

Addendum To
STAND-ALONE
OPERATING
SYSTEM
User's Manual

086-000022-01

Ordering No. 086-000022

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Printed in the United States of America

Rev. 01, April 1975

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Original Release - April 1975

This addendum, 086-000022-01, updates the Stand-Alone Operating System User's Manual, 093-000062-04.
Double bars on the outside margin of each page indicate areas of change from the original manual.

STAND-ALONE OPERATING SYSTEM User's Manual

093-000062-04

Ordering No. 093-000062

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Rev. 04, July 1974

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Original Release - October 1971
First Revision - July 1972
Second Revision - February 1973
Third Revision - June 1973
Fourth Revision - July 1974
Addendum - March 1975 (not released)
Addendum - April 1975

This revision of the Stand-Alone Operating System User's Manual, 093-000062-04 and its addendum, 086-000022-01, supersedes 093-000062-03 and constitutes a major revision to the manual. A chapter on CLI commands has been added and the system utility programs are described in greater detail in this revision. Double bars on the outside of each page indicate areas of change from the parent manual, 093-000062-04.

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CHAPTER 2

SOS FILES AND DEVICES

SOS files may reside on any SOS device; these devices include magnetic tape units, high speed paper tape reader, high speed paper tape punch, teletypewriter keyboard, etc. In this sense, the terms file and device are interchangeable in the SOS environment. Files are "read from" and "written to", devices are also "read from" and "written to". In the case of magnetic and cassette tapes however, the term file is slightly more encompassing:

The tape unit or device may contain several files. For example, cassette unit 1 may contain the files CT1:0, CT1:1, CT1:2 and CT1:3.

Cassette and magnetic tape units are the only devices upon which more than one file may reside at the same time. The expression file/device which occurs throughout the remainder of this manual denotes this distinction.

SPECIFYING SOS DEVICES

In a Standard SOS environment, a device is "opened" by passing its fixed SOS Channel Number to the operating system. Under RDOS-SOS, a device is "opened" by passing its filename and an RDOS Channel Number (0-76₈) to the operating system; the system then translates that name into the appropriate SOS Channel Number in order to complete the "open". The RDOS Channel Number that is passed is only assigned to that device for the duration of the "open". The SOS Channel Numbers are always assigned to the same devices however. The list of SOS devices by name and by SOS Channel Number is shown in Table 2-1.

SPECIFYING SOS DEVICES (Continued)

<u>Device Name</u>	<u>Fixed Channel No.</u>	<u>Device Name</u>	<u>Fixed Channel No.</u>
TTI1	5	MT3	23
\$PLT	6	MT4	24
TTO1	7	MT5	25
\$TTP	10	MT6	26
\$CDR	11	MT7	27
\$TTO	12	CT0	30
\$TTI	13	CT1	31
\$LPT	14	CT2	32
\$PTR	15	CT3	33
\$PTP	16	CT4	34
\$TTR	17	CT5	35
MT0	20	CT6	36
MT1	21	CT7	37
MT2	22		

Table 2-1. SOS Devices

The device names are the same as those recognized by RDOS. TTI1 and TTO1 refer to a second Teletype® * which uses device codes 50₈ and 51₈. The other names are self-explanatory. All SOS Utilities recognize devices by the names shown in the table.

LOADING SOS ROUTINES AND DEVICE DRIVERS

In order to select any program in the SOS Libraries for loading, an ENTRY symbol (.ENT) in the desired program must resolve an EXTERNAL (.EXTN or .EXTD) symbol declared in a previously loaded program. Programmers using the SOS or Stand-alone RLDR must use .EXTN. It is the user's responsibility to supply these EXTERNAL declarations to the Relocatable Loader before the SOS Libraries are provided as input to the loader. Each separately assembled program in the SOS Libraries has one or more ENTRY symbols associated with it. Many of these programs also have EXTERNAL declarations which select successive library programs for loading, once they themselves are loaded. For example, the SOS Magnetic Tape Library contains 8 separate programs: a control table and I/O buffer for units 1-7 plus a control table, I/O buffer and

*Teletype is a registered trademark of Teletype Corporation, Skokie, Illinois.

LOADING SOS ROUTINES AND DEVICE DRIVERS (Continued)

device driver (which controls from 1-8 units) for unit 0. In order to load the necessary programs to support 8 units, only one EXTERNAL declaration need be specified however. That program will then cause the loading of each subsequent program in the library.

The complete set of necessary EXTERNAL declarations in relocatable binary format is called a trigger. Triggers are produced in two ways:

- (1) By assembling a source program of the form:

```
.TITLE    TRIGGER
.EXTN     A,B,C,...
.END
```

where A,B,C,... are the symbols that are ENTRY points in the desired routines in the SOS Libraries.

- (2) By using the SYSGEN program to produce the relocatable binary file directly. In the above example, the SYSGEN command line shown below would produce an equivalent file on the high speed punch.

```
(SYSG) TRIGG/T $PTP/O A B C ... )
```

Table 2-2 lists the necessary EXTERNAL NORMAL declarations in order to select any SOS Library program for loading.

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CASSETTE AND MAGNETIC TAPE FILES (Continued)

Physical Characteristics of Cassette and Magnetic Tapes (Continued)

Since consecutive EOF marks always mark the end of the tape to SOS, overwriting or rewriting a file makes any files which used to follow this file inaccessible. For example, if file 3 were overwritten on a tape containing 13 files (files 0-12), files 4 through 12 would become inaccessible and an attempt to reference any file greater than 3 would result in a FILE NON-EXISTENT error.

System commands described in later chapters are used to initialize a tape drive and release a tape drive. The CLI "INIT" command causes a tape on that drive to be rewound and initialized. Full initialization (INIT/F) causes the tape to be rewound and two EOF's to be written. An INIT/F should be performed on all blank (new) magnetic tapes and cassettes before using them. The RELEASE command causes the tape to be rewound and then released from the system.

If a parity error is detected during reading, the system attempts to reread data ten times before issuing a FILE DATA error. If an error is detected after writing, the system will attempt to backspace, erase and rewrite ten times. If the rewrite is unsuccessful after ten times, a FILE DATA error is returned.

Opening Magnetic Tape and Cassette Files

A cassette or magnetic tape file is opened using the .OPEN command (see page 4-8). When performing an .OPEN command under RDOS-SOS, AC0 must contain a byte pointer to the unit name/file number. The string for the pointer has the format:

MTn:dd

where: n is the unit number (0-7) of the magnetic tape unit.

dd is the file number (0-99).

Either a one-digit or two-digit number may be used to reference file numbers 0-9. File number 8 on unit 2 could be referenced as:

MT2:08 or MT2:8

CT2:08 or CT2:8

CASSETTE AND MAGNETIC TAPE FILES (Continued)

Opening Magnetic Tape and Cassette Files (Continued)

An example of this would be:

```
          LDA 0, FILE8           ;LINKS THE FILE
          .SYSTM
          .OPEN 3                ;SPECIFY CHANNEL (0-76 OCTAL)
          error return
          normal return
FILE8:   .+ 1*2
          .TXT *MT2:08*         ;FILE
```

Thus, channel number 3 is linked to the file (MT2:8) as specified by the byte pointer. Once the file has been opened, the file is then referenced by channel number 3.

Under Standard SOS, the fixed channel number is given in the .OPEN command (20-27 for magnetic tapes and 30-37 for cassette units). AC0 contains the file number, which in this case can be any positive number from 0-99₁₀. For example:

```
          LDA 0, FILE8
          .SYSTM
          .OPEN 22              ;MT2
          error return
          normal return
FILE8:   8.                    ;FILE NUMBER
```

or

SYSTEM CONSOLE BREAKS (Continued)

The SOS Editor treats the CTRL A break somewhat differently. If the break is entered while one of the following Editor commands is in progress:

T, Y, N, E, or P

then the operation is terminated and the program restarts with I/O reset but with the input buffer intact. If this break is entered at some other time while the Editor is executing, it is ignored.

Pressing CTRL and C on a console keyboard causes an immediate transfer to the Core Image Loader program (and is consequently ignored by all non-cassette or magnetic tape utilities). This program issues its prompt message (#) and waits for the user to specify the next program to be loaded. It is very convenient when executing from a master reel (see Chapter 5) to use this feature to swap the utilities in and out of core. All program activity terminates immediately when this break is entered. All appropriately configured SOS utilities except the Editor treat the CTRL C break in this manner.

The SOS Editor ignores this break however. To return to the Core Image Loader from this utility, the "H" command must be issued.

The section on the User Status Table, page 4-30, describes the means available for employing these breaks by user programs.

CORE IMAGE LOADER/WRITER

The core image loader/writer is a utility program that performs two functions: it loads core image files from cassette or magnetic tape into core and produces core image or save files on cassette or magnetic tape from the contents of core. There are two versions of the core image loader/writer -- one for use with cassette drives and another for use with magnetic tape drives. The cassette version works only with cassettes and the magnetic tape version works only with magnetic tape. Both versions when loaded occupy the last 400₈ locations in core.

Installation Procedure

The absolute binary version of the Core Image Loader/Writer, when loaded into core, permits the user to install it on unit 0, file 0 of the appropriate tape. The program types the message

LOAD UNIT 0: STRIKE ANY KEY

at the system console. When a tape reel that is not write protected is mounted on unit 0 and the unit is ready, the user may depress any teletype key. The program then writes the appropriate subset of itself to file 0 of that unit. When this write operation is complete, the message

LOADER INSTALLED

is typed at the system console and the program HALTs. This tape reel is now usable for the Bootstrap Procedure described below. The Installation Procedure may be repeated; depress the CONTINUE switch on the master console and the LOAD UNIT 0: STRIKE ANY KEY message will be issued. A new tape reel may be mounted on unit 0, or the unit assignments changed and the procedure repeated.

Bootstrap Procedure

The core image loader/writer can be bootstrap-loaded from file 0 of the master cassette or magnetic tape reel. The master reel must be installed on cassette or magnetic tape unit 0 and the drive must be rewound manually. This can be done by pressing the REWIND button on the drive unit.

For machines without the Program Load option, deposit the starting address into location 376₈, and deposit 000377 into location 377₈. The starting address is:

060134 - cassette units
060122 - magnetic tape units

Set address switches to 376₈. Press RESE T and then START.

Bootstrap Procedure (Continued)

For machines with the Program Load option, set the data switches on the console to 100034 (for cassette units) or 100022 (for magnetic tape units), press RESET then PROGRAM LOAD.

The core image loader/writer is read into page zero initially and then relocates itself to the high end of memory. At the end of the relocation process, the loader outputs a prompt (#) on the teletype. This prompt indicates that the core image loader is ready to accept a command. Whenever the core image loader/writer is resident in core, the core image loader may be restarted by setting the data switches to the address of the last location in memory, pressing RESET, and then pressing START. The core image writer can be started by setting the data switches to the address of the next to last location in core, pressing RESET and then pressing START.

Core Image Loader Operation

Having issued the # prompt on the teletype, the core image loader waits for an operator response of a device number (0-7) and a file number (0-99) separated by a colon. Device 0 need not be specified. For example:

#2:7) (unit 2, file 7)
#4) (unit 0, file 4)

The indicated cassette or magnetic tape file is loaded from the specified device into memory, starting at the address specified in location 2. If the A key is struck instead of the carriage return after the unit and file entry, the loader will halt after loading is complete. For example:

#1:2A

causes file 2 of unit 1 to be read into core followed by a HALT.

The Core Image Loader always sets the UST CTRL C break location (USTBR) to point to itself after it loads a program. The loaded program may then ignore, disable, or change this location. (See User Status Table, page 4-20)

If the core image loader encounters a non-recoverable error while trying to load a core image file, it will type

*ERR

and halt with the cassette or magnetic tape status word in AC0. The following list describes the error conditions assigned to each bit in the status word.

Core Image Loader Operation (Continued)

<u>BIT</u>	<u>MEANING</u>
1	Data late (perhaps due to a long indirect access chain or a faster device preempting the channel.
3	Illegal command
5	Lateral parity error in a word
6	Addressed tape is beyond the EOT marker
8	Addressed tape is at load point
10	Bad tape (e. g. , data is found in an interrecord gap)
13	Unit is write locked
14	Odd number of bytes detected in a read or write attempt

If rewinding and substituting a fresh cassette or magnetic tape does not cure an error condition, a hardware malfunction is indicated; run the appropriate diagnostic program.

Core Image Writer Operation

The core image writer operates in a manner similar to that of the core image loader. When the core image writer is started (see page 3-5), it outputs a # prompt and waits for specification of a device number and a file number separated by a colon. Unit 0 need not be specified. After the file has been specified, the core image writer will request specification of the upper core address (NMAX) to be written onto tape. It does this by typing:

NMAX:

on the teletypewriter. The operator must then respond with the highest core address (in octal) whose contents he wants written into the core image cassette or magnetic tape file. Upon detection of a non-recoverable error, the core image writer proceeds in the same way as the core image loader. After completing a successful write, the program types OK and HALTS.

CLI Commands

This section contains definitions and descriptions of each of the CLI commands. The commands are listed in alphabetical order at the bottom of the page and described in that order on pages following.

The following conventions are used to define individual CLI command formats:

All upper case letters represent valid command line elements.

Items in a command line printed in lower case indicate either command information or file names which must be supplied in the command line.

Elements enclosed in modified brackets, { }, are optional. Stacked items indicate alternate choices.

The ellipsis (...) is used to indicate that preceding file types or bracketed material may be repeated if desired.

The comma (,), and right slash (/) are significant and necessary parts of any command line definition in which they are found.

APPEND	-	Concatenate two or more files.
BOOT	-	Invoke a utility program or load any file.
BPUNCH	-	Copy a binary file on \$PTP.
COPY	-	Copy a cassette or magnetic tape reel.
DEB	-	Start a program about to be executed in the Debugger.
DUMP	-	Produce a dump format file.
FILCOM	-	Compare two files.
GTOD	-	Get time and date.
INIT	-	Initialize cassette or magnetic tape.
LOAD	-	Reload dumped files.
MKABS	-	Make an absolute binary file from a core image or save file.
MKSAVE	-	Make a save file from an absolute binary file.
PRINT	-	Print an ASCII file on the line printer.
PUNCH	-	Copy an ASCII file on the \$PTP.
RELEASE	-	Release cassette or magnetic tape.
SDAY	-	Set today's date.
STOD	-	Set the time.
TYPE	-	Output the contents of an ASCII file on the system console.
XFER	-	Copy a file to another file.

CLI Commands (Continued)

Name: APPEND

Format: APPEND newfilename oldfilename₁... oldfilename_n }

Purpose: To create a new file, consisting of a concatenation of one or more old files in the order in which their names are listed as arguments. The old files are not changed by the command.

Switches: None.

Examples: APPEND MT0:0 CT1:1 CT1:2 CT1:3 CT1:4)

causes creation of the file MT0:0 containing the contents of files CT1:1 CT1:2 CT1:3 CT1:4 in that order.

APPEND CT0:0 CT1:2 MT1:0 CT1:1 \$PTR)

causes creation of the file CT0:0 containing the files CT1:2, MT1:0, CT1:1 and the paper tape reader.

Note: The same device cannot be used for both input and output files. If it is, an incorrect file number may be written to a block within a tape file. Attempts to reference these files will result in the error message: FILE READ ERROR. Since SOS backs up or spaces forward depending upon the file number read within the last block accessed, attempts to reference other files physically before the incorrectly written file will be erroneous. To recover, manually rewind the tape and bootstrap the CILW. The input file has probably been destroyed.

CLI Commands (Continued)

Name: BOOT

Format: BOOT filename

Purpose: To invoke a utility program or any executable file. To boot a utility program the following are used:

Mnemonics: ASM - load the Assembler
EDIT - load the Text Editor
FORT - load the FORTRAN IV Compiler
LFE - load the Library File Editor
RLDR - load the Relocatable Loader
SYSG - load SYSGEN
CLI - load the Command Line Interpreter

Switches:

Local: /A - causes the Core Image Loader to HALT instead of starting the program after it is loaded.

Examples: BOOT EDIT)

loads and starts the Editor from a master reel.

BOOT RLDR/A)

loads the Relocatable Loader from a master reel and HALTs.

BOOT \$TTR)

LOAD \$TTR, STRIKE ANY KEY

loads an absolute binary tape from the teletypewriter reader.

BOOT CT1:2/A)

causes file 2 on cassette unit 1 to be loaded and HALTs.

CLI Commands (Continued)

Name: BPUNCH

Format: BPUNCH filename₁ { filename₂ ... }

Purpose: To punch a given file or files in binary on the high speed punch. The command is the equivalent of a series of XFER commands:

XFER filename₁ \$PTP;... ;XFER filename_n \$PTP)

The files may come from any input device.

Switches: None.

Examples: BPUNCH MT0:0 MT0:1 CT0:3 \$PTR)

causes files MT0:0, MT0:1, CT0:3, and \$PTR to be punched on the high speed punch.

BPUNCH \$PTR)

causes a duplicate of the paper tape in the high speed reader to be punched.

Library File Editor (Continued)

Examples: T \$PTR
(Continued)

causes the titles of all logical records in the library file mounted in the high speed reader to be printed on the teletypewriter printer by default.

X \$PTR/I \$PTP/O ABC

causes logical record ABC to be extracted from its library file, which is input on the high speed reader. Record ABC is a binary punched on the high speed punch.

Open a File (.OPEN, .EOPEN, or .ROPEN) (Continued)

The format of the .OPEN command is:

```
.SYSTEM  
.OPEN n ;OPEN CHANNEL n  
error return  
normal return
```

Possible errors resulting from .OPEN commands are:

<u>AC2</u>	<u>Mnemonic</u>	<u>Meaning</u>
0	ERFNO	Illegal channel number.
12	ERDLE	File does not exist.
21	ERUFT	Attempt to use channel already in use.
31	ERSEL	Unit improperly selected.

Get the Number of a Free Channel (.GCHN)

This call enables the user to obtain the number of a channel that is currently unused, if any, so that a file may be opened on this channel via one of the file open calls. .GCHN does not open a file on a free channel; it merely indicates a channel that is free at the moment. RDOS-SOS returns the lowest available channel number in the range 0-76. This command is illegal when running under Standard SOS.

The format of this call is:

```
.SYSTEM  
.GCHN  
error return  
normal return
```

Upon a normal return, the information is returned in AC2:

```
AC2      -      Free channel number
```

One possible error return may occur.

<u>AC2</u>	<u>Mnemonic</u>	<u>Meaning</u>
21	ERUFT	No channels are free.

Close a File (.CLOSE)

After use, files may be closed to insure an orderly ending sequence. The channel number is then available for other I/O. The format of the .CLOSE command is:

```
.SYSTEM
.CLOSE n           ;CLOSE CHANNEL n
error return
normal return
```

If the file closed requires trailer (such as the high speed punch) it will be output on the .CLOSE.

Possible errors resulting from a .CLOSE command are:

<u>AC2</u>	<u>Mnemonic</u>	<u>Meaning</u>
0	ERFNO	Illegal number.
15	ERFOP	Attempt to reference a channel not in use.

Close all Files (.RESET)

This command causes all currently open files to be closed. The command also insures that any partially filled buffers are written before the file is closed. The format of the .RESET command is:

```
.SYSTEM
.RESET
error return
normal return
```

The error return from this command is never taken.

Read a Line (.RDL)

This command causes an ASCII line, written with even parity, to be read. AC0 must contain a byte pointer to the starting byte address within the user area into which the line will be read. This area should be 133 bytes long.

Reading will terminate normally after transmitting either a carriage return, form feed, or null to the user. Reading will terminate abnormally after transmission of 132 (decimal) characters without detecting a carriage return, form feed, or null as the 133rd character, upon detection of a parity error, or upon an end-of-file (CTRL Z).

Get Today's Date (.GDAY) (Continued)

.SYSTEM
.GDAY
error return
normal return

No error return is possible.

Set Today's Date (.SDAY)

This command permits the setting of the system calendar to a specific date. The user passes the number of the month in AC1 (January is month number 1), the number of the day within the month in AC0 and the number of the current year -- less 1968--in AC2. This is the date that is unconditionally returned to the .GDAY command. It is not incremented when the time of day clock overflows. The format of the .SDAY command is:

.SYSTEM
.SDAY
error return
normal return

One possible error message is:

<u>AC2</u>	<u>Mnemonic</u>	<u>Meaning</u>
41	ERTIM	Illegal day, month, or year.

Note that there is no checking for invalid dates such as 9/31 or 2/30.

Delay the Execution of a Task (.DELAY)

The calling program is suspended for the number of real-time clock pulses indicated by AC1. The real-time clock frequency was specified at load time (see .GHRZ).

The format of this command is:

AC1 - Number of RTC pulses

.SYSTEM
.DELAY
error return
normal return

The error return is never taken. A "JMP ." instruction within the system is executed until this period elapses.

Examine the System Real Time Clock (.GHRZ)

This system call permits the user to examine the Real Time Clock frequency. The frequency is returned in AC0, in the following manner:

<u>AC0</u>	<u>Meaning</u>
0	There is no Real Time Clock in the system.
1	Frequency is 10 HZ.
2	Frequency is 100 HZ.
3	Frequency is 1000 HZ.
4	Frequency is 60 HZ (line frequency)
5	Frequency is 50 HZ (line frequency)

The format of this call is:

.SYSTEM
.GHRZ
error return
normal return

The error return is never taken.

SERVICING USER INTERRUPTS

There are several considerations which must be made by any user wishing to service device interrupt requests. See Appendix A - Adding User Supplied Device Handlers.

Identify a User Interrupt (.IDEF)

In order to introduce to the system those devices (not identified at LOAD time) whose interrupts the system is to recognize, the system call .IDEF must be issued. This adds an entry to the SOS Interrupt Search List (See Appendix A). AC0 contains the device code of the new device. AC1 contains the address of the new device's DCT. If the device code that is passed is 77g, then AC1 contains the address to which the system passes control whenever it detects a power-fail interrupt. The format of the command is:

.SYSTEM
.IDEF
error return
normal return

Identify a User Interrupt (Continued)

Possible error messages are:

<u>AC2</u>	<u>Mnemonic</u>	<u>Meaning</u>
36	ERDNM	Illegal device code(>77 ₈). Device code 77 ₈ is reserved for power monitor/auto restart option.
45	ERIBS	Interrupt device code in use.

Remove User Interrupt Servicing Program (.IRMV)

To prevent the system's recognition of user interrupts which have been previously identified by the .IDEF command, the .IRMV command must be issued. AC0 contains the user device code which is to be removed from the system's recognition. The format of the .IRMV command is:

```
.SYSTEM
.IRMV
error return
normal return
```

One possible error message may be given:

<u>AC2</u>	<u>Mnemonic</u>	<u>Meaning</u>
36	ERDNM	Illegal device code (>77 ₈).

ERROR MESSAGES

<u>Code</u>	<u>Mnemonic</u>	<u>Meaning</u>	<u>Applicable Commands</u>
0	ERFNO	Illegal channel number.	. OPEN . EOPEN . ROPEN . GTATR . RDL . RDS . WRL . WRS
2	ERICM	Illegal system command.	- - -
3	ERICD	Illegal command for device.	. RDL . RDS . WRL . WRS
6	EREOF	End of file.	. RDL . RDS
7	ERRPR	Attempt to read a read-protected file.	. RDL . RDS
10	ERWPR	Attempt to write a write-protected file.	. WRL . WRS
12	ERDLE	Attempt to reference a non-existent file	. OPEN . EOPEN . ROPEN
15	ERFOP	Attempt to reference a file not opened	. GTATR . CLOSE . RDL . RDS . WRL . WRS

DEVICE RESPONSE TO SOS COMMANDS (Continued)

\$PTR

- . OPEN Device is initialized; a prompt message is written and a response is necessary for the program to continue.
- . CLOSE Device is reinitialized.
- . RDS The specified bytes are read into the user area from the device, unedited.
- . RDL The ASCII string is read into the user area from the device. Rubouts and line feeds are ignored.

\$PTP

- . OPEN Device is initialized; leader is punched.
- . CLOSE Device is reinitialized after outstanding I/O is complete; trailer is punched.
- . WRS The specified bytes are output to the device, unedited.
- . WRL The ASCII string is output to the device with rubouts inserted after tabs, a line feed after a carriage return, and nulls after a form feed.

MTA

(See Chapter 2, SOS Cassette and Magnetic Tape Files.)

- . OPEN Device is initialized; the specified file is located on the tape reel, and the read/write head positioned to the file mark preceding. ||
- . CLOSE Device is reinitialized. Following write operations, the last partial block is output to the file (padded with nulls if necessary) and two end of files marks are written.
- . RDS The specified bytes are read into the user area from the file, unedited.
- . RDL The ASCII string is read into the user area from the file. Rubouts and line feeds are ignored.
- . WRS The specified bytes are output to the file, unedited.
- . WRL The ASCII string is output to the file.

USER STATUS TABLE

The User Status Table (UST) is a 24 octal word table which records all information pertinent to the execution of an entire program level. This table is located at addresses 0400 through 0423 inclusive and has the following structure:

<u>address</u>	<u>label</u>	<u>contents</u>
400	USTPC	Program counter
401	USTZM	ZMAX
402	USTSS	Start of Symbol Table (SST)
403	USTES	End of Symbol Table (EST)
404	USTNM	NMAX after runtime .MEMIs
405	USTSA	Starting address of program
406	USTDA	Debugger address; -1 if not loaded
407	USTHU	Highest load address
410	USTCS	FORTTRAN common area size
411	USTIT	Interrupt address (Control A keyboard character)
412	USTBR	Break address (Control C keyboard character)
413	USTCH	Number of channels and TCBs (unused by SOS)
414	USTCT	Current TCB pointer (unused by SOS)
415	USTAC	Start of active TCB chain (unused by SOS)
416	USTFC	Start of free TCB chain (unused by SOS)
417	USTIN	Initial Start of NREL code (INMAX)
420	USTOD	Overlay directory address (unused by SOS)
421	USTSV	State variable generalized save routine (unused in SOS)
422	USTRV	Revision level (unused by SOS)
423	USTIA	TCB address of interrupt or break procedure (unused by SOS)

Location 400 - USTPC is the program counter.

Location 401 - USTZM points to the first available location in page zero for page zero relocatable code.

Location 402 and 403 - USTSS and USTES point to the start and end of the symbol table respectively. The loader sets 402 and 403 to 0 if the debugger is not loaded.

Location 404 - USTNM contains NMAX. The loader sets the pointer to the first free location for further loading or for allocation of temporary storage at run time.

*Location 12, USTP always points to the start of the UST.

USER STATUS TABLE (Continued)

Location 405 - USTSA points to the program starting address, specified by the .END statement. If no starting address is specified by any loaded program, -1 is stored in 405. If several programs specify starting addresses, USTSA contains the address specified in the last program loaded. (Location 377 contains a JMP @2, which transfers control to a routine in SOS which performs a .SYSI and then branches to the program starting address. Therefore, the user can conveniently restart his program at 377, assuming that he has specified a starting address.)

Location 406 - USTDA points to the starting address of the debugger, or if the debugger is not loaded, 406 contains -1.

Location 407 - USTHU is set to the value of NMAX at the termination of loading. This word is never changed by the operating system during program execution. It is used to reset USTNM whenever a .SYSI is executed.

Location 410 - USTCS contains the size of the FORTRAN unlabeled common area.

Location 411 and 412 - USTIT and USTBR are the interrupt address and break address respectively. Both are initialized to -1. Whenever the location contains 0 or -1, the corresponding interrupt is ignored by the system. To receive control after CTRL A interrupts, USTIT must be changed by the user program to the desired transfer address. The Core Image Loader sets USTBR to the beginning address of the Core Image Loader whenever it loads a save file into core. The user program may then modify USTBR to either point to its own CTRL C break address or to disable CTRL C interrupts. When control is passed to the USTIT address, machine interrupts are enabled; when control is passed to the USTBR address, machine interrupts are disabled.

Location 413-416 - Locations that are used by RDOS and RTOS.

Location 417 - USTIN contains the address of the start of normally relocatable code (440₈).

Location 420 - Location used by RDOS.

Location 421 - USTSV points to the address of the FORTRAN state variable save routine.

Location 422-423 - Locations that are used by RDOS.



CHAPTER 5

CONFIGURING SOS UTILITY PROGRAMS

The process of configuring a utility program generally consists of the following:

1. Producing a trigger which specifies the desired I/O support.
2. Performing a relocatable load of the trigger, the appropriate SOS libraries, and the relocatable binary (RB) version of the utility program.

These procedures apply to all SOS utilities except the assembler. The assembler program requires an execution pass on the DGC command definitions in order to expand its permanent symbol table appropriately after it had been loaded.

SUPPLIED TAPES

The tapes listed below comprise the SOS package. These tape lists are separated according to those that are supplied to paper tape, cassette or magnetic tape users. For a complete list of type and revision numbers, consult your Software Subscription Release Notice.

SOS Paper Tape System Tapes

Model 3088, Support for Paper Tape only

<u>Name</u>	<u>Tape No.</u>
Relocatable Debug II	089-000031
Relocatable Floating Point Interpreter	089-000046
Relocatable Binary Punch	089-000080
SOS Library File Editor (SLFE.RB)	089-000081
SOS Text Editor (SEdit.RB)	089-000104
SOS Extended Assembler	089-000106
SOS System Generation (SYSG.RB)	089-000122
SOS Stand-Alone Parameters	090-000498
SOS User Application Parameters	090-000889
RDOS User Parameters (PARU.SR)	090-002935
NOVA [®] * Basic Instruction Set (NBID.SR)	090-002998
Floating Point Instructions (FPID.SR)	090-002999

*NOVA is a registered trademark of Data General Corporation, Southboro, Massachusetts.

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SOS Paper Tape System Tapes (Continued)

<u>Name</u>	<u>Tape No.</u>
Operating Systems Instructions (OSID.SR)	090-003000
ECLIPSE™* Extended Instructions (NEID.SR)	090-003239
ECLIPSE Floating Point Instructions (NFPID.SR)	090-003240
Binary Loader (BLDR.AB)	091-000004
Tape Duplicator (DUP.AB)	091-000008
Single User Basic (BASIC.AB)	091-000018
Extended Relocatable Loader (RLDR.AB)	091-000038
SOS Library File Editor (SLFE.AB)	091-000057
SOS Extended Assembler (SASM.AB)	091-000069
SOS System Generation (SYSG.AB)	091-000070
SOS Text Editor (SEdit.AB)	091-000094
Relocatable Math. Library (MATH.LB)	099-000001
Stand-Alone Operating System (SOS.LB)	099-000010
Stand-Alone unmapped NOVA Debug	089-000179
Stand-Alone mapped NOVA debug	089-000180
Stand-Alone unmapped ECLIPSE Debug	089-000181
Stand-Alone mapped ECLIPSE Debug	089-000182

The absolute binary (AB) versions of these programs are preconfigured with conventional paper tape support, viz., high speed paper tape reader and punch, full teletypewriter (keyboard, printer, reader, and punch) and 80 column line printer.

SOS Paper Tape Systems with Cassette/Magnetic Tape Support

Users having cassettes or magnetic tape drives will receive all the tapes supplied to users having paper tape systems as listed above, plus the following:

Model 3229, Cassette/Magnetic Tape Support

<u>Name</u>	<u>Tape No.</u>
SOS CT/MT Relocatable Loader (SRLDR.RB)	089-000120
SOS Command Line Interpreter (SCLI.RB)	089-000121
SOS CT Core Image Loader/Writer (CILWCT.AB)	091-000067
SOS MT Core Image Loader/Writer (CILWMT.AB)	091-000068
SOS Command Line Interpreter (SCLI.AB)	091-000075
SOS CT/MT Relocatable Loader (SRLDR.AB)	091-000076
SOS Cassette Driver Library (SOSCT.LB)	099-000041
SOS Magnetic Tape Driver Library (SOSMT.LB)	099-000042

* ECLIPSE is a trademark of Data General Corporation, Southboro, Massachusetts.

SOS Cassette Systems

Users with cassette systems also receive four cassette reels: 070-000002, 070-000003, 070-000054, and 070-000093. These contain programs in save (SV) or executable format and in relocatable binary (RB) format as follows:

Model 3236C, Cassette Systems

070-000002 (first cassette):

Core Image Loader/Writer (CILWCT.SV)	File 0
CT/MT Relocatable Loader (SRLDR.SV)	File 1
Command Line Interpreter (SCLI.SV)	File 2
Text Editor (SEEDIT.SV)	File 3
Extended Assembler (SASM.SV)	File 4

070-000003 (second cassette):

Stand-Alone Operating System Cassette Driver Library (SOSCT.LB)	File 0
Stand-Alone Operating System Magnetic Tape Driver Library (SOSMT.LB)	File 1
Stand-Alone Operating System Library (SOS.LB)	File 2
Command Line Interpreter (SCLI.RB)	File 3
Text Editor (SEEDIT.RB)	File 4
Extended Assembler (SASM.RB)	File 5
Relocatable Loader (SRLDR.RB)	File 6
Library File Editor (SLFE.RB)	File 7
System Generation (SYSG.RB)	File 8

070-000054 (third cassette):

Library File Editor (SLFE.SV)	File 0
System Generation (SYSG.SV)	File 1
Relocatable Floating Point Interpreter (RFPI.RB)	File 2
Stand-Alone Unmapped NOVA Debug (SADEB.RB)	File 3
Stand-Alone Mapped NOVA Debug (SAMDEB.RB)	File 4
Stand-Alone Unmapped ECLIPSE Debug (SABDEB.RB)	File 5
Stand-Alone Mapped ECLIPSE Debug (SAADEB.RB)	File 6
Cassette Core-Image Loader/Writer	File 7
Magnetic Tape Core-Image Loader/Writer	File 8

SOS Cassette Systems (Continued)

070-000093 (fourth cassette):

SOS Stand-Alone Parameters (PARA.SR)	File 0
SOS User Application Parameters (PARUA.SR)	File 1
RDOS User Parameters (PARU.SR)	File 2
NOVA Basic Instruction Definitions (NBID.SR)	File 4
NOVA Floating Point Instruction Definitions (FPID.SR)	File 5
RDOS Instruction Definitions (OSID.SR)	File 6
ECLIPSE Extended Instruction Definitions (NEID.SR)	File 7
ECLIPSE Floating Point Instruction Definitions (NFPID.SR)	File 8
Relocatable Math. Library (MATH.LB)	File 9

Procedures for configuring SOS utilities using cassette input files are identical in concept to those using paper tape input files (described later in this chapter). The use of cassettes instead of paper tape makes the configuration procedures easier and quicker, however.

SOS Magnetic Tape Systems

Users with magnetic tape systems receive magnetic tape reel 071-000004, containing files in source file, relocatable binary, and save file formats as indicated in the following list:

Core Image Loader/Writer (CILWMT.SV)	File 0
CT/MT Relocatable Loader (SRLDR.SV)	File 1
Command Line Interpreter (SCLI.SV)	File 2
Text Editor (SEdit.SV)	File 3
Extended Assembler (SASM.SV)	File 4
Library File Editor (SLFE.SV)	File 5
System Generation (SYSG.SV)	File 6
Magnetic Tape Driver Library (SOSMT.LB)	File 7
Cassette Driver Library (SOSCT.LB)	File 8
Stand-Alone Operating System Library (SOS.LB)	File 9
Command Line Interpreter (SCLI.RB)	File 10
Text Editor (SEdit.RB)	File 11
Extended Assembler (SASM.RB)	File 12
CT/MT Relocatable Loader (SRLDR.RB)	File 13
Library File Editor (SLFE.RB)	File 14
System Generation (SYSG.RB)	File 15

SOS Magnetic Tape Systems (Continued)

NOVA Basic Instruction Definitions (NBID.SR)	File 16
NOVA Floating Point Instruction Definitions (FPID.SR)	File 17
RDOS Instruction Definitions (OSID.SR)	File 18
RDOS User Parameters (PARU.SR)	File 19
SOS Stand-Alone Parameters (PARA.SR)	File 21
SOS User Application Parameters (PARUA.SR)	File 22
ECLIPSE Extended Instruction Definitions (NEID.SR)	File 23
ECLIPSE Extended Floating Point Instruction Definitions (NFPID.SR)	File 24
Relocatable Math. Library (MATH.LB)	File 25
Relocatable Floating Point Interpreter (RFPI.RB)	File 26
SOS MT Core Image Loader/Writer (CILWMT.AB)	File 27
SOS CT Core Image Loader/Writer (CILWCT.AB)	File 28
Stand-Alone Unmapped NOVA Debug (SADEB.RB)	File 29
Stand-Alone Mapped NOVA Debug (SAMDEB.RB)	File 30
Stand-Alone Unmapped ECLIPSE Debug (SABDEB.RB)	File 31
Stand-Alone Mapped ECLIPSE Debug (SAADEB.RB)	File 32

Procedures for configuring SOS utilities using the magnetic tape master reel and two magnetic tape drives are identical in concept to those using paper tape input files. Paper tape procedures are described in the following two sections. The use of a magnetic tape master reel instead of many paper tape master files adds an extra measure of convenience to the configuration procedures.

PRODUCING A TRIGGER

Triggers are produced by the SYSG program. This program accepts a command line, which contains device driver ENTRY symbols, from the console device. It outputs a relocatable binary file (the trigger) which is comprised of EXTERNAL NORMAL symbols corresponding to the named device drivers. These EXTERNAL NORMALs cause the selection or "triggering" of the desired routines for loading when the trigger precedes the SOS Libraries as input to the relocatable loader.

The first step to produce a trigger is to load and start the SYSG program. This can be done by using the binary loader to load the absolute binary SYSG paper tape (091-000070) or an executable SYSG from cassette (file 1 of cassette 3) or magnetic tape (file 6). SYSG is loaded from cassette or magnetic tape using the appropriate Core Image Loader/Writer (CILWCT.AB or CILWMT.AB).

PRODUCING A TRIGGER (Continued)

When the SYSGEN program is started, it outputs the prompt message:

SYSG

and waits for the user to type a command line. This command line has the following format:

```
(SYSG) driver1...drivern .RDSI [.CTB] [.RTC1] output-file/O ↑ )  
      {triggername/T} )
```

where:

- | | |
|---------------------|---|
| <u>driver</u> | is an entry symbol in the desired device driver routine. Table 2-2 lists all possible symbols. |
| .CTB | is the optional Command Table Builder. This symbol must be specified for triggers to be used in configuring the SOS Assembler, the SOS Relocatable Loader, the SYSGEN program, and the SOS FORTRAN IV Compiler. |
| .RTC1 | causes the loading of a 10 Hz Real Time Clock Driver from the SOS Library. This symbol must be specified for the CLI. |
| <u>output-file</u> | is the name of the file/device to which the user wishes the trigger to be output. This name must be followed by the /O switch. |
| <u>trigger-name</u> | is the optional title (.TITL) of the trigger. If this name is omitted the trigger will be named SGTRG, by default. If the name is present, it must be followed by the /T switch. |

An example of the use of the SYSG program is shown below. This command line causes a trigger to be generated at the high speed paper tape punch to provide support for a small Teletype, high speed reader and punch, Command Table Builder, and cassette units 0 and 1:

```
(SYSG) .PTRD .PTPD .STTY $PTP/O .RDSI .CTB .CTU1 )
```


PRODUCING A TRIGGER (Continued)

The trigger produced will have the title SGTRG since no trigger title was specified.

After the trigger has been output, the SYSGEN program will again type its prompt (SYSG) and wait for another command. If more than one utility program is to be configured, requiring different triggers, it is most convenient to generate all the necessary triggers before overwriting the SYSGEN program in core.

A discussion of the SYSGEN program, including its associated error messages, is included in Chapter 3.

PROCEDURES FOR CONFIGURING UTILITIES USING PAPER TAPE

Relocatable binary versions of SOS utilities are provided so that users may load each utility with a specific trigger and with a SOS library. The end result of this process will be a set of SOS utilities with only that device support which each user desires. Unwanted drivers are not loaded, and core space that would have been occupied by these drivers is freed for use by the utilities.

Configuring Utilities except the Assembler

The following is a step-by-step description for configuring all SOS Paper Tape Utilities except the assembler. The end result is an absolute binary paper tape of the utility. Before starting the procedure the trigger to be used should be generated on paper tape. Each typed command in this procedure must be terminated by a carriage return.

1. Using the binary loader, load the Extended Relocatable Loader (tape 091-000038).
2. Mount the trigger in the Teletype reader and type 1, or in the high speed paper tape reader and type 2.
3. For paper tape SOS systems, mount the SOS Library (099-000010) in the Teletype reader and type 1 or in the high speed paper tape reader and type 2.

If the trigger specifies support for cassette or magnetic tape drives, first mount the SOS Cassette Library (099-000041) or the SOS Magnetic Tape Library (099-000042), and type 1 or 2 as appropriate. Then mount the SOS Library (099-000010) and type 1 or 2 as appropriate.

Configuring Utilities except the Assembler (Continued)

4. Mount the relocatable binary version of the program, to be configured, in the Teletype reader and type 1, or in the high speed paper tape reader and type 2.
5. Type 5 and note the value of NMAX output by the relocatable loader on the teletypewriter. This number will be used in Step 11.
6. Mount the relocatable binary punch program (089-000080) on the Teletype reader and type 1, or on the high-speed paper tape reader and type 2.
7. Type 6 and note the value of RBFP output by the relocatable loader on the teletypewriter; this number will be used in Step 9.
8. Type 8 to terminate the loading process.
9. Enter RBFP (from Step 7) into the data switches on the computer console, press RESET and then press START.
10. Type 0H for output on the Teletype punch or 1H for output on the high-speed paper tape punch.
11. Type 1, nmaxP where nmax is the value of NMAX noted in Step 5.
12. Type 377E, to specify a starting address for the program.

Configuring the Assembler

The following is a step by step description for configuring the SOS Assembler. It is similar to the preceding procedures; however before an absolute binary tape is punched, the DGC command definitions are added to the assembler permanent symbol table.

1. Using the binary loader, load the Extended Relocatable Loader (tape 091-000038).
2. Mount the trigger in the Teletype reader and type 1, or in the high-speed paper tape reader and type 2.
3. For paper tape SOS systems, mount the SOS Library (099-000010) in the teletypewriter and type 1 or in the high speed paper tape reader and type 2.

Configuring the Assembler (Continued)

If the trigger specifies support for cassette or magnetic tape drives, first mount the SOS Cassette Library (099-000041) or the SOS Magnetic Tape Library (099-000042) and type 1 or 2 as appropriate. Then mount the SOS Library (099-000010) and type 1 or 2 as appropriate.

4. Mount the relocatable binary version of the SOS Extended Assembler (089-000106) in the Teletype reader and type 1, or in the high speed paper tape reader and type 2.
5. Enter 016500₈ in the data switches on the computer console and type 3.
6. Mount the relocatable binary punch program (089-000080) on the Teletype reader and type 1, or on the high-speed paper tape reader and type 2.
7. Type 6 and note the value of RBFP output by the relocatable loader on the teletypewriter; this number will be used in Step 13.
8. Type 8 to terminate the loading process.
9. Press CONTINUE on the computer console to start the assembler.
10. Mount the extended assembler command definitions tape, NBID.SR (090-002998) for NOVA systems, in the Teletype reader and type 0 \$TTR/3, or in the high-speed paper tape reader and type 0 \$PTR/3. For ECLIPSE systems, also mount NEID.SR (090-003239) and repeat the keyboard commands.
11. Mount the remaining tapes, OSID.SR (090-003000), and FPID.SR (090-002999) for NOVA systems or NFPID.SR (090-003240) for ECLIPSE systems, when they are requested by the prompt message; strike any key on the console when the tapes are mounted.
12. When the assembler halts, examine AC0 and note its contents (NMAX); this value will be used in step 15.
13. Enter RBFP (from step 7) into the data switches on the computer console, press RESET, and then press START.
14. Type 0H for output on the Teletype punch or 1H for output on the high-speed paper tape punch.

Configuring the Assembler (Continued)

15. Type 1, nmaxP where nmax is the value of NMAX noted in step 11.
16. Type 377E to specify a starting address for the program.

PRODUCING A MASTER REEL USING PAPER TAPE INPUT FILES

The following procedure details the necessary steps to configure SOS utility programs and at the same time produce a master cassette or magnetic tape reel. The assumption is made that only one cassette or magnetic tape drive is available and that all programs input to the Relocatable Loader are on paper tape. The high speed paper tape reader is assumed to be the input device for these tapes.

Before starting this procedure, the triggers should have been generated on paper tapes. When the cassette or magnetic tape reel that is required for this procedure has been mounted, the cassette should have its file protect tab in place and the magnetic tape should contain a write permit ring, so that files may be written on them. Each typed command in this procedure must be terminated by a carriage return. The master reel generated on unit 0 need never be removed from that unit during the following procedures.

1. CILW:

Using the binary loader, load and start the appropriate absolute binary version of the Core Image Loader/Writer (CILWCT.AB for cassette; CILWMT.AB for magnetic tape). When started, this program will output the following message to the console device:

LOAD UNIT 0: STRIKE ANY KEY

Place the cassette or magnetic tape reel that is to become the master on unit 0 and depress any key on the console keyboard. This program will write the Core Image Loader/Writer to file 0 of unit 0. When the loader has been successfully written, the message

LOADER INSTALLED

is printed at the console and the tape is rewound. This program may be used to install additional loaders at this point. After the program HALTs, the user may change cassette or magnetic tape

PRODUCING A MASTER REEL USING PAPER TAPE INPUT FILES (Continued)

reels, and depress the CONTINUE switch on the master console. The message on the preceding page is again printed; the user may repeat this procedure as often as desired.

2. RLDR:

The binary loader remains in high core. Using this loader, load the absolute binary version of the SOS Relocatable Loader (091-000076). This program outputs the prompt message (RLDR) to the console device; respond with the command line:

CT0:1/S \$PTR/4 (for cassette)
MT0:1/S \$PTR/4 (for magnetic tape)

If the Teletype reader is used, substitute \$TTR for \$PTR. As the relocatable loader requests them, mount the following paper tapes in order:

1. The trigger to be used for the Relocatable Loader.
2. The SOS Cassette Library (099-000041) for cassette or the SOS Magnetic Tape Library (099-000042) for magnetic tape.
3. The SOS Library (099-000010).
4. The relocatable binary version of the SOS Relocatable Loader (089-000120).

The loader will produce a core image of the tailored Relocatable Loader on file 1 of the master reel, type OK, and HALT when finished. This version of the loader is now usable for the remaining procedures.

It will typically need to be re-loaded via the CILW, but in this one case it is already present in core. Hence to restart the loader, merely depress the CONTINUE switch on the master console.

3. CLI:

After the Relocatable Loader outputs the prompt message (RLDR) to the console, respond with the command line:

PRODUCING A MASTER REEL USING PAPER TAPE INPUT FILES (Continued)

3. CLI: (Continued)

CT0:2/S \$PTR/4 (for cassette)
MT0:2/S \$PTR/4 (for magnetic tape)

If the Teletype reader is used, substitute \$TTR for \$PTR. As the relocatable loader requests them, mount the following paper tapes in order:

1. The trigger to be used for the Command Line Interpreter.
2. The SOS Cassette Library (099-000041) for cassette or the SOS Magnetic Tape Library (099-000042) for magnetic tape.
3. The SOS Library (099-000010).
4. The relocatable binary version of the SOS Command Line Interpreter (089-000121).

The loader will produce a core image or save file version of this utility program on the designated file of the master reel. It will type OK and halt when finished.

4. Restore RLDR:

The Relocatable Loader must be restored to core using the CILW.

For systems with PROGRAM LOAD, first manually rewind unit 0, make the unit ready, depress RESET on the master console. Set data switches 0, 11, and 14 to ones, and depress PROGRAM LOAD.

For systems without PROGRAM LOAD, restart the CILW by setting the address of the last location in core into the data switches on the master console. Depress RESET, then START.

When the CILW is invoked and types its prompt message (#) to the console device, respond with the command line:

0:1

The user-configured version of the SOS Relocatable Loader will be returned to core.

PRODUCING A MASTER REEL USING PAPER TAPE INPUT FILES (Continued)

5. EDIT:

Repeat step 3, making the following substitutions:

1. CT0:3/S or MT0:3/S instead of CT0:2 or MT0:2 respectively in the Relocatable Loader command line.
2. The trigger for the SOS Text Editor instead of the trigger for the CLI.
3. The relocatable binary version of the SOS Text Editor (089-000104) instead of that of the CLI.

6. Restore RLDR:

Repeat step 4 to restart the Relocatable Loader.

7. ASM:

Repeat step 3 making the following substitutions:

1. CT0:4/S or MT0:4/S instead of CT0:2/S or MT0:2/S respectively in the Relocatable Loader command line.
2. The trigger for the SOS Assembler instead of the trigger for the CLI.
3. The relocatable binary version of the SOS Assembler (089-000106) instead of that of the CLI.

8. ASM:

Depress the CONTINUE switch on the master console to start the assembler.

9. ASM:

Respond to the assembler prompt message (ASM) with the following command line :

PRODUCING A MASTER REEL USING PAPER TAPE INPUT FILES (Continued)

9. ASM: (Continued)

0 \$PTR/3 (or "0 \$TTR" if the Teletype reader is used)

If the Floating Point Instruction definitions are not desired,
respond with:

0 \$PTR/2 or 0 \$TTR/2.

10. ASM:

Mount each command definition tape as it is requested (by the

LOAD { $\begin{matrix} \$TTR \\ \$PTR \end{matrix}$ } STRIKE ANY KEY message) and depress any
console key.

One of the two following sets of tapes, in the order given below
must be loaded; the first set is for NOVA systems, the second is for
ECLIPSE systems.

NOVA systems:	NOVA Basic Instructions,	(090-002998)
	NBID.SR	
	*Floating Point Instructions,	(090-002999)
	FPID.SR	
	Operating System Instruc-	(090-003000)
	tions, OSID.SR	
ECLIPSE systems:	NOVA Basic Instructions,	(090-002998)
	NBID.SR	
	ECLIPSE Extended Instruc-	(090-003239)
	tions, NEID.SR	
	ECLIPSE Floating Point	(090-003240)
	Instructions, NFPID.SR	
	Operating System Instruc-	(090-003000)
	tions, OSID.SR	

*only use if these command definitions are desired for permanent symbols.

PRODUCING A MASTER REEL (Continued)

ASM: (Continued)

The assembler will perform a one pass assembly on these source files and then HALT.

11. ASM:

EXAMINE (using the master console switches) the contents of AC0 and note for use in step 12.

12. CILW:

Start the Core Image Writer by setting the address of the next to last location in core into the data switches on the master console, pressing RESET, and then START. Respond to this program's prompt message (#) with:

0:4

Respond to the next prompt message (NMAX:) with the octal value noted in step 11. The Core Image Writer will rewrite a core image of the assembler to file 4 of the master reel. This copy contains the assemblers permanent symbols in the symbol table. It will type OK and HALT when finished.

13. Restore RLDR:

Repeat step 4 to restart the Relocatable Loader.

14. LFE:

Repeat step 3 making the following substitutions:

1. CT0:5/S or MT0:5/S instead of CT0:2/S or MT0:2/S respectively in the Relocatable Loader command line.
2. The trigger for the SOS Library File Editor (LFE) instead of the trigger for the CLI.
3. The relocatable binary version of the SOS LFE (089-000081) instead of that of the CLI.

PRODUCING A MASTER REEL (Continued)

15. Restore RLDR:

Repeat step 4 to restart the Relocatable Loader.

16. SYSG:

Repeat step 3 making the following substitutions:

1. CT0:6/S or MT0:6/S instead of CT0:2/S or MT0:2/S respectively in the Relocatable Loader command line.
2. The trigger for the SOS SYSGEN program instead of the trigger for the CLI.
3. The relocatable binary version of SOS SYSGEN (089-000122) instead of that of the CLI.

This completes the generation of a master reel.

CONFIGURING A SOS FORTRAN IV COMPILER

The procedures for configuring a FORTRAN IV compiler are identical to the previous procedures. The additional tapes that are required are the relocatable binary version of the FORTRAN IV Compiler (089-000161) and the SOS FORTRAN Interface (089-000041). The input order of the tapes to the appropriate relocatable loader is the following:

1. FORTRAN Compiler trigger (see Producing a Trigger).
2. SOS Cassette Library, SOSCT.LB (099-000041) for cassette systems.
3. SOS Magnetic Tape Library, SOSMT.LB (099-000042) for magnetic tape systems.
4. SOS Library, SOS.LB (099-000010).
5. SOS FORTRAN Interface, SOSFI.RB (089-000041).
6. FORTRAN IV Compiler, FORT.RB (089-000161).

SOS DEVICE HANDLING STRATEGY (Continued)

In general, these variables should be consistent among devices; that is, the first device in the Interrupt Search List should not be interruptible by any other devices, the second device in the list should only be interruptible by the first, and the last one should be interruptible by all other devices. This scheme cannot be rigidly adhered to because many devices share a priority bit in the interrupt mask. It is recommended that as nearly as possible device handlers observe these conventions. There is actually no interdependence between these variables however; if a user does not follow these conventions in adding his device handler, he will merely introduce slight inefficiencies into the processing of interrupts. The procedures for user specification of these device handler variables are discussed later in this appendix.

These considerations broadly summarize the information that must be provided to and used by the system to control Level One devices. To properly support Level Two devices, several additional pieces of information are required by the system:

1. The system must be able to associate the text string identifying the file/device with a physical SOS Channel Number whenever the device is opened. (This applies only to systems which use the RDOS to SOS Interface Program. When that program is not used, then the SOS Channel Number is specified in the ".OPEN" command).
2. The system must be able to map from the SOS Channel Number to a body of information which enables it to recognize the unique properties of the device, start it, stop it, and buffer I/O for it. This body of information is contained in the Device Control Table, DCT.

The DCT also contains much of the information that is used by the system interrupt dispatcher to service both Level One and Level Two devices at interrupt time. A DCT or some subset of it must therefore be provided for every unique device being incorporated into SOS, regardless of the device support level. The word by word layout of the DCT is described starting on page A-10. There are various means available to the user to link the DCT that he supplies into the system. These options are itemized and elaborated upon in the following section.

SOS DEVICE HANDLING STRATEGY (Continued)

The critical system requirements for each device level are summarized below:

Level One Devices:

1. A DCT
2. A position in the SOS Interrupt Search List
3. An interrupt service routine* which performs all necessary interrupt level device functions and returns control appropriately to the system interrupt dispatcher.
4. A device clear routine which is called on all system initializations (.SYSI) and resets (.RESE).
5. All other necessary device control routines. These routines are never entered through the operating system however.

Level Two Devices:

1. A DCT
2. A position in the SOS Interrupt Search List.
3. An interrupt service routine* (see above).
4. A device clear routine (see above).
5. A (physical) SOS Channel Number associated with the DCT. (Inherent in this requirement is a position in the SOS Channel Number Map.)
6. A file/device name associated with the SOS Channel Number. This only applies to devices which are running in an RDOS-SOS environment.
7. The routines to perform the appropriate subset of system commands (.OPEN, .CLOSE, .RDL, .WRL, .RDS and .WRS) meaningful to the device. These routines make partial or full use of the SOS global sub-routines.

*Note that in writing an interrupt service routine, the programmer must preserve the contents of AC2 which points to the location of the DCT.

LICENSED MATERIAL - PROPERTY OF DATA GENERAL CORPORATION

0001 PARU MACRO REV 03.00

12:08:44 04/09/75

```

01
02      ;=====
03      ; RDOS REVISION 04 USER PARAMETERS
04      ;=====
05
          .TITL  PARU
07
08
09
10      ;
11      ; UFT ENTRY
12      ;
13
14      ; USER FILE DEFINITION (UFD) OF UFT
15
16      000000 .DUSR UFTFN=0          ;FILE NAME
17      000005 .DUSR UFTEX=5          ;EXTENSION
18      000006 .DUSR UFTAT=6          ;FILE ATTRIBUTES
19      000007 .DUSR UFTLK=7          ;LINK ACCESS ATTRIBUTES
20      000007 .DUSR UFLAD=7          ;LINK ALTERNATE DIRECTORY
21      000010 .DUSR UFTBK=10         ;NUMBER OF LAST BLOCK IN FILE
22      000011 .DUSR UFTBC=11         ;NUMBER OF BYTES IN LAST BLOCK
23      000012 .DUSR UFTAD=12         ;DEVICE ADDRESS OF FIRST BLOCK (0 UNASSIGNED)
24      000013 .DUSR UFTAC=13         ;YEAR-DAY LAST ACCESSED
25      000014 .DUSR UFTYD=14         ;YEAR-DAY CREATED
26      000014 .DUSR UFLAN=14         ;LINK ALIAS NAME
27      000015 .DUSR UFTHM=15         ;HOUR-MINUTE CREATED
28      000016 .DUSR UFTP1=16         ;UFD TEMPORARY
29      000017 .DUSR UFTP2=17         ; " "
30      000020 .DUSR UFTUC=20         ;USER COUNT
31      000021 .DUSR UFTDL=21         ;DCT LINK
32
33      ; DEVICE CONTROL BLOCK (DCB) OF UFT
34
35      000022 .DUSR UFTDC=22         ;DCT ADDRESS
36      000023 .DUSR UFTUN=23         ;UNIT NUMBER
37      000024 .DUSR UFCA1=24         ;CURRENT BLOCK ADDRESS (HIGH ORDER)
38      000025 .DUSR UFTCA=25         ;CURRENT BLOCK ADDRESS (LOW ORDER)
39      000026 .DUSR UFTCB=26         ;CURRENT BLOCK NUMBER
40      000027 .DUSR UFTST=27         ;FILE STATUS
41      000030 .DUSR UFEA1=30         ;ENTRY'S BLOCK ADDRESS (HIGH ORDER)
42      000031 .DUSR UFTEA=31         ;ENTRY'S BLOCK ADDRESS (LOW ORDER)
43      000032 .DUSR UFFNA1=32        ;NEXT BLOCK ADDRESS (HIGH ORDER)
44      000033 .DUSR UFTNA=33         ;NEXT BLOCK ADDRESS (LOW ORDER)
45      000034 .DUSR UFLA1=34         ;LAST BLOCK ADDRESS (HIGH ORDER)
46      000035 .DUSR UFTLA=35         ;LAST BLOCK ADDRESS (LOW ORDER)
47      000036 .DUSR UFTDR=36         ;SYS.DR DCB ADDRESS
48      000037 .DUSR UFFA1=37         ;FIRST ADDRESS (HIGH ORDER)
49      000040 .DUSR UFTFA=40         ;FIRST ADDRESS (LOW ORDER)
50
51      ; DCB EXTENSION
52
53      000041 .DUSR UFTBN=41         ;CURRENT FILE BLOCK NUMBER
54      000042 .DUSR UFTBP=42         ;CURRENT FILE BLOCK BYTE POINTER
55      000043 .DUSR UFTCH=43         ;DEVICE CHARACTERISTICS
56      000044 .DUSR UFTCN=44         ;ACTIVE REQ COUNT
57      ;B0 INDICATES Q, 0=DSQ1,1=DSQ2
58
59
60

```

LICENSED MATERIAL - PROPERTY OF DATA GENERAL CORPORATION

0002 PARU

```

01
02      000045 .DUSR UFTEL=UFTCN-UFTFN+1      ;UFT ENTRY LENGTH
03      000022 .DUSR UFDEL=UFTDL-UFTFN+1      ;UFD ENTRY LENGTH
04
05      177764 .DUSR UDBAT=UFTAT-UFTDC ;NEGATIVE DISP. TO ATTRIBUTES
06      177777 .DUSR UDDL=UFTDL-UFTDC ;NEGATIVE DISP. TO FIRST ADDRESS (HIGH ORDER)
07      177770 .DUSR UDBAD=UFTAD-UFTDC ;NEGATIVE DISP. TO FIRST ADDRESS (LOW ORDER)
08      177766 .DUSR UDDBK=UFTBK-UFTDC ;NEGATIVE DISP. TO LAST BLOCK
09      000017 .DUSR UDDBN=UFTBN-UFTDC ;POSITIVE DISP. TO CURRENT BLOCK
10
11
12
13      ;
14      ; FILE ATTRIBUTES
15      ;
16
17      100000 .DUSR ATRP =1B0                ;READ PROTECTED
18      040000 .DUSR ATCHA=1B1                ;CHANGE ATTRIBUTE PROTECTED
19      020000 .DUSR ATSAV=1B2                ;SAVED FILE
20      000400 .DUSR ATNRS=1B7                ;CANNOT BE A RESOLUTION ENTRY
21      000100 .DUSR ATUS1=1B9                ;USER ATTRIBUTE # 1
22      000040 .DUSR ATUS2=1B10               ;USER ATTRIBUTE # 2
23      000002 .DUSR ATPER=1B14               ;PERMANENT FILE
24      000001 .DUSR ATWP =1B15               ;WRITE PROTECTED
25
26      ;
27      ; FILE CHARACTERISTICS
28      ;
29
30      003400 .DUSR ATMSK=7B7                ;TO GET HIGH ORDER PART OF 3330
31      ; ADDRESSES OUT OF UFTDL
32      010000 .DUSR ATLNK=1B3                ;LINK ENTRY
33      004000 .DUSR ATPAR=1B4                ;PARTITION ENTRY
34      002000 .DUSR ATDIR=1B5                ;DIRECTORY ENTRY
35      001000 .DUSR ATRES=1B6                ;LINK RESOLUTION (TEMPORARY)
36      000200 .DUSR ATDIO=1B8                ;DIRECT I/O ONLY
37      000010 .DUSR ATCON=1B12               ;CONTIGUOUS FILE
38      000004 .DUSR ATRAN=1B13               ;RANDOM FILE

```

LICENSED MATERIAL - PROPERTY OF DATA GENERAL CORPORATION

10003 PARU

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59

; DEFINE THE DEVICE CHARACTERISTICS

```

000001 .DUSR DCCPO= 1B15 ; DEVICE REQUIRING LEADER/TRAILER
000001 .DUSR DCSTO= 1B15 ; USER SPECIFIED TIME OUT CONSTANT (MCA)
000002 .DUSR DCCGN= 1B14 ; GRAPHICAL OUTPUT DEVICE WITHOUT TABBING
; HARDWARE
000004 .DUSR DCIDI= 1B13 ; INPUT DEVICE REQUIRING OPERATOR INTERVENTION
000010 .DUSR DCCNF= 1B12 ; OUTPUT DEVICE WITHOUT FORM FEED HARDWARE
000020 .DUSR DCTO= 1B11 ; TELETYPE OUTPUT DEVICE
000040 .DUSR DCKEY= 1B10 ; KEYBOARD DEVICE
000100 .DUSR DCNAF= 1B09 ; OUTPUT DEVICE REQUIRING NULLS AFTER FORM FEEDS
000200 .DUSR DCRAT= 1B08 ; RUBOUTS AFTER TABS REQUIRED
000400 .DUSR DCPCK= 1B07 ; DEVICE REQUIRING PARITY CHECK
001000 .DUSR DCLAC= 1B06 ; REQUIRES LINE FEEDS AFTER CARRIAGE RTN
002000 .DUSR DCSP0= 1B05 ; SPOOLABLE DEVICE
004000 .DUSR DCFWD= 1B04 ; FULL WORD DEVICE (ANYTHING GREATER THAN
010000 .DUSR DCFF0= 1B03 ; FORM FEEDS ON OPEN
020000 .DUSR DCLTU= 1B02 ; CHANGE LOWER CASE ASCII TO UPPER
040000 .DUSR DCC80= 1B01 ; READ 80 COLUMNS
100000 .DUSR DCDIO= 1B00 ; SUSPEND PROTOCOL ON TRANSMIT (MCA)
100000 .DUSR DCBDK= 1B00 ; DISK CHARACTERISTIC (SET NON-PARAMETRICALLY)
; SET MEANS ITS 3330
100000 .DUSR DCSPC= 1B00 ; SPOOL CONTROL
; SET = SPOOLING ENABLED
; RESET = SPOOLING DISABLED

```

; DEFINE SWITCHES

```

100000 .DUSR A.SW= 1B00
040000 .DUSR B.SW= 1B01
020000 .DUSR C.SW= 1B02
010000 .DUSR D.SW= 1B03
004000 .DUSR E.SW= 1B04
002000 .DUSR F.SW= 1B05
001000 .DUSR G.SW= 1B06
000400 .DUSR H.SW= 1B07
000200 .DUSR I.SW= 1B08
000100 .DUSR J.SW= 1B09
000040 .DUSR K.SW= 1B10
000020 .DUSR L.SW= 1B11
000010 .DUSR M.SW= 1B12
000004 .DUSR N.SW= 1B13
000002 .DUSR O.SW= 1B14
000001 .DUSR P.SW= 1B15
100000 .DUSR Q.SW= 1B00
040000 .DUSR R.SW= 1B01
020000 .DUSR S.SW= 1B02
010000 .DUSR T.SW= 1B03
004000 .DUSR U.SW= 1B04
002000 .DUSR V.SW= 1B05
001000 .DUSR W.SW= 1B06
000400 .DUSR X.SW= 1B07
000200 .DUSR Y.SW= 1B08
000100 .DUSR Z.SW= 1B09

```

LICENSED MATERIAL - PROPERTY OF DATA GENERAL CORPORATION

10004 PARU

```

01
02      ;
03      ; SYSTEM CONSTANTS.
04      ;
05
06      000377 .DUSR SCWPB=255.          ; WORDS PER BLOCK
07      000400 .DUSR SCDBS=256.          ; SIZE OF DISK BLOCK
08      000100 .DUSR SCRRL=64.           ; WORDS PER RANDOM RECORD
09      000204 .DUSR SCLLG=132.          ; MAX LINE LENGTH
10      000030 .DUSR SCAMX=24.           ; MAX ARGUMENT LENGTH IN BYTES
11      000006 .DUSR SCFNL=UFTEX-UFTFN+1 ; FILE NAME LENGTH
12      000005 .DUSR SCEXT=UFTEX-UFTFN   ; EXTENSION OFFSET IN NAME AREA
13      000012 .DUSR SCMER=10.           ; MAX ERROR RETRY COUNT
14      000016 .DUSR SCSTR=16            ; SAVE FILE STARTING ADDRESS
15      177660 .DUSR SCTIM=-80.           ; RINGIO 1 MS. LOOP TIME (SN)
16      000000 .DUSR SCPPL=0              ; PRIMARY PARTITON LEVEL
17      000006 .DUSR SCPPA=6              ; PRIMARY PARTITION BASE ADDRESS
18      000000 .DUSR SCSYS=0              ; SYS.DR ADDRESS OFFSET
19      000001 .DUSR SCPSH=1              ; PUSH DIRECTORY OFFSET
20      000004 .DUSR SCPNM=4              ; MAX NUMBER OF PUSH LEVELS
21      000011 .DUSR SCMAP=SCPNM*2+SCPSH ; RELATIVE BASE ADDRESS OF MAP.DR
22      000001 .DUSR SCBPB=1              ; RELATIVE BACKGROUND PUSH BASE
23      000005 .DUSR SCFPB=SCBPB+SCPNM   ; RELATIVE FOREGROUND PUSH BASE
24      000021 .DUSR SCFZW=SCBPB+(SCPNM*4) ; FRAME SIZE WORD (SKIP DOUBLE WORD PUSH INDICES)
25      000022 .DUSR SCNVW=SCFZW+1       ; NUMBER-OF-SYSTEM-OVERLAYS WORD
26      100000 .DUSR SFINT=1B0            ; INTERRUPT FLAG
27      000001 .DUSR SFBRK=1B15          ; BREAK FLAG
28      000066 .DUSR SCNSO=66            ; NUMBER OF SYSTEM OVERLAYS
29
30
31      ; DEFINE SYSTEM BOOTSTRAP CONSTANTS
32
33      000000 .DUSR SCTBP=0                ; TEXT STRING BYTE POINTER
34      000001 .DUSR SCINS=1                ; SWITCHED FULL/PARTIAL-OVERLAYS ADDRESS
35      000002 .DUSR SCPSA=2                ; PROGRAM START ADDRESS
36      000002 .DUSR SCPAR=SCPSA           ; PARTIAL INIT ADDRESS
37      000003 .DUSR SCINT=3                ; FULL/PARTIAL-OVERLAYS INIT ADDRESS
38      000004 .DUSR SCCLI=SCINT+1         ; ADDRESS OF END OF CLI
39      000005 .DUSR SCZMX=SCCLI+1         ; SQUASHED/UNSQUASHED FLAG
40      000006 .DUSR SCCPL=SCZMX+1         ; CURRENT PARTITION LEVEL
41      000007 .DUSR SCPBA=SCCPL+1         ; PARTITION BASE ADDRESS (LOW ORDER)
42      000010 .DUSR SCOFA=SCPBA+1         ; OVERLAY BASE ADDRESS (LOW ORDER)
43      000011 .DUSR SCPB1=SCOFA+1        ; PARTITION BASE ADDRESS (HIGH ORDER)
44      000012 .DUSR SCOF1=SCPB1+1        ; OVERLAY BASE ADDRESS (HIGH ORDER)
45      000013 .DUSR SCBAS=SCOF1+1        ; BASE OF INFORMATION BLOCK
46      000013 .DUSR SCSWC=SCBAS          ; SWITCH FOR SCINS ENTRY
47      000020 .DUSR SCIDV=20              ; INITIAL DEVICE CODE
48
49      000000 .DUSR SCAUN=0                ; ASCII UNIT NUMBER
50      000001 .DUSR SCUN=1                ; UNIT (DEVICE CODE)
51      000002 .DUSR SCGO=2                ; ENTRY TO PASS FILENAME
52      000004 .DUSR SCNGO=4               ; ENTRY TO ASK FROM CONSOLE
53

```


LICENSED MATERIAL - PROPERTY OF DATA GENERAL CORPORATION

10005 PARU

```

01
02           ; DEFINE THE SYSTEM ERROR CODES
03
04 000000 .DUSR ERFNO= 0           ; ILLEGAL CHANNEL NUMBER
05 000001 .DUSR ERFNM= 1           ; ILLEGAL FILE NAME
06 000002 .DUSR ERICM= 2           ; ILLEGAL SYSTEM COMMAND
07 000003 .DUSR ERICD= 3           ; ILLEGAL COMMAND FOR DEVICE
08 000004 .DUSR ERSV1= 4           ; NOT A SAVED FILE
09 000005 .DUSR ERWR0= 5           ; ATTEMPT TO WRITE AN EXISTENT FILE
10 000006 .DUSR EREOF= 6           ; END OF FILE
11 000007 .DUSR ERRPR= 7           ; ATTEMPT TO READ A READ PROTECTED FILE
12 000010 .DUSR ERWPR= 10          ; WRITE PROTECTED FILE
13 000011 .DUSR ERCRE= 11          ; ATTEMPT TO CREATE AN EXISTENT FILE
14 000012 .DUSR ERDLE= 12          ; A NON-EXISTENT FILE
15 000013 .DUSR ERDE1= 13          ; ATTEMPT TO ALTER A PERMANENT FILE
16 000014 .DUSR ERCHA= 14          ; ATTRIBUTES PROTECTED
17 000015 .DUSR ERFOP= 15          ; FILE NOT OPENED
18 000016 .DUSR ERFUE= 16          ; FATAL UTILITY ERROR
19 000017 .DUSR EREXQ= 17          ; EXECUTE CLI.CM (NO ERROR)
20 000020 .DUSR ERNUL= 20          ; INVISIBLE ERROR CODE
21 000021 .DUSR ERUFT= 21          ; ATTEMPT TO USE A UFT ALREADY IN USE
22 000022 .DUSR ERLLI= 22          ; LINE LIMIT EXCEEDED 0
23 000023 .DUSR ERRTN= 23          ; ATTEMPT TO RESTORE A NON-EXISTENT IMAGE
24 000024 .DUSR ERPAR= 24          ; PARITY ERROR ON READ LINE
25 000025 .DUSR ERCM3= 25          ; TRYING TO PUSH TOO MANY LEVELS
26 000026 .DUSR ERMEM= 26          ; NOT ENUF MEMORY AVAILABLE
27 000027 .DUSR ERSPC= 27          ; OUT OF FILE SPACE
28 000030 .DUSR ERFIL= 30          ; FILE READ ERROR
29 000031 .DUSR ERSEL= 31          ; UNIT NOT PROPERLY SELECTED
30 000032 .DUSR ERADR= 32          ; ILLEGAL STARTING ADDRESS
31 000033 .DUSR ERRD= 33           ; ATTEMPT TO READ INTO SYSTEM AREA
32 000034 .DUSR ERDIO= 34          ; FILE ACCESSIBLE BY DIRECT I/O ONLY
33 000035 .DUSR ERDIR= 35          ; FILES SPECIFIED ON DIFF. DIRECTORIES
34 000036 .DUSR ERDNM= 36          ; DEVICE NOT IN SYSTEM
35 000037 .DUSR EROVN= 37          ; ILLEGAL OVERLAY NUMBER
36 000040 .DUSR EROVA= 40          ; FILE NOT ACCESSIBLE BY DIRECT I/O
37 000041 .DUSR ERTIM= 41          ; USER SET TIME ERROR
38 000042 .DUSR ERNOT= 42          ; OUT OF TCB'S
39 000043 .DUSR ERXMT= 43          ; SIGNAL TO BUSY ADDR
40 000044 .DUSR ERSQF= 44          ; FILE ALREADY SQUASHED ERROR
41 000045 .DUSR ERIBS= 45          ; DEVICE ALREADY IN SYSTEM
42 000046 .DUSR ERICB= 46          ; INSUFFICIENT CONTIGUOUS BLOCKS
43 000047 .DUSR ERSIM= 47          ; QTY ERROR
44 000050 .DUSR ERQTS= 50          ; ERROR IN USER TASK QUEUE TABLE
45 000051 .DUSR ERNMD= 51          ; NO MORE DCB'S
46 000052 .DUSR ERIDS= 52          ; ILLEGAL DIRECTORY SPECIFIER
47 000053 .DUSR ERDSN= 53          ; DIRECTORY SPECIFIER NOT KNOWN
48 000054 .DUSR ERD2S= 54          ; DIRECTORY IS TOO SMALL
49 000055 .DUSR ERDDE= 55          ; DIRECTORY DEPTH EXCEEDED
50 000056 .DUSR ERDIU= 56          ; DIRECTORY IN USE
51 000057 .DUSR ERLDE= 57          ; LINK DEPTH EXCEEDED
52 000060 .DUSR ERFIU= 60          ; FILE IS IN USE
53 000061 .DUSR ERTID= 61          ; TASK ID ERROR
54 000062 .DUSR ERCMS= 62          ; COMMON SIZE ERROR
55 000063 .DUSR ERCUS= 63          ; COMMON USAGE ERROR
56 000064 .DUSR ERSCP= 64          ; FILE POSITION ERROR
57 000065 .DUSR ERDCH= 65          ; INSUFFICIENT ROOM IN DATA CHANNEL MAP
58 000066 .DUSR ERDNI= 66          ; DIRECTORY NOT INITIALIZED
59 000067 .DUSR ERNDD= 67          ; NO DEFAULT DIRECTORY
60 000070 .DUSR ERFGE= 70          ; FOREGROUND ALREADY EXISTS

```

LICENSED MATERIAL - PROPERTY OF DATA GENERAL CORPORATION

0006 PARU

01	000071	.DUSR	ERMPT=	71	; ERROR IN PARTITON SET
02	000072	.DUSR	EROPD=	72	; DIRECTORY IN USE BY OTHER PROGRAM
03	000073	.DUSR	ERUSZ=	73	; NO ROOM FOR UFTS ON EXEC/EXFG
04	000074	.DUSR	ERMPR=	74	; ADDR ERROR ON .SYSTEM PARAM
05	000075	.DUSR	ERNLE=	75	; NOT A LINK ENTRY
06	000076	.DUSR	ERNTE=	76	; CURRENT BG IS NOT CHECKPOINTABLE
07	000077	.DUSR	ERSDE=	77	; SYS.DR ERROR
08	000100	.DUSR	ERMDE=	100	; MAP.DR ERROR
09	000101	.DUSR	ERDTO=	101	; DEVICE TIME OUT
10	000102	.DUSR	ERENA=	102	; ENTRY NOT ACCESSIBLE VIA LINK
11	000103	.DUSR	ERMCA=	103	; MCA REQUEST OUTSTANDING
12	000104	.DUSR	ERSRR=	104	; INCOMPLETE TRANSMISSION CAUSED BY RECIEVER
13	000105	.DUSR	ERSDL=	105	; SYSTEM DEADLOCK
14	000106	.DUSR	ERCLO=	106	; I/O TERMINATED BY CHANNEL CLOSE
15	000107	.DUSR	ERSFA=	107	; SPOOL FILE(S) ACTIVE
16	000110	.DUSR	ERABT=	110	; TASK NOT FOUND FOR ABORT
17	000111	.DUSR	ERDOP=	111	; DEVICE PREVIOUSLY OPENED
18	000112	.DUSR	EROVF=	112	; SYSTEM STACK OVERFLOW
19	000113	.DUSR	ERNMC=	113	; NO MCA RECEIVE REQUEST OUTSTANDING
20	000114	.DUSR	ERNIR=	114	; NO INIT/RELEASE ON OPENED DEVICE (MAG TAPE)
21	000115	.DUSR	ERXMZ=	115	; .XMT & .IXMT MESSAGES MUST BE NON-ZERO
22	000116	.DUSR	ERCANT=	116	; 'YOU CAN'T DO THAT'

LICENSED MATERIAL - PROPERTY OF DATA GENERAL CORPORATION

10007 PARU

```

01
02           ; DEFINE THE CLI ERROR CODES
03
04     000300 .DUSR   CNEAR=  300   ; NOT ENOUGH ARGUMENTS
05     000301 .DUSR   CILAT=  301   ; ILLEGAL ATTRIBUTE
06     000302 .DUSR   CND8D=  302   ; NO DEBUG ADDRESS
07     000303 .DUSR   CCLTL=  303   ; COMMAND LINE TOO LONG
08     000304 .DUSR   CNSAD=  304   ; NO STARTING ADDRESS
09     000305 .DUSR   CCKER=  305   ; CHECKSUM ERROR
10     000306 .DUSR   CNSFS=  306   ; NO SOURCE FILE SPECIFIED
11     000307 .DUSR   CNACM=  307   ; NOT A COMMAND
12     000310 .DUSR   CILBK=  310   ; ILLEGAL BLOCK TYPE
13     000311 .DUSR   CSPER=  311   ; NO FILES MATCH SPECIFIER
14     000312 .DUSR   CPHER=  312   ; PHASE ERROR
15     000313 .DUSR   CTMAR=  313   ; TOO MANY ARGUMENTS
16     000314 .DUSR   CTMAD=  314   ; TOO MANY ACTIVE DEVICES
17     000315 .DUSR   CILNA=  315   ; ILLEGAL NUMERIC ARGUMENT
18     000316 .DUSR   CSFUE=  316   ; FATAL SYSTEM UTILITY ERROR
19     000317 .DUSR   CILAR=  317   ; ILLEGAL ARGUMENT
20     000320 .DUSR   CCANT=  320   ; IMPROPER OR MALICIOUS INPUT
21     000321 .DUSR   CTMLI=  321   ; TOO MANY LEVELS OF INDIRECT FILES
22     000322 .DUSR   CSYER=  322   ; SYNTAX ERROR
23     000323 .DUSR   CBKER=  323   ; BRACKET ERROR
24     000324 .DUSR   CPARE=  324   ; PAREN ERROR
25     000325 .DUSR   CCART=  325   ; < WITHOUT > OR > WITHOUT <
26     000326 .DUSR   CCAR1=  326   ; ILLEGAL NESTING OF <> AND ()
27     000327 .DUSR   CINDE=  327   ; ILLEGAL INDIRECT FILENAME
28     000330 .DUSR   CPAR1=  330   ; ILLEGAL NESTING OF () AND []
29
30     000330 .DUSR   CCMAX=  CPAR1  ; MAX CLI ERROR CODE
31     000036 .DUSR   ERML=   30.   ; MAXIMUM ERROR MESSAGE LENGTH
32
33
34
35
36           ; DEFINE THE PANICS
37
38     100001 .DUSR   PNMPE=  @1     ; MAP.DR ERROR
39     100002 .DUSR   PNSDE=  @2     ; SYSTEM DIRECTORY ERROR
40     100003 .DUSR   PNC8O=  @3     ; SYSTEM STACK FAULT
41     100004 .DUSR   PNIDA=  @4     ; INCONSISTENT SYSTEM DATA
42     100005 .DUSR   PNMDD=  @5     ; MASTER DEVICE DATA ERROR
43     100006 .DUSR   PNMDT=  @6     ; MASTER DEVICE TIME OUT
44     100007 .DUSR   PNDPE=  @7     ; MOVING HEAD DISK ERROR
45     100010 .DUSR   PNCUI= @10    ; UNCLEARABLE UNDEFINED INTERRUPT
46     100012 .DUSR   PNCBK= @12    ; INSUFFICIENT CONTIGUOUS BLOCKS TO BUILD
47                                     ; PUSH SPACE INDICES
48     100011 .DUSR   PNILL= @11    ; ILLEGAL EXTENDED INSTRUCTION
49     100013 .DUSR   PNPSH= @13    ; RTN BEYOND TOP OF WORLD
50     100014 .DUSR   PNIPB= @14    ; INCONSISTENT OR IMPOSSIBLE CONDITION
51                                     ; RELATED TO DUAL PROCESSORS (IPB)
52     100015 .DUSR   PNITR= @15    ; INT WORLD TRAPPED

```

LICENSED MATERIAL - PROPERTY OF DATA GENERAL CORPORATION

10008 PARU

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01
02      ;
03      ; USER STATUS TABLE (UST) TEMPLATE
04      ;
05      000400 .DUSR   UST=    400      ; START OF BACKGROUND USER STATUS AREA
06
07      000012 .DUSR   USTP=12          ;PZERO LOC FOR UST POINTER
08      ; NOTE- USTP MUST CORRESPOND TO PARS PZERO ALLOCATIONS
09
10      000000 .DUSR   USTPC=  0
11      000001 .DUSR   USTZM=  1          ; ZMAX
12      000002 .DUSR   USTSS=  2          ; START OF SYMBOL TABLE
13      000003 .DUSR   USTES=  3          ; END OF SYMBOL TABLE
14      000004 .DUSR   USTNM=  4          ; NMAX
15      000005 .DUSR   USTSA=  5          ; STARTING ADDRESS
16      000006 .DUSR   USTDA=  6          ; DEBUGGER ADDRESS
17      000007 .DUSR   USTHU=  7          ; HIGHEST ADDRESS USED
18      000010 .DUSR   USTCS= 10          ; FORTRAN COMMON AREA SIZE
19      000011 .DUSR   USTIT= 11          ; INTERRUPT ADDRESS
20      000012 .DUSR   USTBR= 12          ; BREAK ADDRESS
21      000013 .DUSR   USTCH= 13          ; # TASKS (LEFT), # CHANS (RIGHT)
22      000014 .DUSR   USTCT= 14          ; CURRENTLY ACTIVE TCB
23      000015 .DUSR   USTAC= 15          ; START OF ACTIVE TCB CHAIN
24      000016 .DUSR   USTFC= 16          ; START OF FREE TCB CHAIN
25      000017 .DUSR   USTIN= 17          ; INITIAL START OF NREL
26      000020 .DUSR   USTOD= 20          ; OVLY DIRECTORY ADDR
27      000021 .DUSR   USTSV= 21          ; FORTRAN STATE VARIABLE SAVE ROUTINE (OR 0)
28      000022 .DUSR   USTRV= 22          ; REVISION
29      000023 .DUSR   USTIA= 23          ; TCB ADDR OF INT OR BREAK PROC
30
31      000023 .DUSR   USTEN= USTIA      ; LAST ENTRY
32
33      000030 .DUSR   UFPT=  30          ; SAVE SOS

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LICENSED MATERIAL - PROPERTY OF DATA GENERAL CORPORATION

10009 PARU

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01
02      ;
03      ; DEFINE TASK CONTROL BLOCK (TCB) TEMPLATE
04      ;
05
06      000000 .DUSR TPC=      0      ;USER PC + CARRY
07      000001 .DUSR TAC0=     1      ;AC0
08      000002 .DUSR TAC1=     2      ;AC1
09      000003 .DUSR TAC2=     3      ;AC2
10      000004 .DUSR TAC3=     4      ;AC3
11      000005 .DUSR TPRST=    5      ;STATUS BITS (RIGHT BYTE) + PRIORITY (LEFT BYTE)
12      000006 .DUSR TSYS=     6      ;SYSTEM CALL WORD
13      000007 .DUSR TLNK=     7      ;LINK WORD
14      000010 .DUSR TUSP=    10      ;USP
15      000011 .DUSR TELN=    11      ;TCB EXTENTION ADDR
16      000012 .DUSR TID=     12      ;TASK ID
17      000013 .DUSR TTMP=    13      ;SCHEDULER TEMPORARY
18      000014 .DUSR  TKLAD=    14      ;USER KILL PROC ADDR
19      000015 .DUSR  TSP=     15      ;STACK POINTER
20      000016 .DUSR  TFP=     16      ;FRAME POINTER
21      000017 .DUSR  TSL=     17      ;STACK LIMIT
22      000020 .DUSR  TSO=     20      ;OVERFLOW ADDR
23
24      000015 .DUSR TLN=TKLAD-TPC+1  ;LENGTH OF TCB
25      ; DEFINE BIRD TCB AND ALL SINGLE TASK
26      000021 .DUSR TLNB= TSO-TPC+1
27
28      ; DEFINE TASK STATUS BITS
29      ;
30      ; 1B0 = TASK PENDED
31      ; 1B1 = SUSPENDED
32      ; 1B2 = WAITING FOR OVERLAY AREA OR .XMTW/.REC
33      ; 1B3 = WAITING FOR .TRDOP (READ OPERATOR INPUT)

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LICENSED MATERIAL - PROPERTY OF DATA GENERAL CORPORATION

!0010 PARU

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01      ;
02      ; DEFINE OVERLAY NODE TABLE
03      ;
04
05
06      000000 .DUSR   OVNDS=0           ;DIRECTORY NODE TABLE START
07      000001 .DUSR   OVRES=1          ;CURRENT OVLY+USER COUNT
08      000002 .DUSR   OVDIS=2         ;NUMBER OF OVERLAYS (LEFT BYTE)
09      000003 .DUSR   OVBLK=3         ;SIZE IN BLOCKS (RIGHT BYTE)
10      000004 .DUSR   OVNAD=4         ;STARTING BLOCK
11      000004 .DUSR   OVNAD=4         ;CORE ADDR FOR NODE
12
13
14
15      ; OFFSETS FOR USER TASK QUEUE TABLE
16
17      000000 .DUSR   QPC= 0           ;STARTING PC
18      000001 .DUSR   QNUM= 1         ;NUMBER OF TIMES TO EXEC
19      000002 .DUSR   QTOV= 2         ;OVERLAY
20      000003 .DUSR   QSH= 3          ;STARTING HOUR
21      000004 .DUSR   QSMS= 4         ;STARTING SEC IN HOUR
22      000005 .DUSR   QPRI= TPRST     ;MUST BE SAME
23      000006 .DUSR   QRR= 6          ;RERUN TIME INC IN SEC
24      000007 .DUSR   QTLNK= TLNK     ;MUST BE SAME
25      000010 .DUSR   QOCH= 10        ;CHAN OVERLAYS OPEN ON
26      000011 .DUSR   QCOND= 11       ;TYPE OF LOAD
27      000012 .DUSR   QLDST= 12       ;LOAD STATUS
28      000013 .DUSR   QTLN= QLDST-QPC+1 ; 1B0= LOADING, 1B15= DEQUE REQ REC
29
30
31
32
33      ;
34      ; TUNING FILE DISPLACEMENTS:
35      ;
36
37      000000 .DUSR   .TUN=0           ;OFFSET TO NUMBER WORD IN PAIR
38      000001 .DUSR   .TUC=.TUN+1     ;OFFSET TO 1ST COUNT IN PAIR
39      000003 .DUSR   .TUP=.TUC+2     ;OFFSET TO 2ND COUNT OF PAIR
40      000005 .DUSR   .TUNX=.TUP+2    ;LENGTH OF COUNT PAIR
41
42      000001 .DUSR   .TUNSTK=1         ;NUMBER STACKS IN SYSTEM
43      000002 .DUSR   .TUSTK= .TUNSTK+.TUC-.TUN ;STACK COUNT
44      000004 .DUSR   .TUPSTK=.TUNSTK+.TUP-.TUN ;STACK PEND COUNT
45
46      000006 .DUSR   .TUNCEL=.TUNSTK+.TUNX ;NUMBER CELLS IN SYSTEM
47      000007 .DUSR   .TUCEL= .TUNCEL+.TUC-.TUN ;CELLS COUNTS
48      000011 .DUSR   .TUPCEL=.TUNCEL+.TUP-.TUN
49
50      000013 .DUSR   .TUNBUF=.TUNCEL+.TUNX ;BUFFERS, EXCLUDING TUNING BUFFERS
51      000014 .DUSR   .TUBUF= .TUNBUF+.TUC-.TUN ;COUNTS
52      000016 .DUSR   .TUPBUF=.TUNBUF+.TUP-.TUN
53
54      000020 .DUSR   .TUNOV= .TUNBUF+.TUNX ;OVERLAYS
55      000021 .DUSR   .TUOV= .TUNOV+.TUC-.TUN
56      000023 .DUSR   .TUPOV= .TUNOV+.TUP-.TUN
57
58      000025 .DUSR   TULEN=.TUNOV+.TUNX

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10011 PARU

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01
02           ; COPYRIGHT (C) DATA GENERAL CORPORATION, 1972, 1973
03           ; ALL RIGHTS RESERVED.
04
05
06           ;SOS USER APPLICATION PARAMETERS (PARUA)
07
08           ;STACK DISPLACEMENTS
09
10      000006 .DUSR   SSEL=   6           ; ENTRY LENGTH
11      000005 .DUSR   SOSEC=  5           ; ENTRY COUNT FOR SOS USER ROUTINES
12      000000 .DUSR   RTR=    0           ; FRAME LAYOUT:
13      000001 .DUSR   T0=    1           ; RETURN LOCATION
14      000002 .DUSR   T1=    2           ; TEMPORARIES
15      000003 .DUSR   SAC0=  3           ; SAVE ACCUMULATORS
16      000004 .DUSR   SAC1=  4
17      000005 .DUSR   SAC2=  5
18      177775 .DUSR   OAC0=  SAC0-SSEL   ; THESE DISPLACEMENTS PERMIT
19      177776 .DUSR   OAC1=  SAC1-SSEL   ; "CALLEE" TO GET AT "CALLER'S"
20      177777 .DUSR   OAC2=  SAC2-SSEL   ; REGISTERS
21      177772 .DUSR   ORTR=  RTR-SSEL
22      177773 .DUSR   OT0=   T0-SSEL
23      177774 .DUSR   OT1=   T1-SSEL
24
25                                     ; COMMAND TABLE DISPLACEMENTS
26
27      000000 .DUSR   CTBP=   0           ; STRING BYTE POINTER
28      000001 .DUSR   CTSW=   1           ; SWITCH WORD
29      000002 .DUSR   CTNBP=  2           ; NEXT STARTING BYTE POINTER
30      000002 .DUSR   CTEL=   2           ; ENTRY LENGTH
31
32                                     ; COMMAND TABLE SWITCHES
33
34      100000 .DUSR   SW0=    1B0         ; EACH OF THESE BIT SETTINGS
35      040000 .DUSR   SW1=    1B1         ; MAY BE EQUIVALENCED TO A MEAN-
36      020000 .DUSR   SW2=    1B2         ; INGFUL VALUE IN THE USER APPLI-
37      010000 .DUSR   SW3=    1B3         ; CATION PROGRAM. THE ARRANGEMENT
38      004000 .DUSR   SW4=    1B4         ; OF THE TRANSLATE TABLE (TRT)
39      002000 .DUSR   SW5=    1B5         ; DETERMINES THE PRECISE MEANING
40      001000 .DUSR   SW6=    1B6         ; OF EACH SWITCH.
41      000400 .DUSR   SW7=    1B7
42      000200 .DUSR   SW8=    1B8
43      000100 .DUSR   SW9=    1B9
44      000040 .DUSR   SW10=   1B10
45      000020 .DUSR   SW11=   1B11
46
47           .EOT

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0012 PARU

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01
02           ; COPYRIGHT (C) DATA GENERAL CORPORATION, 1971, 1973
03           ; ALL RIGHTS RESERVED.
04
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06           ;
07           ;           SOS PARAMETERS
08           ;
09
10           ;           LINKAGE
11
12     006003 .DUSR   SAVE=   JSR @3
13     002004 .DUSR   RTRN=   JMP @4
14     000000 .DUSR   RTLOC=   0
15     000001 .DUSR   AC0=    1
16     000002 .DUSR   AC1=    2
17     000003 .DUSR   TMP=    3
18     000004 .DUSR   SLGT=   TMP+1
19     177775 .DUSR   OAC0=   AC0-SLGT
20     177776 .DUSR   OAC1=   AC1-SLGT
21     177777 .DUSR   OTMP=   TMP-SLGT
22     177774 .DUSR   ORTN=   RTLOC-SLGT
23     000006 .DUSR   NFRAM=   6.
24     000030 .DUSR   SSZ=    NFRAM*SLGT
25
26           ;           PAGE ZERO
27
28     000006 .DUSR   RLOC=    6
29     000007 .DUSR   CMSK=    7
30     000010 .DUSR   CSP=    10
31     000011 .DUSR   CDCT=    11           ; IN SERVICE DCT
32     000013 .DUSR   BDCT=    13           ; BEGINNING OF DCT CHAIN
33     000014 .DUSR   CAC0=    14
34     000015 .DUSR   CAC1=    15
35
36
37           ;           ADDITIONAL UST DEFINITIONS
38
39     000030 .DUSR   USTSP=   30           ; UST SPARE WORD AREA
40     000031 .DUSR   USTS1=  USTSP+1 ; SECOND SPARE
41     000032 .DUSR   USTA0=  USTS1+1
42     000033 .DUSR   USTA1=  USTA0+1
43     000034 .DUSR   USTA2=  USTA1+1
44     000035 .DUSR   USTA3=  USTA2+1
45     000036 .DUSR   USTCY=  USTA3+1
46     000037 .DUSR   USTWA=  USTCY+1
47
48           ;           ADDITIONAL DEVICE CHARACTERISTICS
49
50     100000 .DUSR   DCDIR=  1B0           ; SOS DATA CHANNEL DEVICE
51

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LICENSED MATERIAL - PROPERTY OF DATA GENERAL CORPORATION

10013 PARU

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; DEVICE CONTROL TABLE (DCT) LAYOUT

; COMMON TO ALL DEVICES

000000 .DUSR DCTCD= 0 ; DEVICE CODE
000001 .DUSR DCTMS= 1 ; MASK OF LOWER PRIORITY DEVICES

; DEFINE THE MASK BITS

000001 .DUSR MSTTO= 1B15
000002 .DUSR MSTTI= 1B14
000004 .DUSR MSPTP= 1B13
000010 .DUSR MSLPT= 1B12
000040 .DUSR MSCDR= 1B10
000010 .DUSR MSPLT= 1B12
000040 .DUSR MSMTA= 1B10
000020 .DUSR MSPTR= 1B11

000002 .DUSR DCTCH= 2 ; DEVICE CHARACTERISTICS
000003 .DUSR DCTLK= 3 ; LINK TO NEXT DCT
; (-1 TERMINATES THE CHAIN)
000004 .DUSR DCTIS= 4 ; INTERRUPT SERVICE ROUTINE ADDRESS
000005 .DUSR DCTIL= 5 ; INTERRUPT MACHINE STATE LINK

000006 .DUSR DCTDT= 6 ; COMMAND DISPATCH TABLE ADDRESS WORD
000007 .DUSR DCTST= 7 ; ADDRESS OF DEVICE START ROUTINE
000010 .DUSR DCTSP= 10 ; ADDRESS OF DEVICE STOP ROUTINE
000011 .DUSR DCTFL= 11 ; FLAGS (ACTIVE, ATTACHED, ETC.)

; DEFINE THE FLAGS

000001 .DUSR DCACT= 1B15 ; ACTIVE FLAG
000200 .DUSR DCACPT= 1B8 ; ACCEPT CHARACTER FLAG
100000 .DUSR DCKMD= 1B0 ; TTY KEYBOARD MODE FLAG

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10014 PARU

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; COMMON TO DEDICATED DEVICES (I.E. SINGLE USER/SINGLE BUFFER)

000012 .DUSR DCTBS= 12 ; BUFFER SIZE (BYTES)
 000013 .DUSR DCTBF= 13 ; BUFFER FIRST ADDRESS (BYTE)
 000014 .DUSR DCTBL= 14 ; BUFFER LAST ADDRESS
 000015 .DUSR DCTIP= 15 ; BUFFER INPUT POINTER (BYTE)
 000016 .DUSR DCTOP= 16 ; BUFFER OUTPU POINTER
 000017 .DUSR DCTCN= 17 ; COUNT OF ACTIVE DATA
 000020 .DUSR DCTTO= 20 ; TIMEOUT WORD (ALL INPUT DEVICES)
 000020 .DUSR DCTCC= 20 ; COLUMN COUNTER (ALLOUTPUT DEVICES)
 000021 .DUSR DCTRC= 21 ; RESTART CONSTANT (ALL INPUT DEVICES)
 000021 .DUSR DCTLG= 21 ; LINE COUNTER (ALL OUTPUT DEVICES)
 000022 .DUSR DCTAT= 22 ; DEVICE ATTRIBUTES
 000023 .DUSR DCTFC= 23 ; DEVICE FIXED CHARACTERISTICS
 000000 .DUSR LCHNO= 0 ; LOWEST LEGAL CHANNEL #
 000037 .DUSR HCHNO= 37 ; HIGHEST LEGAL CHANNEL #

; MAG TAPE PARAMETERS

000377 .DUSR MTBWZ= 377 ; BUFFER WORD SIZE
 000776 .DUSR MTBBZ= MTBWZ*2 ; BUFFER BYTE SIZE
 000377 .DUSR CTBWZ= MTBWZ
 000776 .DUSR CTBBZ= MTBBZ

; INTERRUPT FRAME TEMPLATE

000024 .DUSR IAC0= DCTFC+1
 000025 .DUSR IAC1= IAC0+1
 000026 .DUSR IAC2= IAC1+1
 000027 .DUSR IAC3= IAC2+1
 000030 .DUSR IPC= IAC3+1
 000031 .DUSR IRLOC= IPC+1
 000032 .DUSR IMSK= IRLOC+1
 000007 .DUSR IFRL= 7 ; INTERRUPT FRAME LENGTH

.EOT

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0016 PARU

AC0	000001	12/15	12/19
AC1	000002	12/16	12/20
ATCHA	040000	2/18	
ATCON	000010	2/37	
ATDIO	000200	2/36	
ATDIR	002000	2/34	
ATLNK	010000	2/32	
ATMSK	003400	2/30	
ATNRS	000400	2/20	
ATPAR	004000	2/33	
ATPER	000002	2/23	
ATRAN	000004	2/38	
ATRES	001000	2/35	
ATRP	100000	2/17	
ATSAV	020000	2/19	
ATUS1	000100	2/21	
ATUS2	000040	2/22	
ATWP	000001	2/24	
A.SW	100000	3/34	
BDCT	000013	12/32	
B.SW	040000	3/35	
CAC0	000014	12/33	
CAC1	000015	12/34	
CBKER	000323	7/23	
CCANT	000320	7/20	
CCAR1	000326	7/26	
CCART	000325	7/25	
CCKER	000305	7/09	
CCLTL	000303	7/07	
CCMAX	000330	7/30	
CDCT	000011	12/31	
CILAR	000317	7/19	
CILAT	000301	7/05	
CILBK	000310	7/12	
CILNA	000315	7/17	
CINDE	000327	7/27	
CMSK	000007	12/29	
CNACM	000307	7/11	
CNDBD	000302	7/06	
CNEAR	000300	7/04	
CNSAD	000304	7/08	
CNSFS	000306	7/10	
CPAR1	000330	7/28	7/30
CPARE	000324	7/24	
CPHER	000312	7/14	
CSFUE	000316	7/18	
CSP	000010	12/30	
CSPER	000311	7/13	
CSYER	000322	7/22	
CTBBZ	000776	14/27	
CTBP	000000	11/27	
CTBWZ	000377	14/26	
CTEL	000002	11/30	
CTMAD	000314	7/16	
CTMAR	000313	7/15	
CTMLI	000321	7/21	
CTNBP	000002	11/29	
CTSW	000001	11/28	
C.SW	020000	3/36	

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 0017 PARU

DCACP	000200	13/37
DCACT	000001	13/36
DCBDK	100000	3/22
DCC80	040000	3/20
DCCGN	000002	3/06
DCCNF	000010	3/09
DCCPO	000001	3/04
DCDIO	100000	3/21
DCDIR	100000	12/50
DCFFO	010000	3/18
DCFWD	004000	3/17
DCIDI	000004	3/08
DCKEY	000040	3/11
DCKMD	100000	13/38
DCLAC	001000	3/15
DCLTU	020000	3/19
DCNAF	000100	3/12
DCPCK	000400	3/14
DCRAT	000200	3/13
DCSPC	100000	3/24
DCSPO	002000	3/16
DCSTO	000001	3/05
DCTAT	000022	14/16
DCTBF	000013	14/07
DCTBL	000014	14/08
DCTBS	000012	14/06
DCTCC	000020	14/13
DCTCD	000000	13/08
DCTCH	000002	13/22
DCTCN	000017	14/11
DCTDT	000006	13/30
DCTFC	000023	14/17
DCTFL	000011	13/33
DCTIL	000005	13/26
DCTIP	000015	14/09
DCTIS	000004	13/25
DCTLG	000021	14/15
DCTLK	000003	13/23
DCTMS	000001	13/09
DCTO	000020	3/10
DCTOP	000016	14/10
DCTRC	000021	14/14
DCTSP	000010	13/32
DCTST	000007	13/31
DCTTO	000020	14/12
D.SW	010000	3/37
ERABT	000110	6/16
ERADR	000032	5/30
ERCAN	000116	6/22
ERCHA	000014	5/16
ERCLO	000106	6/14
ERCM3	000025	5/25
ERCM9	000062	5/54
ERCRE	000011	5/13
ERCUS	000063	5/55
ERD2S	000054	5/48
ERDCH	000065	5/57
ERDDE	000055	5/49

14/32

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0018 PARU

ERDE1	000013	5/15
ERDIO	000034	5/32
ERDIR	000035	5/33
ERDIU	000056	5/50
ERDLE	000012	5/14
ERDNI	000066	5/58
ERDNM	000036	5/34
ERDOP	000111	6/17
ERDSN	000053	5/47
ERDTO	000101	6/09
ERENA	000102	6/10
EREOF	000006	5/10
EREXQ	000017	5/19
ERFGE	000070	5/60
ERFIL	000030	5/28
ERFIU	000060	5/52
ERFNM	000001	5/05
ERFNO	000000	5/04
ERFOP	000015	5/17
ERFUE	000016	5/18
ERIBS	000045	5/41
ERICB	000046	5/42
ERICD	000003	5/07
ERICM	000002	5/06
ERIDS	000052	5/46
ERLDE	000057	5/51
ERLLI	000022	5/22
ERMCA	000103	6/11
ERMDE	000100	6/08
ERMEM	000026	5/26
ERML	000036	7/31
ERMPR	000074	6/04
ERMPT	000071	6/01
ERNDD	000067	5/59
ERNIR	000114	6/20
ERNLE	000075	6/05
ERNMC	000113	6/19
ERNMD	000051	5/45
ERNOT	000042	5/38
ERNTE	000076	6/06
ERNUL	000020	5/20
EROPD	000072	6/02
EROVA	000040	5/36
EROVF	000112	6/18
EROVN	000037	5/35
ERPAR	000024	5/24
ERQTS	000050	5/44
ERRD	000033	5/31
ERRPR	000007	5/11
ERRTN	000023	5/23
ERSCP	000064	5/56
ERSDE	000077	6/07
ERSDL	000105	6/13
ERSEL	000031	5/29
ERSFA	000107	6/15
ERSIM	000047	5/43
ERSPC	000027	5/27
ERSQF	000044	5/40

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0019 PARU

ERSRR 000104	6/12		
ERSV1 000004	5/08		
ERTID 000061	5/53		
ERTIM 000041	5/37		
ERUFT 000021	5/21		
ERUSZ 000073	6/03		
ERWPR 000010	5/12		
ERWR0 000005	5/09		
ERXMT 000043	5/39		
ERXMZ 000115	6/21		
E.SW 004000	3/38		
F.SW 002000	3/39		
G.SW 001000	3/40		
HCHNO 000037	14/20		
H.SW 000400	3/41		
IAC0 000024	14/32	14/33	
IAC1 000025	14/33	14/34	
IAC2 000026	14/34	14/35	
IAC3 000027	14/35	14/36	
IFRL 000007	14/39		
IMSK 000032	14/38		
IPC 000030	14/36	14/37	
IRLOC 000031	14/37	14/38	
I.SW 000200	3/42		
JMP 000000	12/13		
JSR 004000	12/12		
J.SW 000100	3/43		
K.SW 000040	3/44		
LCHNO 000000	14/19		
L.SW 000020	3/45		
MSCDR 000040	13/17		
MSLPT 000010	13/16		
MSMTA 000040	13/19		
MSPLT 000010	13/18		
MSPTP 000004	13/15		
MSPTR 000020	13/20		
MSTTI 000002	13/14		
MSTTO 000001	13/13		
MTBBZ 000776	14/25	14/27	
MTBWZ 000377	14/24	14/25	14/26
M.SW 000010	3/46		
NFRAM 000006	12/23	12/24	
N.SW 000004	3/47		
OAC0 177775	11/18	12/19	
OAC1 177776	11/19	12/20	
OAC2 177777	11/20		
ORTN 177774	12/22		
ORTR 177772	11/21		
OT0 177773	11/22		
OT1 177774	11/23		
OTMP 177777	12/21		
OVBLK 000003	10/10		
OVDIS 000002	10/08		
OVNAD 000004	10/11		
OVNDS 000000	10/06		
OVRES 000001	10/07		
O.SW 000002	3/48		
PNCBK 100012	7/46		

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 0020 PARU

PNC SO	100003	7/40		
PNC UI	100010	7/45		
PND PE	100007	7/44		
PNIDA	100004	7/41		
PNILL	100011	7/48		
PNIPB	100014	7/50		
PNITR	100015	7/52		
PNMDO	100005	7/42		
PNMDT	100006	7/43		
PNMPE	100001	7/38		
PNPSH	100013	7/49		
PNSDE	100002	7/39		
P.SW	000001	3/49		
QCOND	000011	10/26		
QLDST	000012	10/27	10/29	
QNUM	000001	10/18		
QOCH	000010	10/25		
QPC	000000	10/17	10/29	
QPRI	000005	10/22		
QRR	000006	10/23		
QSH	000003	10/20		
QSMS	000004	10/21		
QTLN	000013	10/29		
QTLNK	000007	10/24		
QTOV	000002	10/19		
Q.SW	100000	3/50		
RLOC	000006	12/28		
RTLLOC	000000	12/14	12/22	
RTR	000000	11/12	11/21	
RTRN	002004	12/13		
R.SW	040000	3/51		
SAC0	000003	11/15	11/18	
SAC1	000004	11/16	11/19	
SAC2	000005	11/17	11/20	
SAVE	006003	12/12		
SCAMX	000030	4/10		
SCAUN	000000	4/49		
SCBAS	000013	4/45	4/46	
SCBPB	000001	4/22	4/23	4/24
SCCLI	000004	4/38	4/39	
SCCPL	000006	4/40	4/41	
SCDBS	000400	4/07		
SCEXT	000005	4/12		
SCFNL	000006	4/11		
SCFPB	000005	4/23		
SCFZW	000021	4/24	4/25	
SCGO	000002	4/51		
SCIDV	000020	4/47		
SCINS	000001	4/34		
SCINT	000003	4/37	4/38	
SCLLG	000204	4/09		
SCMAP	000011	4/21		
SCMER	000012	4/13		
SCNGO	000004	4/52		
SCNSO	000066	4/28		
SCNVW	000022	4/25		
SCOF1	000012	4/44	4/45	
SCOFA	000010	4/42	4/43	

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0021 PARU

SCPAR	000002	4/36						
SCPB1	000011	4/43	4/44					
SCPBA	000007	4/41	4/42					
SCPNM	000004	4/20	4/21	4/23	4/24			
SCPPA	000006	4/17						
SCPPL	000000	4/16						
SCPSA	000002	4/35	4/36					
SCPSH	000001	4/19	4/21					
SCRRL	000100	4/08						
SCSTR	000016	4/14						
SCSWC	000013	4/46						
SCSYS	000000	4/18						
SCTBP	000000	4/33						
SCTIM	177660	4/15						
SCUN	000001	4/50						
SCWPB	000377	4/06						
SCZMX	000005	4/39	4/40					
SFBRK	000001	4/27						
SFINT	100000	4/26						
SLGT	000004	12/18	12/19	12/20	12/21	12/22	12/24	
SOSEC	000005	11/11						
SSEL	000006	11/10	11/18	11/19	11/20	11/21	11/22	11/23
SSZ	000030	12/24						
SW0	100000	11/34						
SW1	040000	11/35						
SW10	000040	11/44						
SW11	000020	11/45						
SW2	020000	11/36						
SW3	010000	11/37						
SW4	004000	11/38						
SW5	002000	11/39						
SW6	001000	11/40						
SW7	000400	11/41						
SW8	000200	11/42						
SW9	000100	11/43						
S.SW	020000	3/52						
T0	000001	11/13	11/22					
T1	000002	11/14	11/23					
TAC0	000001	9/07						
TAC1	000002	9/08						
TAC2	000003	9/09						
TAC3	000004	9/10						
TELN	000011	9/15						
TFP	000016	9/20						
TID	000012	9/16						
TKLAD	000014	9/18	9/24					
TLN	000015	9/24						
TLNB	000021	9/26						
TLNK	000007	9/13	10/24					
TMP	000003	12/17	12/18	12/21				
TPC	000000	9/06	9/24	9/26				
TPRST	000005	9/11	10/22					
TSL	000017	9/21						
TSO	000020	9/22	9/26					
TSP	000015	9/19						
TSYS	000006	9/12						
TTMP	000013	9/17						
TULEN	000025	10/50						

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 0022 PARU

TUSP	000010	9/14					
T.SW	010000	3/53					
UDBAD	177770	2/07					
UDBAT	177764	2/05					
UDBBK	177766	2/08					
UDBBN	000017	2/09					
UDDL	177777	2/06					
UFCA1	000024	1/37					
UFDEL	000022	2/03					
UFEA1	000030	1/41					
UFFA1	000037	1/48					
UFLA1	000034	1/45					
UFLAD	000007	1/20					
UFLAN	000014	1/26					
UFNA1	000032	1/43					
UFPT	000030	8/33					
UFTAC	000013	1/24					
UFTAD	000012	1/23	2/07				
UFTAT	000006	1/18	2/05				
UFTBC	000011	1/22					
UFTBK	000010	1/21	2/08				
UFTBN	000041	1/53	2/09				
UFTBP	000042	1/54					
UFTCA	000025	1/38					
UFTCB	000026	1/39					
UFTCH	000043	1/55					
UFTCN	000044	1/56	2/02				
UFTDC	000022	1/35	2/05	2/06	2/07	2/08	2/09
UFTDL	000021	1/31	2/03	2/06			
UFTDR	000036	1/47					
UFTEA	000031	1/42					
UFTEL	000045	2/02					
UFTEX	000005	1/17	4/11	4/12			
UFTFA	000040	1/49					
UFTFN	000000	1/16	2/02	2/03	4/11	4/12	
UFTHM	000015	1/27					
UFTLA	000035	1/46					
UFTLK	000007	1/19					
UFTNA	000033	1/44					
UFTP1	000016	1/28					
UFTP2	000017	1/29					
UFTST	000027	1/40					
UFTUC	000020	1/30					
UFTUN	000023	1/36					
UFTYD	000014	1/25					
UST	000400	8/05					
USTA0	000032	12/41	12/42				
USTA1	000033	12/42	12/43				
USTA2	000034	12/43	12/44				
USTA3	000035	12/44	12/45				
USTAC	000015	8/23					
USTBR	000012	8/20					
USTCH	000013	8/21					
USTCS	000010	8/18					
USTCT	000014	8/22					
USTCY	000036	12/45	12/46				
USTDA	000006	8/16					
USTEN	000023	8/31					

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 0023 PARU

USTES 000003	8/13						
USTFC 000016	8/24						
USTHU 000007	8/17						
USTIA 000023	8/29	8/31					
USTIN 000017	8/25						
USTIT 000011	8/19						
USTNM 000004	8/14						
USTOD 000020	8/26						
USTP 000012	8/07						
USTPC 000000	8/10						
USTRV 000022	8/28						
USTS1 000031	12/40	12/41					
USTSA 000005	8/15						
USTSP 000030	12/39	12/40					
USTSS 000002	8/12						
USTSV 000021	8/27						
USTWA 000037	12/46						
USTZM 000001	8/11						
U.SW 004000	3/54						
V.SW 002000	3/55						
W.SW 001000	3/56						
X.SW 000400	3/57						
Y.SW 000200	3/58						
Z.SW 000100	3/59						
.TUBU 000014	10/51						
.TUC 000001	10/38	10/39	10/43	10/47	10/51	10/55	
.TUCE 000007	10/47						
.TUN 000000	10/37	10/38	10/43	10/44	10/47	10/48	10/51
	10/52	10/55	10/56				
.TUNB 000013	10/50	10/51	10/52	10/54			
.TUNC 000006	10/46	10/47	10/48	10/50			
.TUNO 000020	10/54	10/55	10/56	10/58			
.TUNS 000001	10/42	10/43	10/44	10/46			
.TUNX 000005	10/40	10/46	10/50	10/54	10/58		
.TUOV 000021	10/55						
.TUP 000003	10/39	10/40	10/44	10/48	10/52	10/56	
.TUPB 000016	10/52						
.TUPC 000011	10/48						
.TUPO 000023	10/56						
.TUPS 000004	10/44						
.TUST 000002	10/43						

