DECSYS-7
OPERATING MANUAL

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CHAPTER 1

DESCRIPTION

DECSYS-7, a DECtape-oriented operating system, facilitates FORTRAN programming for Digital Equipment's PDP-7 general-purpose computer. Prime advantages are:

> Minimum dependence on paper tape
>
> Less user intervention
>
> Efficient use of computer time
>
> Improved user-computer communications

Machine requirements for use of the system include a PDP-7 configuration having at least 8,192 words of core memory, one DECtape Control Type 550, and two DECtape transports (either one Dual DECtape Unit Type 555, or two Single DECtape Transports Type TU55).

Each DECSYS-7 installation receives one reel of DECtape (the system master) and a paper tape containing a permanent Bootstrap Routine. The system master tape contains a Keyboard Monitor, eleven system (utility) programs, FORTRAN input-output library routines, and eleven commonly-required library arithmetic functions.

The DECSYS-7 system tape combines the logical functions of a system master, or library, tape with those of an input, or working tape. As such, it stores three types of programs: system, library, and working. System programs are those required for operation of DECSYS-7. The user calls them implicitly through the entry of a keyboard command to the DECSYS-7 Keyboard Monitor. The Monitor accepts and verifies such requests, initiates the printout of error messages where necessary, and loads the appropriate system program. Commonly required subroutines are classed as library programs. The working group consists of user programs originating in the FORTRAN language. Under control of the appropriate system program, the user can call these programs from the system tape to be edited, compiled, assembled, debugged, or executed.

Although users may optionally add their own system, library, and working programs to the supplied DECSYS-7 system tape, it is recommended that they reserve this original tape as a master. Using the capabilities of DECSYS-7, they should make so-called working system tapes to which they can add systems, library, and working programs as they desire. Adherence to this convention will protect the original programs supplied from being inadvertantly destroyed.

REFERENCE DOCUMENTS

The following indicated documents should be readily available to the DECSYS-7 user. Although a minimum of reference is made to them in this manual, a familiarity with their contents will enable a more rapid grasp of DECSYS-7 operational concepts.

Document No.	Title
F-75	PDP-7 User's Handbook
7-2-S	PDP-7 Programming Manual, FORTRAN II
7-3-S	PDP-7 Programming Manual, Symbolic Assembler
7-4-S	PDP-7 Programming Manual, Debugging System
7-20-10-FB	PDP-7 DECTOG Program, PDP-7 Program Library

Some items of which the user should be aware are:

1. The differences between the FIODEC and ASCII codes (refer to F-75).

2. The concept of assembling subroutines in library format (refer to 7-3-S, The FORTRAN Assembly System).

3. The differences in assembling programs in absolute binary or relocatable binary format.

4. The operation of the Linking Loader (refer to 7-3-S).

5. The procedure for certifying DECtape (writing mark and timing tracks, refer to DECTOG Program).

SYSTEM USE

The DECSYS-7 Operating System has three general uses.

1. Editing a system tape or creating a system tape.
2. Editing the working-program group of a system tape.
3. FORTRAN operations (compile, assemble, etc.).

Each is initialized by the user's call for a system program residing on the system tape in use (the assumption is made throughout this manual that users will follow Digital Equipment's recommendation that they make

working system tapes by copying the supplied DECSYS-7 master tape onto certified DECtape). Of the eleven system programs supplied by Digital on the master tape, only the following may be called through the Keyboard Monitor.

LABEL	ASSEMBLE
CONTENTS	LOAD
UPDATE	EDIT
COMPILE	

The four other supplied system programs (compiler, assembler, loader, and FORTRAN object time system) are implicitly called through the three set-up programs: COMPILE, ASSEMBLE, and LOAD.

System Tape Editing

Three system programs are involved in system tape editing: UPDATE, LABEL, and CONTENTS.

UPDATE

UPDATE has two functions:

1. Make a new system tape by copying the contents of a system tape mounted on one DECtape transport onto a certified DECtape mounted on the other transport.

2. Add system, library, and working programs to a system tape from paper-tape input.

In making a system tape, the user may request that the entire contents be copied, or he may specify certain system, library, and working programs to be deleted from the new tape during the copying operation. He may also add programs of the three types to the new tape from paper-tape input.

LABEL

LABEL prints the tape label (name and date identification) for the system tape in use. This label consists of two alphanumeric strings separated by a colon (:). The user can modify the label by typein at the console teleprinter. When a new system tape is made, UPDATE automatically calls in LABEL for the assignment of identification to the new tape.

CONTENTS

CONTENTS prints both the program names and the initial block numbers of their system tape residence for requested program groups which may include any or all of the three types: system, library, and working.

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Working-Program Editing

A working program may exist on a system tape in any or all of three versions: FORTRAN, intermediate language (assembler source), and relocatable binary (assembler output). The EDIT system program permits the user to accomplish or direct the accomplishment of the following operations by typeins.

1. Modify, add to, and delete from FORTRAN and intermediate language versions.

2. List (print out) a FORTRAN or intermediate language version either in its entirety or one page at a time.

3. Produce a paper tape in FIODEC or ASCII of a FORTRAN or intermediate language version in its entirety or one page at a time.

4. Produce a paper tape of a relocatable version. A jump to the appropriate entry in the Linking Loader is punched rather than the loader itself. If a program has been assembled in library format, the tape may be punched in library format.

5. Through a text mode, create FORTRAN or intermediate language versions for addition to the system tape.

FORTRAN Operations

FORTRAN operations include the compiling, assembling, loading, executing, and debugging of working type programs stored on a system tape. System programs which may be called through the Keyboard Monitor to accomplish these operations are COMPILE, ASSEMBLE, and LOAD.

COMPILE

The user may execute this system program, the setup routine for the DECtape FORTRAN compiler, in either of two modes: wait or go. After the call for COMPILE has been answered, the user types W or G, to select the mode, followed by a list of not more than five program names. The first name is normally the main program; the remaining names are subprograms. Each must exist on the system tape in FORTRAN language. COMPILE sets up a duty table, indicating the initial system tape residences of the named programs, and calls in the compiler. As each program is compiled, the intermediate language output is stored on the scratch tape (a certified DECtape must be mounted on one of the transports for temporary storage use during all FORTRAN operations). If wait is selected, COMPILE pauses after each compilation. The user must indicate what disposition is to be made of the output. He may request that:

1. The output be added to the system tape, and processing continued. If a previously compiled version of the same named program exists on tape, it will be overwritten.

2. The output not be saved, and processing continued.

3. The output be added to the system tape, and the Keyboard Monitor recalled.

4. The output not be saved, and the Keyboard Monitor recalled.

Mnemonics for these dispositions are, respectively: yes, no, end, and kill. If yes or no disposition is indicated following compilation of the last program in the list, COMPILE automatically calls in ASSEMBLE. In the go mode of COMPILE, the named programs are compiled, assembled, and loaded without user intervention; COMPILE suppresses the pauses and functions as if a pseudo-response of yes was entered for each compilation. ASSEMBLE performs likewise, and then calls in the LOAD system program, which loads the programs and required subroutines (library functions and subprograms) for execution or debugging.

ASSEMBLE

ASSEMBLE, the setup program for the assembler, may also be executed in either a wait or go mode. If called by the user, its mode operations are the same as expressed for COMPILE, with the exception, of course, that relocatable binary (assembler output) versions are produced. The user must select the mode and type a list of not more than five names of programs to be assembled. When called by COMPILE, ASSEMBLE assumes the mode in effect and processes previously named programs; i.e., COMPILE in the go mode calls in ASSEMBLE in the go mode. Regardless of how ASSEMBLE is initiated, intermediate language versions of the named programs must be present on the system tape for the system program and assembler to operate.

LOAD

LOAD, the setup program for the Linking Loader and the debug program, has execute and debug modes of operation as opposed to the wait and go modes of COMPILE and ASSEMBLE. When called through the Keyboard Monitor, LOAD waits for the user to type a list of not more than five program names, the first of which must be the main program. A subroutine need not be included in this list if the name under which it is stored on the system tape is the same as the name which designates the subroutine in the main program; the loader searches for and retrieves it from the system tape. After all required subroutines and library functions have been loaded, the loader announces "load complete." The user must now specify execute

mode or debug mode. In execute, the loader calls in the FORTRAN object time system from the system tape and executes the program. At the conclusion of program execution, the user must recall the Keyboard Monitor if he wishes to return to the system. In debug mode, the loader permits the user to insert a breakpoint prior to execution of the program. At the breakpoint, the values of selected variables are printed. The user may continue inserting breakpoints, one at a time for each execution, until he is satisfied with the program's configuration. The program may then be executed, or the Monitor may be recalled, if the user so desires.

DECTAPE TRANSPORT ASSIGNMENTS

Each transport has, among its manual controls, an eight-position transport selection switch. By setting this switch to number 1, 2, or 3, the user assigns the respective transport to perform specific functions as directed by DECSYS-7 system programs. DECSYS-7 recognizes only these three numbers; it ignores the five other numbered positions (4-8). The user should never assign the same number to more than one transport at the same time as contradictory identification will result in faulty operation of the DECSYS-7 system. The functions associated with the three effective numbers are as follows:

Number 1 - DECSYS-7 assumes that a system tape is on a transport assigned number 1. The system considers this tape as a library (read only) source for the purpose of making another system tape. The user may, when necessary, modify the master tape label (names and date identification) by entering keyboard commands at the teleprinter. When not making a label change, the user should ensure that the number 1 transport's write-control switch is in the WRITE LOCK position to prevent inadvertent overwriting of the master tape contents.

Number 2 - The position of the leftmost ACCUMULATOR switch, AC0, determines the manner in which a transport assigned number 2 functions under DECSYS-7 control. With the switch cleared (down position), the system assumes that a system tape is on the transport. This tape is normally a copy of the master system tape, containing system programs, library routines, and user-written FORTRAN programs. With this setup, the user can compile, assemble, load and execute, debug, and edit FORTRAN programs previously added to the system tape from paper tape or the teleprinter. He may also add system, library, and FORTRAN programs to the system tape from paper tape. The transport write-control switch must be in the WRITE position.

If the AC0 switch is set (up position), the DECSYS-7 system assumes that a certified DECtape is on the number 2 transport. The user can convert the DECtape into a system

tape by copying the contents of a system tape mounted on another transport assigned number 1. While making a system tape, the user can also add his system program, library, routine and FORTRAN programs to the new system tape from paper-tape input.

Number 3 - DECSYS-7 assumes that a certified DECtape is mounted on a transport identified as number 3. This scratch tape serves as an intermediate storage for data accumulated during the performance of operations such as the compiling, assembling, loading, debugging, and editing of user-written FORTRAN programs. Certain system programs may transfer data from the scratch tape to a DECSYS-7 system tape mounted on transport number 2 for the purpose of modifying or adding to the latter's contents. The write-control switch for the scratch tape transport must be in the WRITE position.

Note that the use of three identifying numbers has no relationship to the actual number of DECtape transports necessary for operation of the DECSYS-7 system. In the minimum configuration of the PDP-7 computer system, each of the two required transports may at some time be assigned to perform any one of the functions associated with the three numbers.

SENSE SWITCHES

ACCUMULATOR switches AC0, AC1, AC2, and AC3 (the leftmost four of the 18) serve as sense switches for the DECSYS-7 system. That is, the position in which the user places them, either set (up) or clear (down), imparts control information to the system.

SWITCH AC0 selects the DECtape transport from which the system is to acquire data. With the switch set, the system reads information from a system tape on a transport assigned number 1. Writing on this tape is program-prohibited with the exception of tape label modifications (name and date changes). Normally, this tape is the master library system tape. When cleared, switch AC0 establishes a system tape on a transport assigned number 2 as the source for data. This tape is normally a user-made copy of the master tape with the permissible addition of user-written system programs, library routines, and FORTRAN programs.

SWITCH AC1, when cleared, permits the printout of procedural statements on the console teleprinter as they occur during the execution of a system program. The user familiar with DECSYS-7 can set AC1 to suppress the majority of these statements.

SWITCH AC2 determines in which of two formats, FIODEC or ASCII, (see the PDP-7 Users Handbook for character definitions) DECSYS-7 will accept or produce symbolic paper tapes. The symbolic medium for

the system, both in core and on magnetic tape, however, is FIODEC. With AC2 set (up), the system assumes that the symbolic tape to be read is punched in FIODEC. The code is therefore accepted directly. With AC2 cleared (down), the system expects the symbolic paper tape to be punched in ASCII. DECSYS-7 therefore translates the code input into FIODEC. The production of symbolic paper tapes by the system is of similar nature. Switch AC2 is set when a symbolic tape is to be punched in FIODEC. Clearing the switch directs the system to punch the tape in ASCII.

SWITCH AC3 operates in conjunction with the EDIT system program only. The user sets this switch to suppress automatic tabulation. With AC3 cleared, automatic tabulation occurs, as appropriate.

SYSTEM TAPE FORMAT

DECtapes prepared for the DECSYS-7 user contains 576 blocks of 256 18-bit words each (the standard format for the PDP-7 computer). The first seven blocks of each system tape are allocated, as follows:

Block 0	Unused	
Block 1	Tape Label	Contains alphanumeric strings which identify the tape name and the date on which it was made, updated, edited, etc.
Block 2	System and Working Program Directory	Indicates the system and working programs present on the system tape. Each system entry requires five words: one to designate the type, two for the program name (maximum of six characters), one for the starting address, and one for the initial block number of the program's residence. Each working program entry requires six words: one for the type, two for the name, and one word each for the initial block residences of the three possible program versions: FORTRAN, assembler source, and relocatable binary. When the directory is full, no more programs can be added to the system tape. Two directory words are reserved to indicate the next free directory location and the next free block on the system tape.

Block 3	Library Directory	Stores the names and initial block residences of programs that are stored on the system tape as library subroutines. Each entry requires three words: two for the name, and one for the initial block residences.
Block 4	Keyboard Monitor Residence	Store the Keyboard Monitor in absolute binary (machine) language for call into memory by the Bootstrap Routine which must be resident in memory.

The remaining blocks are allocated to the storage of system, working and library programs. System programs are assembled in absolute binary language for call by the user through the Keyboard Monitor. They have first-word addresses of not less than 20 (octal) and last-word addresses of not more than 10777 (octal). Working programs may be stored in any or all of three versions: FORTRAN, intermediate language (assembler source), and relocatable binary. A relocatable binary version must have originated in the DEC-SYS-7 Operating System because the internal definitions of the FORTRAN object time system for DECSYS-7 differ from those of the paper-tape FORTRAN system. Only subroutines and functions may be included on a system tape as library programs. They must have been assembled in library format, a special relocatable binary format (refer to the PDP-7 Symbolic Assembler Programming Manual, Digital-7-3-S, "The FORTRAN Assembly System").

CHAPTER 2

OPERATING INSTRUCTIONS

This chapter details step-by-step procedures for using DECSYS-7. Users should be familiar with the contents of the PDP-7 User's Handbook and the PDP-7 FORTRAN II Manual, and should read the entire DECSYS-7 Operating Manual before attempting to operate the system. Failure to observe this precaution may result in inadvertent destruction of the supplied contents of the DECSYS-7 master tape.

SYSTEM SETUP

Setup of the DECSYS-7 system includes:

1. Mounting tapes on the DECtape transports
2. Assigning tape-unit numbers for the procedure to be performed
3. Loading the Bootstrap Routine into core memory

DECtapes must be certified (i.e., have their mark and timing tracks written) before use with DECSYS-7 (refer to PDP-7 DECTOG, Digital-7-20-10-FB, in the PDP-7 Program Library).

Mounting Tapes and Assigning Tape-Unit Numbers

1. Mount a DECSYS-7 system tape (the one supplied or a user-made copy of it) and a certified DECtape on separate tape transports (units).

2. Assign tape-unit numbers as follows:

   a. Assign number 1 to the DECSYS-7 tape and number 2 to the DECtape if the contents of the DECSYS-7 tape are to be copied, completely or in part, onto the DECtape. Place the unit 1 write control switch in the WRITE LOCK position to prevent an accidental write; place the unit 2 write control switch in the WRITE position.

   b. For any DECSYS-7 operation other than copying the system tape, assign number 2 to the DECSYS-7 tape and number 3 to the DECtape; the latter serves as a scratch tape during DECSYS-7 operations. Place the write control switches for both units in the WRITE position.

NOTE: The tape label and tape contents procedures (page 14 and 15, respectively) can be performed with the DECSYS-7 tape on either tape unit 1 or tape unit 2.

3. Set switch AC0 (up position) if the DECSYS-7 tape is mounted on tape unit 1; clear the switch (down position) if the tape is on tape unit 2.

Bootstrap Loading and Monitor Calling

The Bootstrap Routine, once loaded, remains resident in core memory unless overwritten by the loading of an absolute binary language program or routine from paper tape, e.g., the Paper-Tape Loader. In this case it must be reloaded to continue using DECSYS-7. To load the Bootstrap Routine:

1. Place the Bootstrap Routine paper tape in the paper-tape reader.
(For PDP-4 the Bootstrap is a normal RIM mode tape. Start RIM loader at 17770_8.)

2. Set the ADDRESS switches to 17640 (octal).

3. Depress the READ-IN switch. Release it when tape motion begins.

4. The loaded Bootstrap Routine automatically reads in the Keyboard Monitor from the DECSYS-7 tape and transfers control to it.

5. The Monitor types

   GA (for Go Ahead)

when ready to accept a typed call for a system program to initiate one of the DECSYS-7 procedures. This message also appears when the Monitor regains control because of procedure termination or user recall. The Monitor is recalled by:

   a. Setting the ADDRESS switches to 17640 (octal), and
   b. Momentarily depressing START.

General Recovery Instructions

The following instructions specify recovery action appropriate to all DECSYS-7 procedures.

Procedure Initiation Error

If Monitor types

   name (what was typed) NFD (for Not FounD)

in response to a typed call for a system program, either the input was incorrectly typed or Monitor could not find the requested program in its search of the DECSYS-7 tape. Retype the input.

Input Typing Errors

Input typing errors are deleted by typing an equal number of rubouts prior to typing an input terminator (exclamation point or carriage return).

DECtape Error Messages

The following DECtape error messages may occur during any DECSYS-7 procedure. Recovery action is shown where applicable:

ITE (incorrigible tape error) - If, in search mode, a block cannot be found after two passes down the tape, the search routine halts and displays the required block number in the AC lights. Depress CONTINUE to recall the Monitor.

EFS (error flag in search mode) - This flag should never occur in search mode. If the error is believed to be transient, depress CONTINUE to resume the search.

EOT (end of tape) - The physical end of tape has been reached during a write operation. No recovery is possible.

MTE (miss, mark-track error, end) - The most likely cause for this error is that a tape-unit in WRITE LOCK position was disabled when a write operation was initiated. (Depress CONTINUE to recall the Monitor.)

CSE (checksum error) - Checksum failed during a read operation. Depress CONTINUE to recall the Monitor.

TAPE EDITING

DECSYS-7 tape editing procedures enable the user to:

1. Check and/or change a tape label (name and date).

2. Determine what programs are stored on a tape.

3. Make a complete tape copy of a master tape to serve as a backup or as an additon to the DECSYS-7 tape group.

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4. Copy selected programs from a DECSYS-7 tape onto a certified DECtape to create another DECSYS-7 tape.

5. Add programs to DECSYS-7 tape from paper tape.

Tape Label (Name and Date) Procedure

This procedure prints out a DECSYS-7 tape label; a typein can change the label if required.

1. Type: LABEL!

2. LABEL types the existing tape label; e.g.:
    BINGO: 7 MAY 1965

3. There are four options: change the date, change the name, change the name and date, or retain the label.

> NOTE: If the DECSYS-7 tape is on tape unit 1, the unit's write control switch must be in the WRITE position before a label change is made. LABEL is the only system program that permits writing on a DECSYS-7 tape mounted on unit 1. Switch AC0 determines from which unit the label is read: up position reads unit 1, down position reads unit 2.

a. To retain the tape label as is, type an exclamation point (!).

b. To change just the date, type a colon (:) and then the date, which may be expressed in a variety of formats. Typical formats are: 8 MAY 1965, 8/5/65, and MAY 8, 1965. Terminate the date with an exclamation point.

c. To change the entire tape label, or just the name, type the following: NAME (alphanumeric string punctuated by space alone), a colon, the new date or old date, and an exclamation point.

If the label types, TYPIN ERROR, retype the input.

4. The typing of an exclamation point (!), alone or following a tape label change, terminates the tape label procedure. Control returns automatically to the Keyboard Monitor, which types
    GA
to signify its readiness to accept a system program call.

Tape Contents Procedure

This procedure determines what programs and routines are present on a DECSYS-7 tape. Switch AC0 is up to read the contents of the tape on unit 1, and down to read the contents of the tape on unit 2.

1. Type: CONTENTS!

2. When called, CONTENTS types the following message, unless switch AC1 is set
(up) to suppress the typeout:

INDICATE REQUIRED FILES (S, L, W)

where S represents Systems programs, L represents Library programs and W represents Working (user-originated) programs. "Files" refers to these program groups.

3. Type the letters for the program directories that are to be printed out. They must be typed in the S-L-W order; i.e., S must precede L and W, and L must precede W. Terminate the entry with an exclamation point (!). Comma punctuation is not required, but it is accepted by the CONTENTS program. If a requested program directory is not present on the system tape, CONTENTS recalls the Keyboard Monitor. The user must again call CONTENTS and request directories that are present on the tape.

4. If requested directories are present, the CONTENTS program prints out the system tape label and then the program directories in the following format:

NAME S   Decimal Number
NAME L   Decimal Number
NAME W   Decimal Number, Decimal Number, Decimal Number

The printout format consists of the name, or names, assigned to the program in the requested directory (only library programs may have more than one name); the type (indicated by letter, see 2 above); and the decimal number of the first block of tape allocated to storage of the named program. For working programs, starting tape-block numbers are shown for, respectively, the FORTRAN symbolic, assembly source (previously compiled) and relocatable binary (previously assembled) languages. An all-zero number appears for any working program format not present on the tape.

5. Following the printout, control returns automatically to the Monitor which types
GA
to signify that it has control and can accept an input.

DECSYS-7 Tape Complete Copying Procedure

This procedure makes a complete DECtape copy of all programs and routines stored on a DECSYS-7 tape. In practice, the user will make back-up copies of the supplied tape containing all the system and library

programs constituting the DECSYS-7 system, or he will make working DECSYS-7 tapes to which he can add programs from paper tape by the paper-tape input procedure (q.v.). The DECSYS-7 tape is on unit 1 (WRITE LOCK), the scratch DECtape is on unit 2 (WRITE), and switch AC0 is up.

1. Type UPDATE!

2. When called, UPDATE types the following message unless switch AC1 is set to 1 to suppress it.
    SELECT MODE AND FILES (A, S, L, W).

3. Type an exclamation point (!) only (this accomplishes copying of the entire tape). All programs stored on the DECSYS-7 tape on unit 1 are written on DECtape unit 2. When all programs have been copied, UPDATE types
    TYPE LABEL AND DATE.

4. Type an alphanumeric string, punctuated by space alone, for the label (the tape name), then a colon (:), and finally an alphanumeric string for the date. For example:
    ANYNAME: 1APRIL 1965!
Terminate the label and date with an exclamation point. If the program types,
    TYPEIN ERROR
retype the name and date. If an exclamation point is typed alone, the label of the system tape on unit 1 is written as its label on the new tape.

5. UPDATE types
    DISABLE WRITE ON UNIT TWO
and halts.

DECSYS-7 Tape Selective Copying Procedure

Use this procedure to make working DECSYS-7 tapes for specific applications. With it, selected programs are copied from a DECSYS-7 tape (on unit 1 with WRITE LOCK) onto a certified DECtape (on unit 2 with WRITE on). Switch AC0 is in the up position. The procedure also enables replacement programs to be added from paper tape to the new DECSYS-7 tape. Previous versions of programs must be removed before new versions with the same names can be added. By restricting the copying of certain programs, the procedure, in effect, removes these programs from the new tape. This method is the only way of removing programs from a DECSYS-7 tape.

1. Type: UPDATE!

2. When called, UPDATE types the following message unless switch AC1 is set (up) to suppress it.

    SELECT MODE AND FILES (A, S, L, W)

where S, L, and W represent, respectively, the files (groups) of system, library, and working (user-originated) programs. The letter A refers to the append, or adding-from- paper-tape, mode of UPDATE. This mode is not called as part of this procedure, but use is made of its control, as described below.

3. Type the letters representing the groups that contain programs to be deleted or added. The letters must be typed in the S-L-W sequence and comma punctuated; terminate the entry with an exclamation point. UPDATE processes the program groups in the S-L-W order. It first checks to see if changes for a group are indicated. If not, it copies the group of programs onto the new tape. If changes are indicated, UPDATE requests inputs, makes the changes, and then copies the amended group onto the new tape.

4. When the first requested group is processed, UPDATE types

    REMOVE FROM TYPE X (where X is the first typed program group letter).

Type a program name which is to be deleted; terminate with an exclamation point (!). For working programs, the user can delete a specific language version (FORTRAN symbolic, assembly source, or relocatable binary) by prefixing the working program name with F, A, or R, respectively followed by a comma; typing just the working pro- gram name deletes all versions present on the DECSYS-7 tape.

5. UPDATE accepts the typed name and performs a carriage-return to indicate its readiness for the next program name. When all programs of the indicated group to be deleted have been named, type ! in response to the UPDATE carriage-return.

6. After copying the amended program group onto the new tape, UPDATE types

    ADD TO TYPE X (where X is the letter for the program group just amended).

If no programs are to be added to the amended program group from paper tape, type an exclamation point. If programs are to be added, refer to the applicable instructions below.

(except TYPE L)

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a. Adding to Type S (System) Programs

Programs added to the system program group must have been assembled into absolute binary language, have first-word addresses of not less than 20 (octal), and last-word addresses of not more than 10777 (octal). Each routine of the added program must end with START. "START name" is not acceptable. System programs supplied by DEC are self starting so that STM (system tape maker) can build DECSYS-7 tapes from binary paper tapes.

(1) Load paper-tape reader with tape containing a program to be added.

(2) Type the program name, a colon (:), the first-word address, a comma (,), the last-word address, a semicolon (;), and the entry point of the program (all addresses are in octal). Terminate the entry with an exclamation point.

(3) UPDATE loads the routine and listens for the next command.

(4) If the program is on more than one tape, place the next tape in the reader and continue the procedure. Otherwise, skip to step (6). Set the ADDRESS switches to 17770 (octal) and press the START switch. UPDATE loads the program segment and halts.

(5) Continue in this manner until all segments of the program are loaded.

(6) Now set the ADDRESS switches to 11601 (octal) and press START. UPDATE writes the program onto the new DECSYS-7 tape and types OK. Add another program to the system program group by following the "adding-to-type-S" instructions or terminate the procedure by typing ! alone.

NOTE: The Bootstrap Routine must be reloaded to recall the Monitor (page 12).

b. Adding to Type L (Library) Programs

Library programs must have been assembled in library format, a special relocatable binary format (refer to the PDP-7 Symbolic Assembler Manual, Digital-7-3-S, "The FORTRAN Assembly System").

(1) Place the library tape in the paper-tape reader.

(2) Press CONTINUE. UPDATE writes the program on the new DECSYS-7 tape and halts with all ACCUMULATOR lights on.

(3) Continue loading library tapes or terminate the procedure by pressing CONTINUE while no tape is in the reader.

c. Adding to Type W (Working) Program

Sub-type designators are F,A,R. Working programs can be coded in any one of three languages: FORTRAN symbolic, assembler source, or relocatable binary. However, a relocatable binary version of a program must have originated in the DECSYS-7 system since the internal definitions of the FORTRAN object-time system for DECSYS-7 differ from those of the paper-tape FORTRAN system. Symbolic tapes can be punched in either FIODEC or ASCII code. If more than one program is on a single paper tape, the reader head must be raised when the appropriate portion of tape has been read.

(1) Place the paper tape in the reader. Set switch AC2 to 1 if the tape is punched in FIODEC code; clear AC2 to 0 if the tape is punched in ASCII.

(2) Type F, A, or R to indicate the language format of the program on the paper tape, FORTRAN symbolic, assembler source, or relocatable binary, respectively. Type a comma and the program name; terminate with an exclamation point.

(3) UPDATE writes the program on the new DECSYS-7 tape and types OK, indicating its readiness to accept the next working program. Place the next tape in the reader and type the appropriate entry, as in step (2), or terminate the procedure by typing an exclamation point alone.

7. Following completion of all adding procedures, UDATE types
   TYPE LABEL AND DATE.

8. Type an alphanumeric string, punctuated by space alone, for the label (the tape name), then a colon, and finally an alphanumeric string for the date. For example:

ANYNAME:25 JUNE 1965!

Terminate the label-and-date entry with an exclamation point. If UPDATE types

TYPEIN ERROR

retype the entry. Typing ! alone in place of the name and date entry causes the label

for the tape on unit 1 to be written on the new tape.

9. UPDATE types

DISABLE WRITE ON UNIT 2 and halts.	READER IS NOT READY
If bootstrap is still in core (check is made),	The reader head is not down or select
hitting CONTINUE will transfer control to	is lost; back up tape and hit CON-
it. Check that AC0 is set correctly.	TINUE.

DECSYS-7 Paper-Tape Input Procedure

Use this procedure to add user-written systems, library, or working programs to the contents of a DECSYS-7

system tape from paper tape. The system tape is on unit 2, a certified DECtape is on unit 3 for use as a

scratch tape, and both write-control switches are in the WRITE position. Clear switch AC0 (down position).

1. Type: UPDATE!

2. When called, UPDATE types the following message unless switch AC1 is set to 1:

SELECT MODE AND FILES (A, S, L, W)

where S, L, and W represent, respectively, the files, or groups, of System, Library,

and Working (user-originated) programs. The letter A refers to the append, or adding-

from-paper-tape, mode of the update program.

3. Type A, followed by the letters of the groups to which programs are to be added.

The letters must be in the S-L-W sequence, comma punctuated, and terminated by an

exclamation point, e.g., A, S, W! or A, L, W! UPDATE handles the groups in the

System, Library, Working program sequence.

4. UPDATE types

ADD TO TYPE X (where X is the first typed program-group letter).

This message appears for each requested group at its appointed time in the UPDATE

program. Refer to the instruction sets, below, for the applicable adding-from-

paper-tape procedure.

a. Adding to Type S (System) Programs

Programs added to the system program group must have been assembled in absolute binary language, have first-word addresses of not less than 20 (octal), and last-word addresses of not more than 10777 (octal). Each routine of the added program must end with START. "START name" is not acceptable.

(1) Load paper-tape reader with tape containing a program to be added.

(2) Type the program name, a colon (:), the first-word address, the last-word address, a semicolon (;), and the entry point of the program. (All addresses are in octal.) Terminate the entry with an exclamation point.

(3) UPDATE loads the routine and listens for the next command.

(4) If the program is on more than one tape, place the next tape in the reader and continue the procedure. Otherwise, skip to step 6. Set the ADDRESS switches to 17770 (octal) and press the START switch. UPDATE loads the program segment and waits.

(5) Continue in this manner until all segments of the program are loaded.

(6) Now set ADDRESS switches to 11601 (octal) and press START. UPDATE writes the program onto the new DECSYS-7 tape and types OK. Add another program to the system program group by following the adding-to-type-S instructions or terminate the procedure by typing ! alone. (The Bootstrap Routine must be reloaded to recall the Monitor, page 12.)

b. Adding to Type L (Library) Programs

Library programs must have been assembled in library format, a special relocatable binary format (refer to the PDP-7 Symbolic Assembler Manual, Digital-7-3-S, "The FORTRAN Assembly System").

(1) Place the library tape in the paper-tape reader.

(2) Press CONTINUE. UPDATE writes the program on the new DECSYS-7 tape and halts with all ACCUMULATOR lights on.

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(3) Continue loading library tapes or terminate the procedure by pressing CONTINUE while no tape is in the reader.

c. Adding to Type W (Working) Programs

Working programs can be coded in any one of three languages: FORTRAN symbolic, assembler source, or relocatable binary. However, a relocatable binary version of a program must have originated in the DECSYS-7 system since the internal definitions of the FORTRAN object time system for DECSYS-7 differ from those of the paper tape FORTRAN system. Symbolic tapes can be punched in either FIODEC or ASCII code. If more than one program is on a single paper tape, the reader head must be raised when the appropriate portion of tape has been read.

(1) Place paper tape in the reader. Set switch AC2 to 1 if the tape is punched in FIODEC code; clear AC2 to 0 if the tape is punched in ASCII.

(2) Type F, A, or R to indicate the language format of the program on the paper tape, FORTRAN symbolic, assembler source, or relocatable binary, respectively. Type a comma and the program name; terminate with an exclamation point.

(3) UPDATE writes the program on the new DECSYS-7 tape and types OK, indicating its readiness to accept the next working program. Place the next tape in the reader and type the appropriate entry, as in step 2, or terminate the procedure by typing an exclamation point alone.

5. Following completion of all adding procedures, UPDATE types
TYPE LABEL AND DATE.

6. Type an alphanumeric string, punctuated by space alone, for the label (the tape name), then a colon, and finally an alphanumeric string for the date. For example:
ANYNAME:25 JUNE 1965!
Terminate the label-and-date entry with an exclamation point. If UPDATE types
TYPEIN ERROR

retype the entry. Typing ! alone in place of the name and date entry causes the label for the tape on unit 1 to be written on the new tape.

7. UPDATE types

    DISABLE WRITE ON UNIT 2

and halts.

WORKING PROGRAM PROCEDURES

Compiling

The DECSYS-7 FORTRAN compiling procedure may be executed in either of two modes: go or wait. The go mode functions without user intervention to compile, assemble, and load no more than five programs (main program and up to four subprograms thereof) indicated by the user at initialization of the mode. The wait mode permits user intervention, following each compilation, to select one of four options:

1. Store the program just compiled on DECSYS-7 tape and proceed to the next program.
2. Do not store the compiled program; proceed to the next.
3. Store the compiled program; return control to the Keyboard Monitor.
4. Do not store the compiled program; return control to the Keyboard Monitor.

If option 1 or 2 is selected following compiling of the last program, Program Assembling (page 26) is automatically called. The DECSYS-7 tape is on unit 2, a scratch DECtape is on unit 3, and both write control switches are in the WRITE position. Clear switch AC0 (down position).

1. Type: COMPILE!

2. When called, COMPILE types the following message unless switch AC1 is set to 1 to suppress the typing:

    ENABLE WRITE ON TWO THREE

    USE W (AIT) OR G (O)

(The "enable" message is a reminder that both tape units must be in the write mode of operation before continuing with this procedure.) Proceed with the go or wait procedure.

Compiling (Go) Procedure

1. Type: G, names!

where "names" is a comma-punctuated list of no more than five names of FORTRAN programs (main program and subprograms) to be compiled.

> NOTE: The main program must be named first in the list if it is to be executed following the compile, assemble, and load actions.

2. Intermediate results (assembler source, relocatable binary) are automatically stored on the DECSYS-7 tape.

3. After the programs are compiled, assembled, and loaded, the Load program types the following message:

> name (the first name in list) LOAD COMPLETE
> TYPE X CARRIAGE RETURN OR T

The functions of these indicators are:

X	Reads in the OTS (object time system) and executes the loaded program.
T	Types the names and first-word addresses of routines loaded; following this typeout the user may type either X or carriage return in response to the "TYPE X CARRIAGE RETURN OR T" message, which is repeated.
Carriage Return	Selects the debug mode of DECSYS-7 (see FORTRAN Program Check-out, page 30).

> NOTE: If any message other than "name LOAD COMPLETE..." is typed following initiation of the go procedure, compiling has not been accomplished. Refer to the error messages (page 25) for the reason.

Compile (Wait) Procedure

1. Type: W, names!

where "names" is a comma-punctuated list of no more than five names of FORTRAN programs to be compiled.

> NOTE: The main program must be named first if the compiling is to be followed with assemble and load actions, and then execution.

2. As each named program is compiled, COMPILE types

    name COMPILED

    TYPE YES, NO, END, KILL

The functions of these indicators are:

YES	Store (write on DECSYS-7 tape) the assembly source language for the program just compiled; proceed to the next named program.
NO	Do not store the assembly source language for the program just compiled; proceed to the next named program.
END	Store the assembly source language for the program just compiled; return control to the Keyboard Monitor.
KILL	Do not store the assembly source language for the program just compiled; return control to the Keyboard Monitor.

Type the applicable indicator, either completely or just its initial letter (i.e., Y, N, E, or K), followed by a carriage return. If YES or NO (or initial letter) is typed after the last named program is compiled, control is transferred automatically to Program Assembling (page 26).

> NOTE: If COMPILE types any message other than "name COMPILED TYPE
> YES...," compiling has not been accomplished. Refer to error messages,
> below, for the reason.

<u>Error Messages</u>

name NFD	Named program cannot be found on the DECSYS-7 tape.
RESTART TOO MANY NAMES	List of named programs exceeds five.
USE W (AIT) OR G (O)	Procedural error.

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PROGRAM ASSEMBLING

DECSYS-7 has two assembling procedures: go and wait. Once initiated, the go procedure assembles up to five programs, and loads them without user intervention. The wait procedure can also handle up to five programs, but it permits user intervention, as each program is assembled, to select one of four options:

1. Store the program just assembled and proceed to the next.
2. Do not store the assembled program; proceed to the next.
3. Store the assembled program; return control to the Keyboard Monitor.
4. Do not store the assembled program; return control to the Keyboard Monitor.

If option 1 or 2 is selected following assembly of the last program, Program Loading and Execution (page 28) is automatically called. All programs to be assembled must have an assembly source language version on the DECSYS-7 tape. The DECSYS-7 tape is on unit 2, a scratch DECtape is on unit 3, and both write control switches are in the WRITE position. Clear switch AC0 (down position).

1. Type: ASSEMBLE!

2. When called, ASSEMBLE types the following message unless switch AC1 is set to 1 to suppress the typing:

    ENABLE WRITE ON TWO, THREE

    USE W (AIT) OR G (O)

(The "enable" message is a reminder that both tape units must be in the write mode of operation before continuing with this procedure.) Proceed with the go or the wait procedure.

Assembling (Go) Procedure

1. Type: G, names!

where "names" is a comma-punctuated list of up to five names of programs to be assembled.

> NOTE: The main program must be named first in the list if it is to be executed
> following the assemble and load actions.

2. After the programs are assembled and loaded, the Load program types the following message:

> name (the first name in list) LOAD COMPLETE
> TYPE X CARRIAGE RETURN OR T

The functions of these indicators are:

X   Reads in the OTS (object time system) and executes the loaded program.

T   Types the names and first-word addresses of routines loaded; following this typeout, the user may type either X or carriage return in response to the "TYPE X CARRIAGE RETURN OR T" message which is repeated.

Carriage   Selects the debug mode of DECSYS-7 (See FORTRAN Program Check-
Return   out, page 30).

> NOTE: If any message other than "name LOAD COMPLETE..." is typed following initiation of the go procedure, assembling has not been accomplished. Refer to the error messages (page 28) for the reason.

Assemble (Wait) Procedure

1. Type: W, names!

where "names" is a comma-punctuated list of up to five names of programs to be assembled.

> NOTE: The main program must be named first if it is to be executed.

2. As each named program is assembled, ASSEMBLE types:

> name ASSEMBLED
> TYPE YES, NO, END, KILL

The functions of these indicators are:

YES   Save the relocatable binary language for the program just assembled; proceed to the next named program.

Assemble (Wait) Procedure (cont.)

NO   Do not save the relocatable binary language for the program just assembled; proceed to the next named program.

END   Save the relocatable binary language for the program just assembled; return control to the Keyboard Monitor.

KILL   Do not save the relocatable binary language for the program just assembled; return control to the Keyboard Monitor.

Type the applicable indicator, either completely or just its initial letter (i.e., Y, N, E, or K), followed by a carriage return. If YES or NO (or initial letter) is typed after the last named program is assembled, control is transferred automatically to Program Loading and Execution (page 28).

> NOTE: If ASSEMBLE types any message other than "name ASSEMBLED TYPE YES...," assembling has not been accomplished. Refer to error messages, below, for the reason.

Error Messages

name NFD	Named program cannot be found on the DECSYS-7 tape.
RESTART TOO MANY NAMES	List of named programs exceeds five.
USE W (AIT) OR G (O)	Procedural error.
ASSEMBLY INPUT MISSING	Assembly source language for a program is not present on the DECSYS-7 tape.

Recover from these error conditions by momentarily depressing CONTINUE: then type the proper input.

PROGRAM LOADING AND EXECUTION

With this procedure the user can, at one time, load a main program and up to four subprograms from DECSYS-7 tape into memory for execution. All library programs and working-program subroutines required by the programs to be loaded must be present on the same DECSYS-7 tape in the relocatable binary language format. The DECSYS-7 tape is on unit 2, a scratch DECtape is on unit 3, and both write control switches are in the WRITE position. Clear switch AC0 (down position).

1. Type: LOAD! The main program is loaded starting at 100_8.

2. When called, LOAD types the following message unless switch AC1 is set to 1 to suppress the typing:

ENABLE WRITE ON TWO, THREE

(This message is a reminder that both tape units must be in the write mode of operation before continuing with this procedure.)

Type the name of the main program and the names of up to four subprograms to be loaded. Separate the names by commas and terminate the list with an exclamation point.

> NOTE: The user need not name all routines and programs required by the main program or subprograms thereof since a required routine or program will be automatically called from the DECSYS-7 tape for loading provided: its name in the DECSYS-7 library- or working-program directories agrees with the name used by the program requesting it; it exists on tape in the relocatable binary language format. All user programs must be referenced by at least one of the routines named.

3. At the conclusion of loading, LOAD types the following nonsuppressible message (i.e., setting switch AC1 to 1 cannot halt the typing):

name (the main program) LOAD COMPLETE

TYPE X CARRIAGE RETURN OR T.

The functions of these indicators are:

X	Reads in the OTS (object time system) and executes the loaded program.
T	Types the names and first-word addresses of routine loaded; following this typeout, the user may type either X or carriage return in response to the "TYPE X CARRIAGE RETURN OR T" message which is repeated.
Carriage Return	LOAD enters the debug mode (refer to FORTRAN Program Check-Out, page 30).

If LOAD types any message other than "name LOAD COMPLETE...," loading of the program has been terminated because of errors or restrictions. Refer to the following list of messages to determine the reason for termination.

Program Loading and Execution (cont.)

Message	Indication
name UNDEFINED	Requesting variable name cannot be found.
CORE STORE FULL	The loader's table of required symbols exceeds the core-memory allocation.
CANNOT PROCEED UNEXPLAINED ERROR	Relocatable binary language for required program or routine is incorrectly stored on the DECSYS-7 tape, not present, or overwritten.
RESTART TOO MANY NAMES	List of program names entered in step 3 exceeds five. Repeat procedure from step 2 on.
name NFD SYNONYM	Subroutine required by program cannot be found. If an equivalent call exists, type the name terminated by an exclamation point.

FORTRAN PROGRAM CHECK-OUT

The following procedure describes the actions to take when using the debug-mode feature of DECSYS-7 for fast, dynamic testing of FORTRAN programs stored on DECSYS-7 tape. The procedure includes setup, loading a main program (and subprograms, if applicable) from tape into memory, and establishing the parameters for debugging operation. A FORTRAN program must be compiled and assembled before it can be debugged. Refer to the appropriate procedures (Program Compiling, page 23; Program Assembling, page 26) if the program to be checked has not been compiled and/or assembled. Steps 1, 2, and 3 are the same as for normal program loading.

1. Type: LOAD!

2. When called, LOAD types the following message unless switch AC1 is set to 1 to suppress the typing:

    ENABLE WRITE ON TWO, THREE

(This message is a reminder that both tape units must be in the write mode of operation before continuing with this procedure.)

Type: name!
where "name" is the FORTRAN program to be debugged.

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3. The name programs are now loaded into memory from their DECSYS-7 tape residence. Following the loading, LOAD types:

     name LOAD COMPLETE

     TYPE X CARRIAGE RETURN OR T

X and T are used with the Program Loading and Execution procedure (page 28). Type a carriage return to enter the debug mode of DECSYS-7.

> NOTE: If LOAD types any message other than "name LOAD COMPLETE...," the named program has not been loaded. Refer to the Program Loading and Execution procedure (page 28).

4. Following the typing of a carriage return to enter the debug mode, LOAD types:

     TYPE BP (breakpoint)

Type the number of the FORTRAN statement at which the program sequence is to be conditionally interrupted to type out (dump) the computed values for selected variables. Terminate the number with an exclamation point. If more than one program uses the same statement number (or tags), the one first encountered by the loader is the one used.

> NOTE: Retype the statement number if LOAD responds to the input by typing: INPUT FORMAT ERROR

5. LOAD next types:

     XPVL (for fixed-point variable list).

Now indicate the fixed-point variables to be dumped at the breakpoint. If there are none, type an exclamation point. If some fixed-point variables are to be dumped, type their names in a comma-punctuated string and terminate with an exclamation point.

> NOTE: If a variable to be dumped is an array, its name must be followed by a number enclosed with parentheses. This number indicates the subscript limit, the highest element of the array that is to be dumped at execution of the break-point; e.g., IRAY(5)! Array elements from the initial through the subscript limit will be dumped at the breakpoint. For multidimensional arrays, type upper limits for each subscript; e.d., GEORGE(3,5)!

6. LOAD types:

    FPVL (for floating-point variable list)

Now indicate the floating-point variables to be dumped at the breakpoint. If there are none, type an exclamation point. If some floating-point variables are to be dumped at the breakpoint, type their names in a comma-punctuated list and terminate with an exclamation point. (The note in step 5, above, also applies here.)

7. LOAD types:

    R COUNT (repetition count)

R, or repetition, count is the number of program passes to be made through the breakpoint prior to the pass during which the indicated variables are dumped. If the breakpoint is to be executed on the first pass, type an exclamation point. Otherwise, type the number representing the passes desired and terminate with an exclamation point.

> NOTE: It is not always possible to delay the breakpoint execution for the desired repetition count. For example: if the breakpoint is inserted in a program at the occurrence of a CAL (call subroutine) instruction (see User's Handbook, F-75), the breakpoint is executed at the first pass through the selected FORTRAN statement, regardless of the R count entered.

8. LOAD executes the program through the breakpoint the desired number of passes (if possible), dumps (prints out) the specified variables on the teleprinter, and then types:

    TYPE X CARRIAGE RETURN OR T

    a. To continue program debugging, type a carriage return; proceed with step 9.

    b. To debug another program, recall the Keyboard Monitor and repeat the FORTRAN program check-out procedure.

    c. To execute the program, type X (refer to the Program Loading and Execution procedure, page 28).

9. LOAD types, TYPE BP, in response to the carriage return. Change the R count, or any or all of the previously entered breakpoint parameters.

a. To change only the R count, type an exclamation point. LOAD returns to step 7, above.

b. To change any or all breakpoint parameters, repeat the debug mode procedure from step 4 on. Parameters which are not to be changed must be retyped at their appropriate points in the procedure.

This completes the FORTRAN program debugging procedure.

DECSYS-7 EDITOR

The DECSYS-7 Editor operates on working programs only. It allows the user to quickly enter keyboard commands, and text, that:

1. Alter symbolic language versions (FORTRAN and assembler source) of working programs stored on tape.

2. Punch out on paper tape any working program language version stored on tape.

3. List on the teleprinter any working program symbolic language format stored on tape.

4. Enter symbolic versions of working programs on DECSYS-7 tape via the teleprinter keyboard.

The Editor has three modes: executive command, edit, and create. When the Editor is called, the executive-command mode assumes control from the Keyboard Monitor. The user then selects, by a typein command, the edit mode or the create mode. Edit permits the user to request operations, such as text deletion, text insertions, punchouts on paper tape, program listings, etc. Create permits the user to add working programs to DECSYS-7 tape using the keyboard. The user has the option of returning control from the edit and create modes to the executive-command mode for further editing, or directly to the Keyboard Monitor. The DECSYS-7 tape is on unit 2, a scratch DECtape is on unit 3, and both write control switches are in the WRITE position. Clear switch AC0 (down position).

Executive-Command Mode

1. Type: EDIT!

2. When called, the Editor types the following message unless switch AC1 is set to 1.
    READY TAPES ON TWO AND THREE.

(This message serves as a reminder that the DECSYS-7 tape must be on unit 2 and a certified DECtape must be on unit 3 for use as a scratch tape, both in WRITE position.) The Editor is now in the executive-command mode, awaiting one of three possible commands: E, Z, or K.

E	Transfers control to the edit mode
Z	Transfers control to the create mode
K	Returns control to the Monitor

Type one of the letters followed by a carriage return. Refer to the edit mode or create mode for further editing instructions.

Edit Mode

When called, the edit mode waits for the user to indicate the program and language format to be edited.

1. Type: x,name!
    (where "x" is F, A, or R for FORTRAN, assembler source, and relocatable binary, respectively). If edit mode cannot find the indicated language format for the name program on the DECSYS-7 tape, it types:
    name (what the user typed) NFD (for not found).
    To recover from this condition, type K to return control to the Monitor, or type N to return control to the executive-command mode. Terminate either with a carriage return.

2. Edit mode responds with a carriage return when ready to accept a command from the edit-command list (Table 1). All commands in this list are terminated by typing carriage returns. Edit performs the requested operation, does a carriage return, and awaits the next command.

> NOTES: When punching a symbolic tape, put ACCUMULATOR switch AC2 up for FIODEC code or down for ASCII code.
>
> Put switch AC3 up to suppress automatic tabulation. If automatic tabulation is desired, put the switch in the down position.

3. Continue entering commands followed by carriage returns until required editing is complete. Type N to return control to the executive-command mode; type K to return control to the Monitor. Terminate either with a carriage return.

Procedural Messages:

1. Edit mode types TEXT MODE when ready to accept text input if switch AC1 is not set to 1. With AC1 set to 1, edit mode performs a carriage return.

2. Following the carriage return-rub out sequence that terminates a text-page entry and before the OK response to the "A" edit command, edit mode types END TEXT MODE unless switch AC1 is set to 1. With AC1 set to 1, the message is suppressed.

3. If AC1 is set to 1, a text page replaces the old page. When switch AC1 is not set to 1, the user has the following option after typing a "U" edit command. Edit mode types:

RUBOUT FOR NEW NAME, CARRIAGE RETURN NO CHANGE

If rub out is typed in response to this message, edit mode awaits a new program-name entry. The program is blindly added with the new entry in the directory, even if the name was already in directory. Type name!. In effect, the changed text is added to the DECSYS-7 tape without destroying the text of the old program. If a carriage return is typed, the text page replaces the old page. Return to executive command mode of EDIT is automatic.

Error Messages

name NFD (for not found)	Indicates requested program or language format is not present on DECSYS-7 tape being edited.
CHANGED FILE UPDATE	Indicates edit-mode request that user enter a "U" edit command to update the program (file) after corrections have been made before further edit commands are entered.
?	Indicates a user-procedural error; edit mode leaves the user where he was before the error.

Typing Errors

Type rubouts to delete typing errors in text or command entries. The number of rubouts executed must equal the number of characters in error. The correction must be made prior to typing the carriage-return termination.

TABLE 1   EDIT COMMANDS

Command	Function
S	Read the next page (nominally 60 lines).
nS	Read the nth page.
tag, G	Type the line of the current page labeled "tag" (a FORTRAN statement number or a symbolic tag).
nL	Type line n.
n1,n2L	Type lines n1 through n2.
nC	Delete line n; replace it with all text typed up to a carriage return-rub out sequence.
n1,n2C	Delete lines n1 through n2; insert all text typed up to a carriage return-rub out sequence.
nI	Starting at line n, insert all text typed up to a carriage return-rub out sequence.
nD	Delete line n from program.
n1,n2D	Delete lines n1 through n2 from program.
P	Punch the current page on paper tape.
Q	Punch the entire subprogram on paper tape.
W	Type the entire page on the teleprinter.
O	Type the entire subprogram on the teleprinter.
R	Punch the relocatable binary language format for the subprogram.
B	Punch in forward direction the relocatable binary language format if it was prepared in library format. No readable title is punched. DDT-7 symbols are punched.
A	Consider all text next typed in up to a carriage return-rub out sequence as new page to follow last page.
X	Delete the current page. If there is no current page, delete the first page. If the current page is the last page, delete it and update the program on DECSYS-7 tape.
U **	Update the program on DECSYS-7 tape.
/	May be used in place of "n" to represent the last line on a page.
.	May be used in place of "n" to represent the current line; that is, the line just inserted, changed or inserted, or the line following the one just deleted.
:	Preceded by / or ., causes the current line value for / or . to be typed out.
LINE FEED	Types out the next line.

(n represents page or line number in the above commands.)

** Unless editing is terminated by an UPDATE command, the program on DECtape will be the <u>old</u> file.

Create Mode

When called, the create mode waits for the user to indicate the name and language format for the program being added to the DECSYS-7 tape. This name and language should not exist on the tape.

1. Type: x, name!

(where "x" is F or A for FORTRAN or assembler source, respectively).

2. When create mode is ready to accept text, it types:

   TEXT MODE

if switch AC1 is not set to 1. The message is suppressed if the switch is set, and create mode performs a carriage return instead.

3. Enter text by typing on the teleprinter keyboard. At the end of each text page, type a carriage return-rub out sequence. Create mode types END TEXT MODE, if switch AC1 is not set (up) to suppress it, followed by OK. To enter another page, type a carriage return. When all text has been entered, add the program to the DECSYS-7 tape by typing a rub out after the EDIT typeout of OK.

4. Return to executive command mode is automatic.

Error Messages

NFD (not found) Indicates requested program or language format is not present on DECSYS-7 tape being edited.

? Indicates a user-procedural error. Edit mode leaves the user where he was before the error.

Typing Errors

Type rub outs to delete typing errors in text or command entries. The number of rub outs executed must equal the number of characters in error. The correction must be made prior to typing the carriage return mination.

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