

UNIVAC III TAPE CONTROL ROUTINE

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This document is preliminary in nature and is intended as a vehicle for meeting immediate needs with regard to system familiarization and orientation. UNIVAC® Division of Sperry Rand Corporation reserves the right to change and/or modify such information contained herein as may be required by subsequent system developments.

2.0 I N T R O D U C T I O N

There are two program components involved in the use of the tape control routines: the call statement, and the macro instructions. The call statement directs the assembler to incorporate a particular configuration of tape routine coding into the worker program. The configuration of coding incorporated depends upon the value of the parameters in the call statement but will, in all cases, perform the following functions: supply records to, or receive records from, the tape file, a record at a time; determine when a block should be read or written; submit the necessary XF orders to the tape handling portion of the Executive Routine; check labels, sentinels, and block counts; and relinquish control to the Executive when necessary (that is, when worker program processing is suspended pending the completion of a tape order).

The macro instructions are used by the worker program to initiate the processing of a file, to release output records or obtain input records, and to terminate the processing of a file. They direct the assembler to incorporate into worker program linkages with the appropriate subroutines within the tape routine coding.

3.0 CALLING STATEMENT

LABEL	OP'N	OPERANDS
	FILEh	P ₁ ,P ₂ ,P ₃ ,...,P ₂₁

- LABEL** This field must be blank.
- FILEh** File identifier; h is an alphabetic character and is A through F, for an input file, or U through Z, for an output file. Any references to the file in the input/output macro instructions must use this identifier. It must also appear in the label field of the AREA statement pertaining to this field.
- P₁,P₂,P₃...**
P₂₁ Parameters describing the tape routine desired and the file. If all of the parameters cannot fit on one line, the calling statement can be continued on a second line by writing a minus (-) in the most significant operation field character of that line.
- P₁** Decimal number of characters per record. (The mode times the number of UNIVAC III words per record.)
- P₂** Decimal number of records per block.
- P₃** File identification. The file ID is found in words 1 and 10 of the label block. The user must supply 8 characters for this parameter in the form 'aaaabbbb', where aaaa and bbbb are the first and second ID words. (SALT users who need only a 4 character ID specify blanks for bbbb.)
- P₄** Number of blocks that the file area can contain. This parameter may be either 1 or 2. When it is 1, the tape routine will read in a data block only when the previous data block has been exhausted (demand system). When it is 2, the tape routine will read in a data block while the previous block is still being processed (standby system).
- P₅** Rewind option for intermediate reels. It is 1, for rewind with interlock, 2, for rewind without interlock, or 3, for no rewind.
- P₆** Rewind options for the last reel of the file. It is 1, for rewind with interlock, 2, for rewind without interlock, or 3, for no rewind.
- P₇** Form of the macro instructions to be used. For an input file, it is 1, for the index form, or 2, for the transfer form. For an output file, it is 3, for the index form, or 4, for the transfer form.
- P₈** Primary logical tape unit (0 through 15) assigned to the file.
- P₉** Alternate logical tape unit (0 through 15) assigned to the file. If only one tape unit is assigned to the file, P₉ is blank.
- P₁₀** Index register (1 through 7) assigned to the file. This designation must also appear in the AREA statement pertaining to the file. If P₇ is 2 or 4, this designation is blank.
- P₁₁** The type of data block and area associated with a file. (Refer to Sections 4.2 and 4.3.)

For input, P₁₁ may be

- 1, if the file was block written by the UNIVAC III System;
- 3, if the file was either gather written by the UNIVAC III System, or written with P₁₁ = 5 by the UNIVAC 1050 System; or
- 4, if the file was block written by the UNIVAC 1050 System.

For output, p_{11} may be

- 4, if the file is to be block written; or
- 5, if the file is to be written with segment separators.

If p_{11} is 5, p_{12} must be 5 also.

- p_{12} Mode in which tape is to be read or written by the UNIVAC 1050 system. It is 4, for 4 character mode, or 5, for 5 character mode.
- p_{13} Label of the instruction to which control is to be transferred when an end-of-file sentinel is detected. This parameter is blank for an output file.
- p_{14} Label of a closed subroutine which is to be performed in addition to the standard label processing for each reel of the file. This parameter may be left blank if no additional label processing is desired.

The manner in which the user's additional label processing may address the label record depends on whether the file is an input or an output. The label record of an input file will be read in the mode specified by parameter 12; thus its size will be either 48 or 60 characters. The first character of the label record is addressed as FILEh, and the last character as FILEh + 47, or FILEh + 59, depending on the mode. (In a file that uses form 2 of the macro instructions, these labels represent absolute addresses. In a file that uses form 1 of the macro instructions, these labels represent area relative addresses, which will be modified by indexing to produce the correct absolute addresses.)

An output label record will always be written in the 5 character mode and is 60 characters in length. It is addressed in the same fashion as an input label record.

- p_{15} Decimal number of characters in one block. (Refer to AREA statement.)
- p_{16}^* Decimal number of UNIVAC III words per block (including data descriptor words).
- p_{17}^* Decimal number of UNIVAC III words per record.
- p_{18} RT or blank. If the user program operates under control of the real time system (OPR), and priority handling of its tape orders is desired, parameter 18 should be RT. In all other cases it will be blank.
- p_{19} Label of a closed subroutine for error processing or blank.

If the user program operates under control of the real time system (OPR), the user may wish it to type out information, in addition to the standard display codes supplied by the file control routines, for error identification. He should then supply a closed subroutine, specify its label as p_{19} , and expect to gain control under any file control error situation. The standard display code may be accessed at the address recorded in the subroutine's exit line. It will be in the form JD m (see Error Displays). If control is returned to the file control routine, 05 should be added to the address in the subroutine exit line.

In all other cases p_{19} will be blank.

- p_{20}^* If present, it is the 5 character ID (in quotes) of a 6 character numeric date parameter, the value of which is to be supplied via the dating routine (XCOR3) of CORDIAL (see the CORDIAL Tape Service Routine document). A 'K' block, containing a 6 character date field and the 5 character ID, is generated. The date field is preset to blanks. Its least significant character is labeled XGhT9 (for an input), or XPhT9 (for an output), where h is the file identifier. Instructions to pack the date into UNIVAC III decimal format, and to process it in this form, are also generated. If, when the program is executed, the date field is all blanks, the date will not be processed.

If p_{20} is blank, no date processing will be performed.

*This parameter may be left blank for an input file.

p₂₁*

If present, it is the 5 character ID (in quotes) of a 6 character numeric reel-number parameter, the value of which is to be supplied via the dating routine (XCOR3) of CORDIAL. A 'K' block, containing a 6 character reel-number field and the 5 character ID, is generated. The reel-number field is preset to '000001'. Its least significant character is labeled XGhT4 (for an input) or XPhT2 (for an output), where h is the file identifier.

If p₂₁ is not present, a 6 character reel-number field, preset and labeled as described above, will be generated but not within a 'K' block.

Whether p₂₁ is present or not, the instructions to pack the reel number into UNIVAC III decimal format, and to process it in this form, will be generated, and will be executed for each reel of the file.

*This parameter may be left blank for an input file.

4.0 INPUT/OUTPUT AREA

4.1 AREA STATEMENT

<u>LABEL</u>	<u>OP'N</u>	<u>OPERANDS</u>
FILEh	AREA	n,t,c,x

FILEh The designation which appears in the operation field of the calling statement.

The parameters in the operands field have the standard area statement meaning (refer to the Card System General Reference Manual UP 3913, Section 2-C-6 to 2-C-8).

n = the size of the area

t = the kind of data the area is for (A for alphanumeric, B for binary, I for instructions).

c = a character to which the entire area is to be preset.

x = the index register assigned to file h (parameter 10 of the call statement), if any.

4.2 CALCULATING THE AREA SIZE

When the UNIVAC 1050 system reads tapes produced by the UNIVAC III system, the number of characters entered into storage depends on the tape mode. If tape is read in 4 character mode, each word from tape (that is, each group of 3 tape frames) enters 1050 storage as 4 characters. Sign bits on tape are ignored, and do not enter 1050 storage. Segment separators on tape enter as 4 character groups of binary zeros. They are bypassed by the record advance macro instructions.

If tape is read in 5 character mode, each word from tape enters 1050 storage as 5 characters: 4 data characters and a sign character. The sign character is 040 if the sign is negative, or 0 if the sign is positive. A segment separator on tape enters the 1050 system as 4 characters of binary zeros, followed by a 01 character.

Conversely, when the 1050 system writes tapes for the UNIVAC III system, the relation between storage characters and tape frames depends on the mode. In 4 character mode, 4 characters from storage are written onto tape as a UNIVAC III word that is, 3 tape frames with a positive sign. In 5 character mode, the first 4 characters of each 5 character group from storage are written onto tape as data characters. If the MSB (most significant storage bit) of the fifth character is 1, a negative sign is affixed to the tape word; otherwise, a positive sign is affixed. The remainder of the fifth character is ignored and is not written onto tape.

Segment separators can be written by the 1050 system only in the 5 character mode. If the fifth character of a 5 character group, is a 01, the group will be written onto tape as a segment separator. For correct tape parity, the first 4 characters of the group in storage must be all binary zeros. Where required, segment separators will be fabricated and positioned by the record advance macro instructions. (Refer to type V, below.)

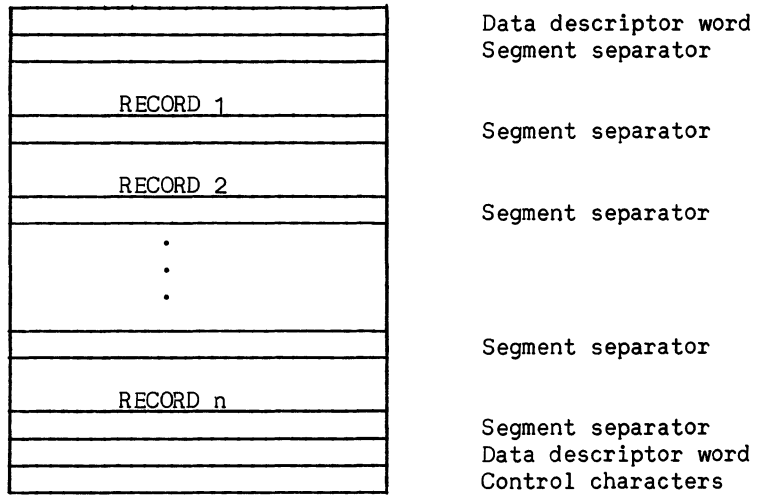
The first and last words of each block are data descriptor words. They, and any segment separators in a block, will be bypassed by the record advance macro instructions.

In addition to the requirements laid down by the UNIVAC III software and hardware, the FILEh coding requires that a 4 character field immediately following each block be set aside for control purposes.

Based on the considerations above, the following five types of tape blocks and data areas are distinguished:

4.2.3 Type III (Input): Gather written by UNIVAC III System, or written with $p_{11} = 5$ by UNIVAC 1050 System.

a. UNIVAC 1050 I/O Data Storage Area



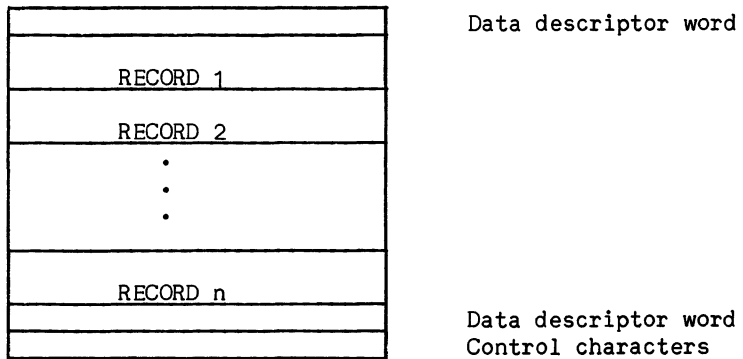
b. Area Size Computation

Size = (Maximum number of records per block) times (record size in characters plus mode) plus (3 times mode) plus 4 or

$$\text{Size} = p_2(p_1 + p_{12}) + 3(p_{12}) + 4$$

4.2.4 Type IV (Input and Output): Block written by UNIVAC 1050 System ($p_{11} = 4$).

a. UNIVAC 1050 I/O Data Storage Area



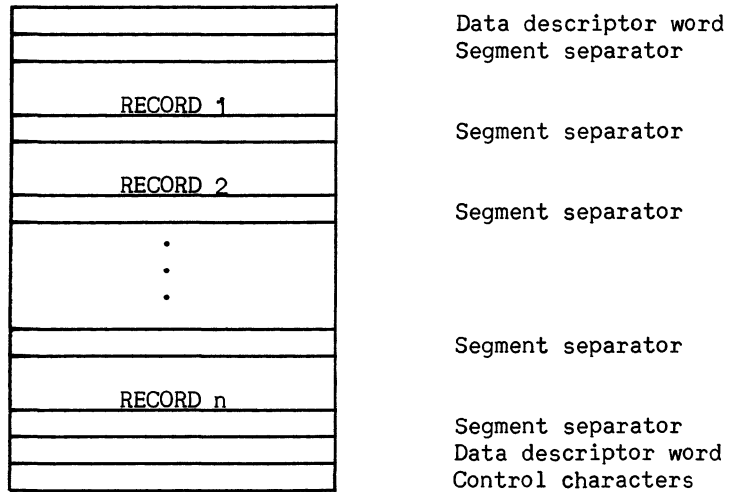
b. Area Size Computation

Size = (Record size in characters) times (maximum number of records per block) plus (2 times mode) plus 4 or

$$\text{Size} = (p_1) \times (p_2) + 2(p_{12}) + 4$$

4.2.5 Type V (Output): Written with segment separators by the 1050 system ($p_{11} = 5$)*.

a. UNIVAC 1050 Data Storage Area



b. Area Size Computation

Size = (Maximum number of records per block) times (record size in characters plus mode) plus (3 times mode) plus 4 or

$$\text{Size} = p_2(p_1 + 5) + 3(5) + 4$$

4.3 Summary of Formulas

To calculate the size of the data area needed, multiply the size of the record (p_1) by the number of records per block (p_2) and add to the appropriate entry from the table below:

MODE (p_{12})	TYPE				
	I ($p_{11} = 1, p_{16} < 512$)	II ($p_{11} = 1, p_{16} > 511$)	III ($p_{11} = 3$)	IV ($p_{11} = 4$)	V ($p_{11} = 5$)
4	20	24	$20 + 4(p_2 - 1)$	12	---
5	24	29	$24 + 5(p_2 - 1)$	14	$24 + 5(p_2 - 1)$

*Mode (p_{12}) must be 5.

5.0 RECORD ADVANCE MACRO INSTRUCTIONS

The worker program communicates with the tape record advance coding through the macro instructions described on the pages following. Format, entrance requirements, exit conditions, and storage requirements, are given for each macro instruction.

In addition to the specific exit conditions given for each macro instruction, it should be noted that all macro instructions destroy the contents of arithmetic registers 1 and 2. Furthermore, form 2 of the GET macro instruction and form 4 of the PUT macro instruction destroy the contents of tetrad 35.

An entry in the label field of a macro instruction will apply to the first line turned out by the macro.

5.1 OPEN (INPUT FILE) (FORMS 1 AND 2)

<u>LABEL</u>	<u>OP'N</u>	<u>OPERANDS</u>
label	OPEN	FILEh

5.1.1 Entrance Requirement

This must be the first macro instruction executed for file h.

5.1.2 Exit Conditions

- a. The label record of file h is read into the input area and is checked.
- b. If a label were specified in parameter 14 of the call line, the subroutine so labeled is performed.
- c. The OPEN macro instruction does not make the first data record of file h available to the worker program.

5.2 GET (FORM 1)

<u>LABEL</u>	<u>OP'N</u>	<u>OPERANDS</u>
label	GET	FILEh

5.2.1 Entrance Requirements

- a. File h has been opened.
- b. The contents of the assigned index register have not been altered since the last execution of a macro instruction for file h.

5.2.2 Exit Conditions

- a. The area relative address of the first character of the next available record of file h is in the assigned index register.
- b. When an end-of-reel sentinel is detected, the following actions are performed:
 - 1) The end-of-reel rewind (parameter 5) is executed for the current reel.
 - 2) If an alternate tape unit were assigned to the file (i.e., if parameter 9 were not blank), a tape unit swap is performed.
 - 3) The label record of the next reel of file h is read into the input area.
 - 4) The label record is checked and the worker program's label check subroutine (parameter 14), if any, is performed.

- 5) The area relative address of the first character of the next available record of file h is in the assigned index register.
- c. When an end-of-file sentinel is detected, the end-of-file rewind (parameter 6) is performed for the current reel, and control is transferred to the worker program's end-of-file processing (parameter 13). The area relative address of the sentinel record does not appear in the assigned index register, and no further macro instructions may be executed for file h.

5.3 GET (FORM 2)

<u>LABEL</u>	<u>OP'N</u>	<u>OPERANDS</u>
label	GET	FILEh, work area

Work area is a label assigned to the first character of an area large enough to contain one record of file h. The area can be either a working storage or the output area of a file which uses form 3 of the PUT macro instruction.

5.3.1 Entrance Requirements

- a. File h has been opened.
- b. If work area is an output area, the file that it is associated with has been opened.

5.3.2 Exit Conditions

- a. The next available record of file h is in work area.
- b. When end-of-reel sentinel is detected, the following actions are performed:
 - 1) The end-of-reel rewind (parameter 5) is executed for the current reel.
 - 2) If an alternate tape unit were assigned to the file (i.e., if parameter 9 were not blank), a tape unit swap is performed.
 - 3) The label record of the next reel of file h is read into the input area.
 - 4) The label record is checked and the worker program's label check subroutine (parameter 14), if any, is performed.
 - 5) The next available record of file h is in work area.
- c. When an end-of-file sentinel is detected, the end-of-file rewind (parameter 6) is performed for the current reel, and control is transferred to the worker program's end-of-file processing (parameter 13). The sentinel record does not appear in work area, and no further macro instructions may be executed for file h.

5.4 CLOSE (INPUT FILE) (FORMS 1 AND 2)

<u>LABEL</u>	<u>OP'N</u>	<u>OPERANDS</u>
label	CLOSE	FILEh

5.4.1 Entrance Requirements

- a. File h has been opened.
- b. If file h uses form 1 of the GET macro instruction, the contents of the assigned index register have not been altered since the last execution of a macro instruction for the file.

5.4.2. Exit Conditions

- a. The end-of-file rewind (parameter 6) is executed, and control passes to the worker program at a point immediately following the macro instruction. The worker program's end-of-file processing is not performed.
- b. No further macro instructions may be executed for file h.

5.5 OPEN (OUTPUT FILE) (FORMS 3 AND 4)

<u>LABEL</u>	<u>OP'N</u>	<u>OPERANDS</u>
label	OPEN	FILEh

5.5.1 Entrance Requirement

This must be the first macro instruction executed for file h.

5.5.2 Exit Conditions

- a. The label record of file h is placed in the output area.
- b. If a label was specified in parameter 14 of the call line, the subroutine so labeled is performed.
- c. The label record is written on tape.
- d. If file h uses form 3 of the PUT macro instruction, OPEN places the area relative address of the first character of the first record area in the assigned index register.

5.6 PUT (FORM 3)

<u>LABEL</u>	<u>OP'N</u>	<u>OPERANDS</u>
label	PUT	FILEh

5.6.1 Entrance Requirements

- a. File h has been opened.
- b. The contents of the assigned index register have not been altered since the last execution of a macro instruction for file h.

5.6.2 Exit Conditions

- a. The area relative address of the first character of the next available record area is in the assigned index register.
- b. The previous record is not available to the worker program.
- c. If an end-of-reel condition is detected, the following actions are performed:
 - 1) End-of-reel sentinels are written on the current reel.
 - 2) The end-of-reel rewind (parameter 5) is performed for the current reel.
 - 3) The label record of file h is placed in the output area.
 - 4) If a label was specified in parameter 14 of the call line, the subroutine so labeled is performed.
 - 5) If an alternate tape unit was assigned to the file (i.e., if parameter 9 was not blank), tape unit swap is performed.
 - 6) The label record is written on tape.
 - 7) The area relative address of the first character of the next available record area is placed in the assigned index register.

5.7 PUT (FORM 4)

<u>LABEL</u>	<u>OP'N</u>	<u>OPERANDS</u>
label	PUT	work area, FILEh

Work area is a label assigned to the first character of an area which contains the next file h record to be placed in the output area. The area can be either a working storage or the input area of a file that uses form 1 of the GET macro instruction.

5.7.1 Entrance Requirements

- a. File h has been opened.
- b. If work area is an input area, the file it is associated with has been opened.

5.7.2 Exit Conditions

- a. One record of file h is transferred from work area to the output area.
- b. If an end-of-reel condition is detected, the following actions are performed:
 1. End-of-reel sentinels are written on the current reel.
 2. The end-of-reel rewind (parameter 5) is performed for the current reel.
 3. The label record of file h is placed in the output area.
 4. If a label was specified in parameter 14 of the call line, the subroutine so labeled is performed.
 5. If an alternate tape unit was assigned to the file (i.e., if parameter 9 were not blank), tape unit swap is performed.
 6. The label record is written on tape.

5.8 CLOSE (OUTPUT FILE) (FORMS 3 AND 4)

<u>LABEL</u>	<u>OP'N</u>	<u>OPERANDS</u>
label	CLOSE	FILEh

5.8.1 Entrance Requirements

- a. File h has been opened.
- b. If file h uses form 3 of the PUT macro instruction, the contents of the assigned index register have not been altered since the last execution of a macro instruction for the file.

5.8.2 Exit Conditions

- a. If there are any records in the output area that have not been written on tape, the data descriptor words are adjusted and the terminal data descriptor word is placed immediately following the last valid record (or its segment separator, if the file is type V). A partial (short) data block is then written.
- b. End-of-file sentinels are written on the current reel.
- c. The end-of-file rewind (parameter 6) is performed.
- d. No further macro instructions may be executed for file h.

6.0 DISPLAYS

Refer to the tape control portion of the Executive Routine for additional stop displays pertaining to input or output operations.

6.1 FORMAT

Error displays in the tape record advance routines have the octal form 30 m 60 ; the m portion breaks down as follows:

```
1  ccc  øøu  uuu  eee  eee
                                     error code (see list below)
                                     unit number
                                     channel (4 for input, 5 for output)
```

6.2 ERROR CODES

In OPS systems, and all non-typewriter systems, to ignore the error stop, set a 7 into the trace switches and press the PROGRAM START button to continue the run. Any other quantity in the trace switches will cause a program jettison.

In OPR console typewriter systems, to ignore the error stop, type 0007 to continue the run. Any other quantity typed will cause a program jettison.

The following octal values represent the six error bit positions of the error display:

6.2.1 Input File

<u>Error Codes</u>	<u>Description</u>
20	File ID error. The file identification from tape, is found in tetrads 5 and 6 in all non-typewriter systems.
21	Reel number error. For non-typewriter systems, the four LSC of AR2 (034, 035, 036, 037) contain the reel number from tape. This quantity is in UNIVAC III decimal code.
22	Irregular block error. The block is not a multiple of the record size, or an improper index register setting existed when GET was executed. If the error is ignored a new block of data will be accessed and processing may continue.
23	Block count error. In non-typewriter systems, tetrad 0 contains the computer block count; tetrad 1 contains the block count from tape. Both quantities are in binary form.
24	Date error. In non-typewriter systems the date from tape is found in the four LSC of AR2.

6.2.2 Output File

Error Codes
None