITION
17
18 023150                      ITEM SO.BIT     2               ;YES/NO ANSWERS
19         000001                      SO.FM1 = BIT0           ;  REFORMAT MODE
20         000002                      SO.FM2 = BIT1           ;  (AGAIN)
21         000003                        SO.FMT = SO.FM1+SO.FM2
22         000004                      SO.CNS = BIT2           ;  RECONSTRUCT MODE
23         000010                      SO.STR = BIT3           ;  RESTORE MODE
24
25 023150                      END
```

```
 1 023150                                    GPRML S.FMT,SO.BIT,SO.FM1,YES   ;REFORMAT?
   023150   000130                                                                        .WORD   T$CODE
   023152   023365                                                                        .WORD   S.FMT
   023154   000001                                                                        .WORD   SO.FM1
 2 023156                                    XFERT SWEND
   023156   017024                                                                        .WORD   T$CODE
 3 023160                                    GPRML S.NRF,SO.BIT,SO.FM2,YES   ;AGAIN - REFORMAT?
   023160   000130                                                                        .WORD   T$CODE
   023162   023214                                                                        .WORD   S.NRF
   023164   000002                                                                        .WORD   SO.FM2
 4 023166                                    XFERT SWEND
   023166   013024                                                                        .WORD   T$CODE
 5 023170                                    GPRML S.CNS,SO.BIT,SO.CNS,YES   ;RECONSTRUCT
   023170   000130                                                                        .WORD   T$CODE
   023172   023444                                                                        .WORD   S.CNS
   023174   000004                                                                        .WORD   SO.CNS
 6 023176                                    XFERT SWEND
   023176   007024                                                                        .WORD   T$CODE
 7 023200                                    GPRML S.RST,SO.BIT,SO.STR,YES   ;RESTORE?
   023200   000130                                                                        .WORD   T$CODE
   023202   023507                                                                        .WORD   S.RST
   023204   000010                                                                        .WORD   SO.STR
 8 023206                                    XFERT SWEND
   023206   003024                                                                        .WORD   T$CODE
 9 023210                                    DISPLAY S.NOF    ;WARNING
   023210   000003                                                                        .WORD   T$CODE
   023212   023630                                                                        .WORD   S.NOF
10 023214                         SWEND:     ENDSFT
                                                                                          .EVEN
   023214                                                                        L10044:
11
12 023214    015   012            S.NRF:     .BYTE 15,12
13 023216    116   117   124                 .ASCII\NOT USING EXISTING INFORMATION WILL DESTROY THE FACTORY BAD SECTOR\
14 023320    015   012                       .BYTE 15,12
15 023322    111   116   106                 .ASCII\INFORMATION ON THE DISKS.\
16 023353    015   012                       .BYTE 15,12
17 023355    101   107   101                 .ASCII\AGAIN - \
18 023365    122   105   106     S.FMT:      .ASCIZ\REFORMAT USING EXISTING BAD SECTOR INFORMATION\
19 023444    122   105   103     S.CNS:      .ASCIZ\RECONSTRUCT BAD SECTOR INFORMATION\
20 023507    104   117   040     S.RST:      .ASCII\DO YOU HAVE A FILE ON THE SYSTEM LOAD DEVICE\
21 023563    015   012                       .BYTE 15,12
22 023565    040   103   117                 .ASCIZ\ CONTAINING BAD SECTOR INFORMATION\
23 023630    131   117   125     S.NOF:      .ASCIZ\YOU CANNOT PROCEED WITHOUT SUCH A FILE.\
24 023700    122   105   123                 .ASCIZ\RESTART PROGRAM AND SELECT TO REFORMAT OR RECONSTRUCT DISK.\
25 023774    000                             .BYTE 0
26                                           .EVEN
27
28                                           .DSABL AMA
29 000000                                    .PSECT END
```

```
    1                                      .SBTTL   PATCH AREA
    2
    3 000000                      $PATCH::
    4            000050                     .REPT 40.
    5                                       .WORD 0
    6                                       .ENDR
    7
    8 000120                      LASTAD

      000120   000142'                                               .EVEN
      000122   000007                                                .WORD TSFREE
      000124                       LSLAST::                           .WORD TSSIZF
    9
   10 000124                       ENDMOD
```

PATCH AREA

```
     1 000124                              BGNSETUP        1
     2
     3 000124                              BGNPTAB
       000124   000000                                                                        .WORD   0
       000126   000005                                                                        .WORD   L10047-./2-1
       000130                                                                         L10045:
     4
     5 000130   172150                     .WORD   172150    ; UNIBUS ADDRESS
     6 000132   000154                     .WORD   154       ; VECTOR ADDRESS
     7 000134   000005                     .WORD   5.        ; BR LEVEL
     8 000136   000077                     .WORD   63.       ; UNIBUS BURST RATE
     9 000140   000000                     .WORD   0.        ; LOGICAL DRIVE NUMBER
    10
    11 000142                              ENDPTAB
       000142                                                                         L10047:
    12
    13 000142                              ENDSETUP
    14
    15
    16
    17
    18
    19
    20
    21         000001             .END
ERRORS DETECTED:  0

VIRTUAL MEMORY USED:  29440 WORDS  ( 115 PAGES)
DYNAMIC MEMORY AVAILABLE FOR  70 PAGES
A:ZUDECO,B:ZUDECO/C=[20,0]SVC34R.MLB/P:1,ZUDECO.DOC,ZUDECO.MAC
```

```
$PATCH   143-3#
A1        1-5#      1-11      1-70      28-35     50-19     53-17     138-88
A2        1-6#      1-12      1-151     28-36     50-22     53-20     138-99
ADR       32-10#
ALOCM     58-16#    59-14     68-19     129-13    130-20    132-4
ASS       1-8#      1-10      1-11      1-12      1-16      1-70      1-151     27-37     28-34     28-35     28-36     48-7      50-16     50-19
          50-22     53-17     53-20     60-1      61-31     64-28     65-1      83-19     127-20    133-13    137-10    138-21    138-69    138-84
          138-88    138-94    138-99    138-108
ASSEMB    28-8      28-8
BAS       52-15#    93-5      93-5      93-5      94-5      94-5
BASL2     52-13#    94-5
BASL3     52-14#
BASLN     52-17#    93-5      94-5
BASNO     52-12#    93-5      94-5
BIT0      32-10#    141-19
BIT00     32-10     32-10#
BIT01     32-10     32-10#
BIT02     32-10     32-10#
BIT03     32-10     32-10#
BIT04     32-10     32-10#
BIT05     32-10     32-10#
BIT06     32-10     32-10#
BIT07     32-10     32-10#
BIT08     32-10     32-10#
BIT09     32-10     32-10#
BIT1      32-10#    43-23     141-20
BIT10     32-10#
BIT11     32-10#
BIT12     32-10#
BIT13     32-10#
BIT14     32-10#
BIT15     32-10#    43-15     44-12     64-27     72-20     80-26     85-15     100-29
BIT2      32-10#    43-24     141-22
BIT3      32-10#    43-25     141-23
BIT4      32-10#    43-27
BIT5      32-10#    43-30
BIT6      32-10#    43-31
BIT7      32-10#    43-33
BIT8      32-10#    43-34
BIT9      32-10#    43-35
BLDC0     108-22    108-24#
BLDC1     108-26#   108-28
BLDCMD    63-18     71-50     74-14     74-44     106-3     108-15#
BOE       32-10#
C$AU      28-8#
C$AUTO    28-8#     136-12
C$BRK     28-8#     61-12     66-19     71-9      111-21    118-12    121-27
C$BSEG    28-8#
C$BSUB    28-8#
C$CEFG    28-8#
C$CLCK    28-8#     127-48    127-50
C$CLEA    28-8#     137-15
C$CLOS    28-8#     65-13     83-20     133-14    137-11
C$CLP1    28-8#
C$CVEC    28-8#     61-22     118-30
C$DCLN    28-8#     57-8      61-30     62-21     70-7      127-18    134-4     134-9     134-15    134-21
```

```
C$DODU   28-8#
C$DRPT   28-8#
C$DU     28-8#
C$EDIT   28-8#   28-34
C$ERDF   28-8#   61-28    71-25    72-36    73-21    74-8     78-22    80-30    107-3    111-29   112-5    116-35   117-11   118-33
         120-44  121-36   122-5
C$ERHR   28-8#
C$ERRO   28-8#
C$ERSF   28-8#   57-7     62-20    70-6     134-3    134-8    134-14   134-20   138-10   138-16
C$ERSO   28-8#
C$ESCA   28-8#
C$ESEG   28-8#
C$ESUB   28-8#
C$ETST   28-8#   138-138
C$EXIT   28-8#   133-16   138-11   138-17   138-137
C$GETB   28-8#   66-21    66-26    67-7     68-23    68-30    69-1     69-11    69-14    83-26
C$GETW   28-8#
C$GMAN   28-8#   135-1    138-20   138-34
C$GPHR   28-8#   128-15   131-4
C$GPLO   28-8#
C$GPRI   28-8#
C$INIT   28-8#   135-104
C$INLP   28-8#
C$MANI   28-8#   138-8
C$MEM    28-8#   127-39
C$MSG    28-8#   55-16    55-20    55-24    55-28    55-32    55-36    55-40    55-44    55-48    55-52    55-56    55-65    55-71
         55-85   55-89    55-93    55-97    55-101   55-106   55-110   55-114   55-118   55-122   55-126   55-130
C$OPEN   28-8#   66-16    83-21    138-22
C$PNTB   28-8#   102-14
C$PNTF   28-8#   102-12   138-52
C$PNTS   28-8#   102-18
C$PNTX   28-8#   55-70    102-16
C$QIO    28-8#
C$RDBU   28-8#
C$REFG   28-8#   127-10   127-12   127-14   127-16
C$RESE   28-8#   28-8#
C$REVI   28-8#   28-34
C$RFLA   28-8#
C$RPT    28-8#
C$SEFG   28-8#
C$SPRI   28-8#   133-12
C$SVEC   28-8#   61-11    63-9     105-20   118-27   127-59
C$TPRI   28-8#
C.BST    43-19#  117-17   130-9
C.DR0    43-37#  72-15    85-12    132-11   138-27
C.DR1    43-38#
C.DR2    43-39#
C.DR3    43-40#
C.DR4    43-41#
C.DR5    43-42#
C.DR6    43-43#
C.DR7    43-44#
C.FLG    43-22#  64-23*   64-29    71-11    71-14    71-16    71-39    71-44    71-48*   72-12*   73-6     73-26    74-35*   74-39*
         74-40   74-47*   74-50*   74-62*   74-63    74-69*   74-70    106-13*  106-14*  109-21*  111-17   112-1*   138-85*  138-86*
         138-95* 138-96*
C.JAD    43-21#
```

```
C.JSR   43-20#   63-8     1C5-19
C.PRI   43-48#   74-65    74-67    74-72*   74-73*
C.REF   43-49#   73-19    109-16*  109-17
C.RING  43-36#   55-146   59-15*   71-10    74-29    108-16   109-15   116-20   117-3   117-22   118-20
C.SIZE  43-51#   64-37    72-5     128-32   129-12   131-12   138-62   138-104
C.TO    43-45#   71-37    74-55    111-14   111-27   121-22   121-33
C.TOH   43-46#   71-34    111-24   121-30
C.TOT   43-47#   71-30    74-53    105-14*  105-15*
C.UADR  43-12#   86-16    118-25   128-24   138-32
C.UNIT  43-13#   64-24    64-25    71-13    138-79
C.VEC   43-16#   63-5     105-16   118-14   128-27   130-7
CALR4   90-6     93-5#
CALR5   90-7     94-5#
CALR6   90-8     95-4#
CALR7   90-9     96-4#
CALR8   90-10    97-4#
CALRE   90-3     90-4     90-5     92-4#
CF.576  39-39#
CF.ATN  39-34#
CF.MSC  39-35#
CF.OTH  39-36#
CF.SHD  39-38#
CF.THS  39-37#
CLOSEF  65-11#   70-1     127-21
CLRBFL  110-22#  110-24
CLRBUF  74-16    74-46    110-16#
CON.A   88-12#   91-21
CON.A1  88-13#   88-15
CON.A2  88-17    88-19#
CON.D   88-23#   91-21
CON.H   88-29#   91-21
CON.N   89-9#    91-21
CON.N1  89-10#   89-12
CON.O   89-3#    91-21
CON.QU  88-3#    88-7     91-21
CON.QX  88-5     88-8#
CON.R   89-17#   91-21
CON.R1  89-19    89-23#
CON.S   89-29#   91-21
CON.S1  89-30#   89-32
CPNT    84-13    84-18    86-21    88-6     88-13    89-10    89-30    93-7    94-7    101-13   101-22   102-5#   125-27   125-32
        125-35
CPNTX   102-13   102-15   102-17   102-19#
CR      32-12#   84-13    86-21    89-10    93-7     94-7     102-8
CT.AVL  43-15#   64-27
CT.BRL  43-18#
CT.CMD  43-24#   71-16    106-13   109-21
CT.MSG  43-25#   71-14    74-39    74-62    111-17   112-1    114-19
CT.REQ  43-27#   73-6     73-26    74-35    74-40    74-47    74-50    106-13
CT.RN   43-23#   71-11    106-14
CT.STA  43-30#   71-39    71-47    74-39    74-62
CT.TM1  43-31#   71-43    71-44    74-39    74-70
CT.TM2  43-33#   74-39    74-63    74-69
CT.U50  43-35#   64-23    138-86   138-96   138-123
CT.U52  43-34#   64-23    138-85   138-95   138-109
CT.UNT  43-14#
```

```
CT.VEC   43-17#   63-6     1C5-17    118-15    128-28
CTABER  130-11   134-2#
CTABS    48-15#  128-3*    128-4*    128-20    131-9     138-25    138-65    138-111   138-115
CTRLRS   48-16#  128-5*    129-29*   138-66    138-110   138-116
D.DRV    44-9#    79-36     86-17    138-33
D.SERN   44-13#   78-17    138-54
D.SIZE   44-15#  132-3
D.UNIT   44-10#   72-19     72-25*    85-14     86-15     138-31
DAS1    135-8    135-13#
DATE    127-37   135-1#    135-32
DATEI    49-2#   135-1     135-2     135-44
DATEO    49-4#    78-26    127-35    135-33
DATEQ    51-3#   135-1
DATEX    54-12#  135-31
DAY     135-5#
DAY1    135-46#  135-57
DAY2    135-47   135-58#
DAYS     49-19#  135-42
DERR    135-4    135-6     135-10    135-12    135-14    135-31#   135-59    135-61    135-64    135-R4    135-88    135-90
DF.ACT   42-21#   74-60
DF.LCL   42-24#
DF.NES   42-22#
DF.SA    42-26#
DFPTBL   30-10#
DIAG     36-33#  108-23
DIAGMC   28-8     28-8
DIVIDE   79-38   100-39    101-7     104-16#   125-19    125-21    125-23
DMEND    48-21#   60-20     62-16*
DMENDS   48-22#   60-21     62-17*
DMFRST   42-47#   68-11     68-21
DMMAIN   42-46#
DMOVRL   42-44#
DMPROG   48-19#   62-13*   105-13    106-1     106-4     106-6     106-7     138-70*   138-112
DMSIZE   48-20#  138-113*  138-114*
DMTMO    42-45#  105-14
DMTRLN   42-43#
DQCONT   79-28    79-61#
DQNO     79-54    79-62#
DQRFMT   79-26    79-53#
DQRSTR   79-27    79-59#
DQUEJP   79-21    79-22#    79-29
DQUEST   75-4     79-16#
DQUESZ   79-18    79-29#
DQUEX    79-19    79-22     79-24     79-25     79-50#    79-57     79-64
DQUNIT   79-23    79-33#
DQUNL1   79-38#   79-42
DQUNL2   79-44#   79-48
DQYES    79-55#   79-60
DSPSIZ   75-9#
DT.AVL   44-12#   72-20     72-25     85-15
DT.UNT   44-11#
DU.DFL   42-33#
DU.FTL   42-36#
DU.INF   42-34#
DU.QUE   42-32#
DU.SPC   42-37#   74-6
```

```
DU.TER    42-35#
DU.TYP    42-39#   74-4      74-19
DUP       36-34#   108-20
E$END     28-8#
E$LOAD    28-8#    28-34
EF.BBR    39-27#
EF.BBU    39-28#
EF.CON    32-10#   127-14
EF.LOG    39-29#
EF.NEW    32-10#
EF.PWR    32-10#   127-16
EF.RES    32-10#   127-12
EF.SEX    39-30#
EF.STA    32-10#   127-10
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ERR002    55-18#   134-8
ERR003    55-22#   134-14
ERR004    55-26#   57-7
ERR005    55-30#   70-6
ERR007    55-34#   62-20
ERR008    55-38#   134-20
ERR009    55-42#   138-16
ERR010    55-46#   138-10
ERR011    55-50#
ERR020    55-54#   61-28     118-33
ERR021    55-58#   122-5
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ERR023    55-73#   117-11
ERR024    55-87#   116-35
ERR025    55-91#   120-44
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ERR032    55-103#  74-8
ERR033    55-108#  73-21
ERR034    55-112#  107-3
ERR036    55-116#  111-29
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ERR100    55-124#  78-22
ERR101    55-128#  80-30
ERR23A    55-76#   55-83
ERR23B    55-77    55-81#
ERR23C    55-80    55-84#
ERRC      87-36    87-43     91-9#
ERRCHR    48-49#   102-5*    102-12    102-14    102-16    102-18
ERRD      87-45    91-21#
ERRME1    52-8#    87-41     89-23     92-4
ERRNL     52-4#    102-10
ERRONE    52-3#    102-7
ERRRSZ    89-18    90-12#
ERRRTB    89-21    90-3#     90-12
ERRTRM    75-7     82-14#
EVL       32-10#
F$AU      28-8#
F$AUTO             136-10    136-12
F$BGN     28-8#    28-26     31-16     32-3      55-14     55-18     55-22     55-26     55-30     55-34     55-38     55-42     55-46     55-50
                   55-54     55-58     55-67     55-73     55-87     55-91     55-95     55-99     55-103    55-108    55-112    55-116    55-120    55-124
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            55-128   113-10   114-18   124-5    125-38   126-3    126-10   127-8    133-16   136-10   137-8    137-17   138-3    138-5
            138-11   138-17   138-137  138-138  138-139  139-3    139-14   141-12   142-9    142-9    143-10   144-1    144-3    144-3
            144-11   144-13
FSCLEA      28-8#    137-8    137-15
FSDU        28-8#
FSEND       28-8     28-8     28-8     28-8     28-8     28-8     28-8     28-8     28-8     28-8     28-8     28-8     28-8     28-8
            28-8     28-8     28-8#    28-26    31-16    32-3     55-16    55-20    55-24    55-28    55-32    55-36    55-40    55-44
            55-48    55-52    55-56    55-65    55-71    55-85    55-89    55-93    55-97    55-101   55-106   55-110   55-114   55-118
            55-122   55-126   55-130   113-14   114-21   124-9    125-38   126-3    133-16   135-104  136-12   137-15   137-17   138-3
            138-5    138-5    138-5    138-11   138-17   138-137  138-138  138-138  138-139  139-3    140-6    142-10   143-10   144-1
            144-3    144-11   144-13
FSHARD      28-8#    139-14   140-6    142-2    142-4    142-6    142-8
FSHW        28-8#    30-10    30-17
FSINIT      28-8#    127-8    135-104
FSJMP       28-8#    133-16   138-11   138-17   138-137
FSMOD       28-8#    28-26    31-16    32-3     125-38   126-3    137-17   138-3    138-139  139-3    143-10
FSMSG       28-8#    55-14    55-16    55-18    55-20    55-22    55-24    55-26    55-28    55-30    55-32    55-34    55-36    55-38
            55-40    55-42    55-44    55-46    55-48    55-50    55-52    55-54    55-56    55-58    55-65    55-67    55-71    55-73
            55-85    55-87    55-89    55-91    55-93    55-95    55-97    55-99    55-101   55-103   55-106   55-108   55-110   55-112
            55-114   55-116   55-118   55-120   55-122   55-124   55-126   55-128   55-130
FSPROT      28-8#    126-10   126-16
FSPWR       28-8#
FSRPT       28-8#
FSSEG       28-8#
FSSOFT      28-8#    141-12   142-2    142-4    142-6    142-8    142-10
FSSRV       28-8#    113-10   113-14   114-18   114-21   124-5    124-9
FSSUB       28-8#
FSSW        28-8#    31-10    31-14
FSTEST      28-8#    138-5    138-138
FCTBUF      48-36#   83-25    83-34
FCTNUM      48-37#   64-41*   83-14    83-23*   83-30*
FDATA       48-35#   67-5     68-2     68-9     68-20    69-13*   69-16*
FFREE       48-11#   55-74    58-16    58-20*   60-16*   60-20*   62-13    62-16    67-11    68-16    127-39*  127-40   128-3    133-9
            138-70   138-121*
FILNAM      54-13#   138-19
FILNAQ      51-4#    138-20
FILOPN      48-26#   65-11    65-14*   66-14    66-17*
FMEM        48-13#   60-16    133-9*   138-121
FMEMS       48-14#   60-17    133-10*  138-122
FMERR       57-7#    58-18
FNAME       48-52#   66-16
FNAME2      48-51#   83-21    138-20   138-22
FNUM        48-31#   60-18    60-25*   127-22*
FS          1-4#     1-8      1-10     1-16     27-37    28-34    48-7     50-16    60-1     61-31    64-28    65-1     83-19    127-20
            133-13   137-10   138-21   138-69   138-84   138-94   138-108
FSIZE       48-12#   58-17*   60-17*   60-21*   62-17    127-40*  133-10   138-122*
FWORD       67-4     67-6     68-1     68-3     69-11#
GSCNTO      28-8#
GSDELM      28-8#
GSDISP      28-8#    142-9
GSEXCP      28-8#
GSHILI      28-8#
GSLOLI      28-8#
GSNO        28-8#    138-20   138-34
GSOFFS      28-8#    135-1    138-20   138-34   140-1    140-2    140-3    140-4    140-5    142-1    142-3    142-5    142-7
GSOFSI      28-8#    135-1    138-20   138-34   140-1    140-2    140-3    140-4    140-5    142-1    142-3    142-5    142-7
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GSPRMA  28-8#    140-1    140-2
GSPRMD  28-8#    135-1    138-20   138-34   140-3    140-4    140-5
GSPRML  28-8#    142-1    142-3    142-5    142-7
GSRADA  28-8#    135-1    138-20   138-34
GSRADB  28-8#
GSRADD  28-8#    140-3    140-4    140-5
GSRADL  28-8#    142-1    142-3    142-5    142-7
GSRADO  28-8#    140-1    140-2
GSXFER  28-8#    142-2    142-4    142-6    142-8
GSYES   28-8#    135-1    140-1    140-2    140-3    140-4    140-5    142-1    142-3    142-5    142-7
GETCDN  99-16    99-18    99-28#
GETCNT  88-12    89-9     89-17    89-29    99-13#   100-15
GETCNX  99-15#   99-27
GETCXX  99-29    99-31#
GTDRVL  85-13#   85-16
GTDRVT  78-16    79-16    80-22    85-11#
GTDUST  63-5#    138-81
H.BRL   140-3    140-10#
H.BST   140-4    140-11#
H.LDR   140-5    140-12#
H.UBA   140-1    140-8#
H.VEC   140-2    140-9#
HC.BF1  36-24#   36-25    74-15
HC.BF2  36-25#   36-27    55-147   74-3     74-45
HC.BSZ  36-13#   36-25    36-27    74-18    110-19   110-21
HC.CCT  36-19#   71-41    71-51*   109-19*
HC.CEV  36-22#   36-23    108-18
HC.CMD  36-18#   36-19    36-20    117-25*  117-26*
HC.CPK  36-23#   36-24    55-134   74-33*   106-4*   106-5*   106-6*   106-7*   108-29*  109-17*  110-18*  110-19*  117-26
HC.ESZ  36-11#   36-21    36-23
HC.INT  36-15#   36-16
HC.ISZ  36-9#    36-16    116-21   117-4
HC.MCT  36-17#   74-74*   109-18*
HC.MEV  36-20#   36-21
HC.MPK  36-21#   36-22    55-136   73-9     73-14    73-19    74-11    74-58    74-60    74-65    74-67    74-72    74-73    106-11
        117-24   138-82
HC.MSG  36-16#   36-17    36-18    117-23*  117-24*  118-21
HC.PSZ  36-12#   36-22    36-24    108-19   108-25
HC.RSZ  36-10#   36-18    36-20    116-21   117-4
HC.SIZ  36-27#   59-13
HCOMM   59-13#   63-13
HEADER  80-24    86-13#
HIGHES  49-6#    138-48   138-52
HO.BRL 129-16    130-3    139-22#  140-3    140-3    140-3
HO.BST 129-21    130-9    139-23#  140-4    140-4    140-4
HO.LDR 132-15    132-22   139-24#  140-5    140-5    140-5
HO.UBA 128-25    139-20#  140-1    140-1    140-1
HO.VEC 128-29    129-19   130-6    139-21#  140-2    140-2    140-2
HOE     32-10#
I$AU    28-8#
I$AUTO  28-8#    136-10#  136-12#
I$CLN   28-8#    137-8#   137-15#
I$DU    28-8#
I$HRD  139-14#   140-6#   142-9
I$INIT  28-8#    127-8#   133-16   135-104#
ISINIT  28-8#    127-8#   133-16   135-104#  31-16#  32-3    32-3#   125-38   125-38#  126-3    126-3#   137-17   137-17#  138-3
I$MOD   28-8#    28-26    28-26#   31-16    31-16#   32-3    32-3#   125-38   125-38#  126-3    126-3#   137-17   137-17#  138-3
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              138-3#    138-139   138-139#  139-3     139-3#    143-10    143-10#
I$MSG         28-8#     55-14#    55-16#    55-18#    55-20#    55-22#    55-24#    55-26#    55-28#    55-30#    55-32#    55-34#    55-36#    55-38#
              55-40#    55-42#    55-44#    55-46#    55-48#    55-50#    55-52#    55-54#    55-56#    55-58#    55-65#    55-67#    55-71#    55-73#
              55-85#    55-87#    55-89#    55-91#    55-93#    55-95#    55-97#    55-99#    55-101#   55-103#   55-106#   55-108#   55-110#   55-112#
              55-114#   55-116#   55-118#   55-120#   55-122#   55-124#   55-126#   55-128#   55-130#
I$PROT        28-8#     126-10#
I$PTAB        28-8#     144-3     144-3#    144-11    144-11#
I$PWR         28-8#
I$RPT         28-8#
I$SEG         28-8#     138-5
I$SETU        28-8#     144-1     144-1#    144-3     144-13    144-13#
I$SFT         141-12#   142-9     142-10#
I$SRV         28-8#     113-10#   113-14#   114-18#   114-21#   124-5#    124-9#
I$SUB         28-8#     138-5
I$TST         28-8#     138-5     138-5#    138-11    138-17    138-137   138-138   138-138#  138-138#
IBE           32-10#
IDU           32-10#
IER           32-10#
INFO          75-5      80-15#    81-14     82-14
INFOE         80-18     80-30#
INFOP         80-20     80-25#
INFOX         80-16     80-26#
INIT0         127-11    127-19#
INIT1         127-13    127-15    127-17    127-24#
INIT10        131-10#   131-13
INIT11        131-11    132-3#
INIT12        132-13#   132-19
INIT13        132-14    132-21#
INIT14        131-5     133-3#
INIT15        133-9#
INIT2         127-26    127-29    127-34#
INIT3         127-36    127-38#
INIT4         128-15#   130-17
INIT5         128-21#   128-33
INIT7         129-26#   129-28
INIT8         131-4#    133-5
INITQT        127-18#   127-33
INITXX        133-12#
INMEM         48-32#
IPADRS        49-34#    61-14     128-6     129-4
ISR           32-10#
IXE           32-10#
J$JMP         28-8#
KNO           127-54    127-61#
KW.BRL        48-43#    127-56*   127-59
KW.CSR        48-42#    71-32     86-19     111-22    121-28    124-8*    125-13    127-45*   127-52*   127-55*   127-60*
KW.EL         48-46#    71-34     71-37     111-24    111-27    115-26    115-27    115-28    121-30    121-33    124-6*    124-7*    125-16    125-17
              127-46*   127-47*
KW.HZ         48-45#    115-16    125-18    127-58*
KW.VEC        48-44#    127-57*   127-59
KW11I         124-5#    127-59
KWOUT.        124-8     127-44#   127-60
KYES          127-49    127-51    127-55#
L$ACP         28-34#
L$APT         28-34#
L$AUT         28-34#
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L$AUTO   28-34     136-10#
L$CCP    28-34#
L$CLEA   28-34     137-8#
L$CO     28-34#
L$DEPO   28-34#
L$DESC   28-34     50-17#
L$DESP   28-34#
L$DEVP   28-34#
L$DISP   28-34     29-9#
L$DLY    28-34#
L$DTP    28-34#
L$DTYP   28-34#
L$DUT    28-34#
L$DVTY   28-34     50-12#
L$EF     28-34#
L$ENVI   28-34#
L$ETP    28-34#
L$EXP1   28-34#
L$EXP4   28-34#
L$EXP5   28-34#
L$HARD   28-34     139-14    139-14#
L$HIME   28-34#
L$HPCP   28-34#
L$HPTP   28-34#
L$HW     28-34     30-10     30-10#
L$ICP    28-34#
L$INIT   28-34     127-8#
L$LADP   28-34#
L$LAST   28-34     143-8#    144-13
L$LOAD   28-34#
L$LUN    28-34#    64-24*    71-13*    85-14*
L$MREV   28-34#
L$NAME   28-34#
L$PRIO   28-34#
L$PROT   28-34     126-10#
L$PRT    28-34#
L$REPP   28-34#
L$REV    28-34#
L$SOFT   28-34     141-12    141-12#
L$SPC    28-34#
L$SPCP   28-34#
L$SPTP   28-34#
L$STA    28-34#
L$SW     28-34     31-10     31-10#
L$TEST   28-34#
L$TIML   28-34#
L$UNIT   28-34#    86-13     130-16    133-4     138-14
L10000   30-10     30-17#
L10001   31-10     31-14#
L10002   55-16#
L10003   55-20#
L10004   55-24#
L10005   55-28#
L10006   55-32#
L10007   55-36#
L10010   55-40#
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L10011    55-44#
L10012    55-48#
L10013    55-52#
L10014    55-56#
L10015    55-65#
L10016    55-71#
L10017    55-85#
L10020    55-89#
L10021    55-93#
L10022    55-97#
L10023    55-101#
L10024    55-106#
L10025    55-110#
L10026    55-114#
L10027    55-118#
L10030    55-122#
L10031    55-126#
L10032    55-130#
L10033   113-14#
L10034   114-21#
L10035   124-9#
L10037   133-16    135-104#
L10040   136-12#
L10041   137-15#
L10042   138-11    138-17    138-137   138-138#
L10043   139-14    140-6#
L10044   141-12    142-10#
L10045   144-3#
L10047   144-3     144-11#
LDDM      64-22#    64-39
LDNEXT    64-26     64-30     64-35     64-37#
LOADB    106-2#
LOADDM    64-34     72-30    105-13#
LOADE1   106-12    107-3#
LOADER    63-16    105-23    106-10    107-4#
LOE       32-10#
LOG       36-32#
LOT       32-10#
LPNT     103-6     103-8     103-10    103-12#  125-24    125-28    125-33
LPNTB     55-15     55-19     55-23     55-27    55-31     55-35     55-39     55-43     55-47     55-51     55-55     55-64     55-69     55-74
          55-78     55-84     55-88     55-92    55-96     55-100    55-104    55-117    55-121    55-125    55-129    55-132    55-138    55-145
          55-149    93-5      94-5     103-7#
LPNTF     86-15     87-41     89-23     92-4     103-5#    127-53    135-31    138-19    138-31
LPNTS    103-11#
LPNTX    103-9#
MD.CMP    39-4#
MD.CWB    39-22#
MD.ERR    39-6#
MD.EXP    39-5#
MD.FEU    39-16#
MD.IMF    39-20#
MD.NXU    39-18#
MD.PRI    39-23#
MD.RIP    39-19#
MD.SCH    39-7#
MD.SCL    39-8#
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MD.SEC   39-9#
MD.SEQ   39-14#
MD.SER   39-10#
MD.SPD   39-15#
MD.SSH   39-11#
MD.SWP   39-21#
MD.VOL   39-17#
MD.WBN   39-12#
MD.WBV   39-13#
MESG     80-25    84-13#
MESSG    52-9#    86-15
MLDRER  132-17   134-7#
MODE     48-38#   79-53    79-59    127-34*  138-6     138-12
MON1    135-17#  135-30
MON2    135-19   135-21#
MON3    135-22   135-24#
MON4    135-25   135-27#
MON5    135-28   135-33#
MON6    135-36   135-39#
MONTHS   49-7#   135-16
MSCP     36-31#
MSGPKL   55-149#  55-152
MSGPKT   55-105   55-145#
NCONF    87-38    87-43#
NCONS    87-37#   87-40
NEWTAB  128-22   129-3#
NOCLOC   52-11#  127-53
NULL     48-50#
NXMAD    48-34#   61-10*   61-18    113-12*  118-26*   118-31
NXMI     61-11   113-10#  118-27
NXTTAB  128-16   129-31   130-10   130-15#
O$APTS   28-8#    28-34
O$AU     28-8#    28-34
O$BGNR   28-8#    28-34
O$BGNS   28-8#    28-32#   28-34
O$DU     28-8#    28-34
O$ERRT   28-8#    28-34
O$GNSW   28-8#    28-32#   28-34
O$POIN   28-8#    28-32    28-32#   28-32#   28-32#   28-34
O$SETU   28-8#    28-32#   28-34    143-8
OP.ABO   38-3#
OP.ACC   38-4#
OP.AVA   38-22#
OP.AVL   38-5#
OP.CCD   38-6#
OP.CMP   38-7#
OP.DUP   38-23#
OP.ELP   38-30#
OP.END   38-20#   73-5     73-8     74-58
OP.ERS   38-8#
OP.ESP   38-29#  106-2
OP.FLU   38-9#
OP.GCS   38-10#
OP.GDS   38-27#   71-49    74-58
OP.GSS   38-28#   63-17
OP.GUS   38-11#
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OP.MRD   38-18#
OP.MWR   38-19#   108-21
OP.ONL   38-12#
OP.RD    38-13#
OP.RLC   38-25#
OP.RPL   38-14#
OP.RSD   38-32#   73-8      74-43
OP.SCC   38-15#
OP.SEX   38-21#
OP.SHC   38-24#
OP.SSD   38-31#   73-5      74-13
OP.SUC   38-16#
OP.WR    38-17#
OSTRE    87-35    87-42     87-47#
OSTRNG   87-34#   87-46     95-6      96-6      97-6      103-17
P.BCNT   40-21#   41-9#     74-11     74-33*    106-5*    110-19*
P.BUFF   40-22#
P.CMST   41-14#
P.CNCL   41-48#
P.CNTF   40-40#   41-46#
P.CNTI   41-49#
P.CPSP   40-34#
P.CRF    40-17#   41-4#     73-19     109-17*
P.CTMO   41-47#
P.CYL    41-26#
P.DEXT   41-52#   138-82
P.DFLG   41-53#   74-60
P.DMDT   40-50#
P.DPI    41-54#   74-65     74-67     74-72     74-73
P.DTO    41-55#
P.ELGF   40-32#
P.FBBK   41-10#
P.FLGS   41-7#
P.GRP    41-25#
P.HSTI   40-31#   41-19#    41-35#
P.HTMO   40-41#
P.LBN    40-24#
P.MEDI   41-21#   41-37#
P.MLUN   41-17#   41-33#
P.MOD    40-20#
P.OPCD   40-19#   41-6#     73-9      74-58     108-29*
P.OTRF   40-27#   41-13#
P.OVRL   40-51#   106-6*    106-7*
P.RBN    40-36#
P.RBNS   41-28#
P.RCTC   41-29#
P.RCTS   41-27#
P.RGID   40-46#
P.RGOF   40-47#
P.SHST   41-23#   41-39#
P.SHUN   40-33#   41-22#    41-38#
P.STS    41-8#    73-14     106-11
P.TIME   40-43#
P.TRCK   41-24#
P.UADR   40-23#   106-4*    110-18*
P.UNCL   41-40#
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P.UNFL   40-30#    41-18#    41-34#
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P.UNSZ   41-41#
P.UNTI   41-20#    41-36#
P.USEF   40-42#
P.VRSN   40-39#    41-45#
P.VSER   41-42#
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PF       48-48     102-12#   103-5
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PNTPKT   55-109    55-113    55-132#
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PRI01    32-10#
PRI02    32-10#
PRI03    32-10#
PRI04    32-10#
PRI05    32-10#
PRI06    32-10#
PRI07    28-34     32-10#    61-11     63-9      105-20    118-27
PS       102-18#   103-11
PTYPE    48-48#    93-8*     94-8*     102-11    103-5*    103-7*    103-9*    103-11*
PX       93-8      94-8      102-16#   103-9
QUE0     78-19     78-26#
QUE7     78-21     78-27#
QUEL     78-28#    78-30
QUEST    75-3      78-16#
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RDERR    67-3      70-1#
RDREC    62-14     66-13#
RDST     66-19#    66-23     67-12     68-33     69-6
RDSTS    66-15     66-18#
READDM   60-24     62-13#
README   62-15     62-20#
RESET    60-15     61-9#     127-38    137-13
RESPCT   71-9#     72-4      72-7      72-31
RESPDM   71-7#     72-8      138-119
RG.FLG   36-4#     74-74     109-18
RG.OWN   36-3#     71-51     74-74     109-18    109-19
RNTIM    52-5#     125-24
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RSPDSP   74-26    75-3#     75-9
RSPERR   73-10    74-58#
RSPERW   73-15    73-21#    74-59
RSPIN    71-15    73-5#
RSPMWR   73-7     73-9#
RSPNTO   71-31    71-33     71-36     71-38     71-54#
RSPNXT   71-12    72-3#     72-33     74-57     74-75
RSPOU    73-27#
RSPOU2   74-41    74-50#
RSPOU3   74-48    74-51#
RSPOU4   71-53    74-53#
RSPOUT   71-18    73-27     74-34     74-39#
RSPPT2   74-3#
RSPPT3   74-7     74-11#
RSPPTW   73-20    73-26#
RSPTM    71-24    71-30#
RSPTMO   71-35    71-39#
RSPTOE   71-40    71-42     72-36#    74-61     74-76
RUNDM    64-15#   138-117
RWORDT   68-5     69-1#
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S.FMT    142-1    142-18#
S.NOF    142-9    142-23#
S.NRF    142-3    142-12#
S.RST    142-7    142-20#
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SA.BST   35-23#
SA.CM1   34-32#
SA.CMD   34-27#
SA.CME   34-37#
SA.CNT   35-16#
SA.CTP   34-40#
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SA.ERC   34-13#
SA.ERR   34-9#    55-68     121-19
SA.GO    35-21#   117-20
SA.INE   35-4#
SA.INT   34-25#
SA.LFC   35-22#
SA.MCV   35-15#   120-38
SA.MS1   34-31#
SA.MSE   34-36#
SA.MSG   34-26#
SA.NV    34-17#
SA.NVE   35-5#
SA.PRG   34-44#
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SA.S2    34-6#   120-23
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SA.S4    34-8#   119-13   120-38
SA.STE   34-39#
SA.STP   34-29#  118-18
SA.TST   35-11#  120-8
SA.VCE   35-3#
SA.VEC   34-24#
SA.WRP   34-28#
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SAMVEC  128-31   134-19#
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SERNUM   52-18#  138-31
SERNX    54-11#  138-52
SETOO   115-17#  115-22
SETO1   115-18   115-20#
SETC2   115-26#  115-29
SETTO    74-56   111-15   115-14#  121-23
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SO.FM2  141-20#  141-21   142-3
SO.FMT   79-53   127-24   138-6    141-21#
SO.STR   79-59   127-31   138-12   141-23#  142-7
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SPECLC   83-18#
SPECLE   83-27   83-33#
SPECLL   83-26#  83-29
SPECLR   83-16   83-24#
SPECLX   83-15   83-34#
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ST.DIA   42-17#
ST.DRV   42-16#
ST.HST   42-14#
ST.MFE   42-10#
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ST.SUB   42-4#
ST.SUC   42-5#
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          55-44    55-48    55-48    55-48    55-52    55-52    55-52    55-56    55-56    55-56    55-65    55-65    55-65    55-71
          55-71    55-71    55-85    55-85    55-85    55-89    55-89    55-89    55-93    55-93    55-93    55-97    55-97    55-97
          55-101   55-101   55-101   55-106   55-106   55-106   55-110   55-110   55-110   55-114   55-114   55-118   55-118
          55-118   55-122   55-122   55-122   55-126   55-126   55-126   55-130   55-130   55-130   56-5#    113-14   114-21   124-9
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          55-87#   55-89    55-91#   55-93    55-95#   55-97    55-99#   55-101   55-103#  55-106   55-108#  55-110   55-112#  55-114
          55-116#  55-118   55-120#  55-122   55-124#  55-126   55-128#  55-130
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        102-14#  102-14#  102-16   102-16   102-16   102-16#  102-16#  102-18   102-18   102-18   102-18#  102-18#  138-52   138-52
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        142-7    142-7#   142-7#   142-7#   142-8    142-8    142-8    142-8    142-8    142-8    142-8#   142-8#   142-8#   142-8#
        142-9    142-9#

T$ERRN  28-8#    57-7     57-7#    61-28    61-28#   62-20    62-20#   70-6     70-6#    71-25    71-25#   72-36    72-36#   73-21
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T$EXCP  135-1    135-1#   138-20   138-20#  138-34   138-34#  140-1    140-1#   140-2    140-2#   140-3    140-3#   140-4    140-4#
        140-5    140-5#

T$FLAG  133-16   133-16   133-16#  133-16#  138-11   138-11   138-11#  138-11#  138-17   138-17   138-17#  138-17#  138-137  138-137
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T$FREE  143-8    144-13#

T$GMAN  28-8#    135-1    135-1#   135-1#   138-20   138-20#  138-20#  138-34   138-34#  138-34#

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        140-5    140-5#

T$LAST  28-8#    143-8#   144-1

T$LOLI  135-1    135-1#   138-20   138-20#  138-34   138-34#  140-1    140-1#   140-2    140-2#   140-3    140-3#   140-4    140-4#
        140-5    140-5#

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        55-56    55-65    55-71    55-85    55-89    55-93    55-97    55-101   55-106   55-110   55-114   55-118   55-122   55-126
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        55-24    55-24    55-24    55-24#   55-26    55-26    55-26#   55-28    55-28    55-28    55-28#   55-30    55-30    55-30#
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        55-89    55-89    55-89    55-89#   55-91    55-91    55-91#   55-93    55-93    55-93    55-93#   55-95    55-95    55-95#
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        55-106   55-106   55-106   55-106#  55-108   55-108   55-108#  55-110   55-110   55-110   55-110#  55-112   55-112   55-112#
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          55-108#  55-110   55-112#  55-114   55-116#  55-118   55-120#  55-122   55-124#  55-126   55-128#  55-130   113-10#  113-14
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          55-58#   55-67    55-67    55-67#   55-73    55-73    55-73#   55-87    55-87    55-87#   55-91    55-91    55-91#   55-95
          55-95    55-95#   55-99    55-99    55-99#   55-103   55-103   55-103#  55-108   55-108   55-108#  55-112   55-112   55-112#
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          136-10   136-10#  137-8    137-8    137-8#   138-5    138-5    138-5#   139-14   139-14   139-14#  141-12   141-12   141-12#
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          55-85    55-85#   55-89    55-89#   55-93    55-93#   55-97    55-97#   55-101   55-101#  55-106   55-106#  55-110   55-110#
          55-114   55-114#  55-118   55-118#  55-122   55-122#  55-126   55-126#  55-130   55-130#  57-7     57-7#    57-7#    57-8
          57-8#    61-11    61-11#   61-12    61-12#   61-22    61-22#   61-28    61-28#   61-28#   61-30    61-30#   62-20    62-20#
          62-20#   62-21    62-21#   63-9     63-9#    65-13    65-13#   66-16    66-16#   66-19    66-19#   66-21    66-21#   66-26
          66-26#   67-7     67-7#    68-23    68-23#   68-30    68-30#   69-1     69-1#    69-11    69-11#   69-14    69-14#   70-6
          70-6#    70-6#    70-7     70-7#    71-9     71-9#    71-25    71-25#   71-25#   72-36    72-36#   72-36#   73-21    73-21#
          73-21#   74-8     74-8#    74-8#    78-22    78-22#   78-22#   80-30    80-30#   80-30#   83-20    83-20#   83-21    83-21#
          83-26    83-26#   102-12   102-12#  102-14   102-14#  102-16   102-16#  102-18   102-18#  105-20   105-20#  107-3    107-3#
          107-3#   111-21   111-21#  111-29   111-29#  111-29#  112-5    112-5#   112-5#   116-35   116-35#  116-35#  117-11   117-11#
          117-11#  118-12   118-12#  118-27   118-27#  118-30   118-30#  118-33   118-33#  118-33#  120-44   120-44#  120-44#  121-27
          121-27#  121-36   121-36#  121-36#  122-5    122-5#   122-5#   127-10   127-10#  127-12   127-12#  127-14   127-14#  127-16
          127-16#  127-18   127-18#  127-39   127-39#  127-48   127-48#  127-50   127-50#  127-59   127-59#  128-15   128-15#  131-4
          131-4#   133-12   133-12#  133-14   133-14#  133-16   133-16#  134-3    134-3#   134-3#   134-4    134-4#   134-8    134-8#
          134-8#   134-9    134-9#   134-14   134-14#  134-14#  134-15   134-15#  134-20   134-20#  134-20#  134-21   134-21#  135-1
          135-1#   135-104  135-104# 136-12   136-12#  137-11   137-11#  137-15   137-15#  138-8    138-8#   138-10   138-10#  138-10#
          138-11   138-11#  138-16   138-16#  138-16#  138-17   138-17#  138-20   138-20#  138-22   138-22#  138-34   138-34#  138-52
          138-52#  138-137  138-137# 138-138  138-138#
MSWORD    28-34    28-34#   29-9     29-9     29-9#    57-7     57-7     57-7     57-7#    61-28    61-28    61-28    61-28#   62-20
          62-20    62-20    62-20#   70-6     70-6     70-6     70-6#    71-25    71-25    71-25    71-25#   72-36    72-36    72-36
          72-36#   73-21    73-21    73-21    73-21#   74-8     74-8     74-8     74-8#    78-22    78-22    78-22    78-22#   80-30
          80-30    80-30    80-30#   107-3    107-3    107-3    107-3#   111-29   111-29   111-29   111-29#  112-5    112-5    112-5
          112-5#   116-35   116-35   116-35   116-35#  117-11   117-11   117-11   117-11#  118-33   118-33   118-33   118-33#  120-44
          120-44   120-44   120-44#  121-36   121-36   121-36   134-8    134-8    134-8#   134-14   134-14   134-14   134-14#  134-20
          134-3    134-3#   134-8    134-8    134-8    134-8#   134-14   134-14   134-14   134-14#  134-20   134-20   134-20   134-20#
          135-1    135-1    135-1#   135-1#   138-10   138-10   138-10   138-10#  138-11#  138-16   138-16   138-16   138-16#  138-17#
          138-20   138-20   138-20#  138-20#  138-34   138-34   138-34#  138-34#  138-137# 140-1    140-1#   140-2    140-2#   140-3
          140-3#   140-4    140-4#   140-5    140-5#   142-1    142-1#   142-2    142-2#   142-3    142-3#   142-4    142-4#   142-5
          142-5#   142-6    142-6#   142-7    142-7#   142-8    142-8#   142-9    142-9    142-9#   144-3    144-3#
MSXFER    142-2    142-2#   142-4    142-4#   142-6    142-6#   142-8    142-8#
MANUAL    138-8
MEMORY    127-39
OPEN      66-16    83-21    138-22
OR        45-9#
PNT       47-20#   125-24   125-28   125-33
PNT...    46-21#   55-15    55-19    55-23    55-27    55-31    55-35    55-39    55-43    55-47    55-51    55-55    55-64    55-69
          55-74    55-78    55-84    55-88    55-92    55-96    55-100   55-104   55-117   55-121   55-125   55-129   55-132   55-138
          55-145   55-149   86-15    87-41    89-23    92-4     93-5     94-5     125-24   125-28   125-33   127-53   135-31   138-19
          138-31
PNTB      47-11#   55-15    55-19    55-23    55-27    55-31    55-35    55-39    55-43    55-47    55-51    55-55    55-64    55-69
          55-74    55-78    55-84    55-88    55-92    55-96    55-100   55-104   55-117   55-121   55-125   55-129   55-132   55-138
          55-145   55-149   93-5     94-5
PNTF      47-8#    86-15    87-41    89-23    92-4     127-53   135-31   138-19   138-31
PNTS      47-17#
PNTX      47-14#
POINTE    28-32
POP       45-23#   58-21    61-23    69-7     70-2     79-44    79-49    85-17    89-24    95-7     96-7     97-7     99-31    101-17
          101-25   102-19   103-18   104-28   108-29   108-30   109-22   110-25   111-30   112-2    112-6    114-20   115-41   119-19
          121-24   125-29   125-34
PRINT     46-8#    84-13    84-18    86-21    88-6     88-13    89-10    89-30    93-7     94-7     101-13   101-22   125-27   125-32
          125-35
PRINTB    102-14
```

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PRINTF 102-12    138-52
PRINTS 102-18
PRINTX  55-70    102-16
PUSH    45-15#   58-16    61-9     66-13    79-33    79-39    85-11    95-4     96-4     97-4     99-13    100-16   100-22   100-40
        102-6    103-12   103-16   104-16   108-15   109-14   110-16   111-11   115-14   118-13   121-18   125-15   125-22
READEF 127-10    127-12   127-14   127-16
SETPRI 133-12
SETVEC  61-11    63-9     105-20   118-27   127-59
SVC     28-7#    28-8
TABLE   33-20#   43-10    44-7     139-18   141-16
XFER   133-16#   138-11#  138-17#  138-137#
XFERT  142-2     142-4    142-6    142-8
```