UNIVAC 1004 III MAGNETIC TAPE UNIT

UNIVAC 1004 SYSTEMS

UP-3938

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UNIVAC 1004 III
Magnetic Tape Unit

The Magnetic Tape Unit for the UNIVAC 1004 III is provided as either a Single Magnetic Tape Unit or a Dual Magnetic Tape Unit. The Dual Magnetic Tape Unit is two adjacent Magnetic Tape Units in one housing. In this case, one of the two units is equipped with the internal controls for both units.

The maximum number of Magnetic Tape Units that may operate with one UNIVAC 1004 III Card Processor is two; this is provided by <u>one</u> Dual Magnetic Tape Unit.

The programmed instructions for a Magnetic Tape Unit include; read forward, write forward, backspace one block, erase before write and rewind. For the protection of recorded data, a Write Ring must be inserted in the tape reel before data will be accepted by that tape.

The Magnetic Tape Unit can be programmed to read or write in 6-data bit magnetic tape code with a seventh, parity bit. This would be those codes written or read in non-return-to-zero 1 mode. Among these codes would be the XS-3, 90-Column and binary coded decimal. This programming versatility also includes handling either odd or even parity. The outer of the seven tracks is designated as the parity track.

The control panel on the front of a Magnetic Tape Unit provides the operator with full manual control over the tape movement when necessary. In addition, this panel contains indicators necessary to inform the operator of the various conditions within the unit.

Physical Characteristics

Dimensions:
Single Magnetic Tape Unit -- Height - 70-1/2", Width - 27", Depth - 31-1/2".
Dual Magnetic Tape Unit -- Height - 70-1/2", Width - 52", Depth - 31-1/2".

Weight
Single Magnetic Tape Unit -- 470 pounds.
Dual Magnetic Tape Unit -- 920 pounds.

Recommended Working Area: - 42" clearance around all sides
Single Magnetic Tape Unit -- 9' x 10'
Dual Magnetic Tape Unit -- 11' x 10'

Inter-Unit Cable Length:- 20' external length between connection points; Processor and Magnetic Tape Unit.

Power Cable Length:- 15' external length

Power Requirements:- 115 Volts, 60 Cycle, Single-Phase.

Power Consumption:
Single Magnetic Tape Unit - 1375 Watts maximum, 1175 Watts average.
Dual Magnetic Tape Unit - 1900 Watts maximum, 1600 Watts average.

Heat Dissipation:
Single Magnetic Tape Unit - 4700 BTU/Hr.
Dual Magnetic Tape Unit - 5220 BTU/Hr.

Speed of Tape Movement:
Forward -- 42.7 inches per second, read or write.
Rewind -- Variable. A 2400' reel can be rewound in less than 3 minutes.

Instantaneous Data Transfer Rate:

200 CPI	8540 characters per second	.117 ms per character
556 CPI	23741 characters per second	.042 ms per character
800 CPI	34160 characters per second	.029 ms per character

Start & Stop Times:

Read Start	9.5 ms
Read Start after Backspace	12.0 ms
Read Stop	10.5 ms*
Write Start	8.2 ms
Write Check	7.0 ms
Write Stop	9.0 ms*
Backspace Start after Read	12.0 ms
Backspace Start after Write	7.2 ms
Backspace Stop	10.5 ms*

* - Processor not interlocked

Transport Select Time:- 6 ms*

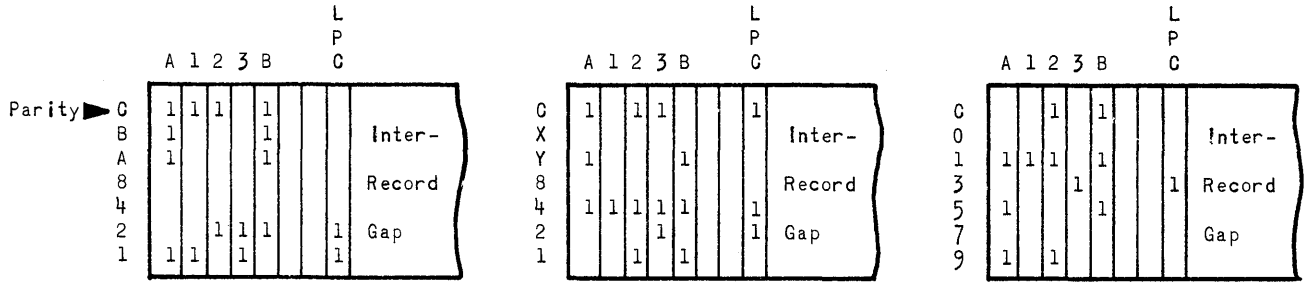
File Protection:- Through the use of a write enable ring in the tape reel, writing on that tape can take place. When this ring is not present, no tape erase or write operation can take place.

Simultaneity:- Tape reading or writing may occur simultaneously with the operation of any one of the following: Card Punch (card punching), Read-Punch Unit (card reading and punching) Paper Tape Punch (paper tape punching).

Tape Characteristics

Dimensions:- 1/2" plastic base, 2400' reel. Reel hubs capable of accepting UNIVAC Compatible with IBM, IBM, and IBM Compatible tape reels.

Data Format:- Variable records separated by 3/4" minimum inter-record gap.



BCD CODE
Even Character Parity

XS-3 CODE
Odd Character Parity

90-COLUMN CODE
Odd Character Parity

Mode of Recording:- Non-Return to Zero 1.

Densities:- 200, 556, or 800 PPI.

Channels:- 7 channels; 6 data and 1 parity.

Load Point Mark:- A Load-Point Mark placed at least 10' from the physical beginning of the tape can be sensed. This is a light-reflective, aluminum strip measuring 1" x 3/16".

End-of-Tape Warning Mark:- An End-of-Tape Warning Mark placed at least 14' from the physical end of the tape can be sensed. This is a light-reflective, aluminum strip measuring 1" x 3/16".

Checking Characteristics

Write Checking:- A Write Check operation during tape writing provides an automatic check of each character as it is recorded. As each character is written, it is checked for parity as it passes the read head.

Bad Spot Detection:- The detection of bad spots in the tape is accomplished by the Write Check operation.

A programmed Erase-before-Write instruction may then be used to by-pass the defective tape area.

Parity Check:- A parity bit included as the seventh or outer track of the tape code provides for odd or even parity checking. When a parity error is detected, a pulse is issued so that the program can be routed into an error subroutine.

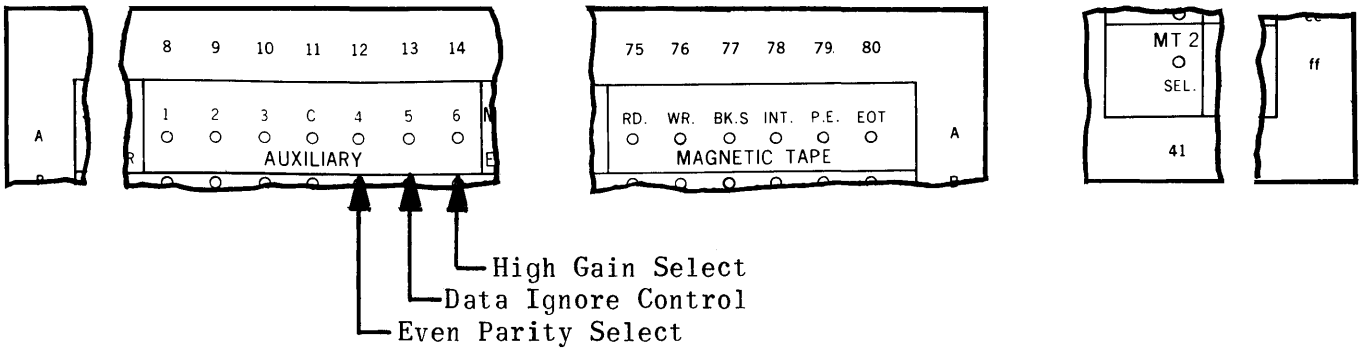
Longitudinal Parity Check:- After the last character of a block has been recorded, the write operation will automatically record a one-bit count of each of the seven channels in which the sum of bits in the related channel is odd to make the count even. This becomes a record checking character when reading.

Normal/High Gain Read:- The program can select whether the reading will be at normal or high gain.

Connection Panel Functions and Hub Assignments

The UNIVAC 1004 III tape processing abilities have added some new hubs to the UNIVAC 1004 Connection Panel as well as modifying the use of some existing ones.

The connection panel hubs shown here are of prime importance in magnetic tape programming.



The following explanation of these hubs and their functioning includes the added features and modifications mentioned above.

1. Read Magnetic Tape (A,75)

   Is activated from the Process hub of the step on which the tape read order is to be initiated. Information from tape will be entered into storage beginning with the first location specified by the Operand 2 of the tape read step.

   Tape reading continues until the inter-record gap is sensed.

2. Write Magnetic Tape (A,76)

   Is activated from the Process hub of the step on which the order is to be initiated. Information specified by the OP1 of this step will be written as a tape record.

3. Backspace (A,77)

   This hub is impulsed to initiate the backspace of one tape record.

4. Tape Interlock (A,78)

   During a tape operation's program step the INT hub functions to control the advance of the operand addresses, keeping them in step with the relatively slower speed of the magnetic tape unit.

   The wiring of the INT hub to the Insert Transfer and Compress Start uses the Operand One and Operand Two address control abilities of the two features to govern the transfer of the data characters between the Magnetic Tape Unit and Core Storage. (See Page 2, Address Controls, Data Flow, Transfer Operations - UP-3871.)

The INT hub functions as follows for address control during tape operation:

When an A-Pulse is issued by this hub, the Operand Address Controls are prevented from advancing the Operand One and Operand Two addressed, a character entered into or accessed from storage will recirculate.

When a B-Pulse is issued by this hub, the Operand Address Controls allow the Operand Two addresses to advance to permit:

A new character from the tape to be entered into storage or

A new character from storage to be issued for writing on the tape.

Included in this address control is the wiring from Step Output to 90/80 Δ and Compress End.

The wiring of the 90/80 Δ completes the requirements of the Insert process for address control.

The wiring of Compress End allows the advance of the Operand Two Address except when prevented by the impulsing of Compress Start by an A-Pulse from the INT. hub.

5. End of Tape (A,80)

The End of Tape hub will emit an A-Pulse whenever the reflective strip located at the end of the magnetic tape is detected by a photocell in the magnetic tape transport. This signal can be stored in a program select and be used to cause program modification.

After emission from the EOT hub there is room to write one more tape record.

6. Parity Error (A,79)

The Parity Error hub emits an A-Pulse on a tape read or write step if there is a character parity or longitudinal parity error sensed.

In a tape write step the hub emits when an error is sensed by the write-check circuits.

This signal can be used to set program selects, halt, or step sequence change.

7. Transport 2 Select (ff,41)

The Transport Select hub is used to determine which Transport is to be used. An A-Pulse to this hub will select Transport 2. The absence of an A-Pulse at this hub will select Transport 1.

This hub should be controlled by a Program Select. When it is necessary to switch transports, the transport selection may be made prior to giving the operation. The transport selection must be present until the tape operation has been initiated.

8. Data Ignore Control
(Auxiliary 5) (A,13)

The Data Ignore Control hub is used to ignore data being read from tape. Whenever an A-Pulse is received at this hub, data will not be transferred from tape into memory.

9. High Gain Select
(Auxiliary 6) (A,14)

An A-Pulse wired to this hub will cause reading and write-check reading of a tape on high gain.

10. 90/80 Δ (ff,69)

Wiring the character generator hub, 90/80 Δ, from step output completes the wiring requirements of the Insert operation for address control.

11. CMPS END (ff,49)

The wiring of Compress End from Step Output allows the advance of the Operand Two address except when prevented by the impulsing of Compress Start by an A-Pulse from the INT hub.

12. Even Parity Select
(Auxiliary 4) (A,12)

The wiring of this hub causes the character parity checking mode to change from odd to even.

If this hub is wired while a write operation is in progress, even parity will be written on the output tape.

The following information is a more detailed explanation of several tape processing steps.

IMPORTANT:- No two tape operations may take place on consecutive steps. Following a Parity Error, the intervening step must be other than a No Process step to clear the error condition.

MAGNETIC TAPE READ

The purpose of this step is to cause the Magnetic Tape Unit to read one tape record and to control the entry of the characters being read into the memory of the UNIVAC 1004 III.

This step must include the following connection panel wiring:

The wiring of its Step Output hub to:

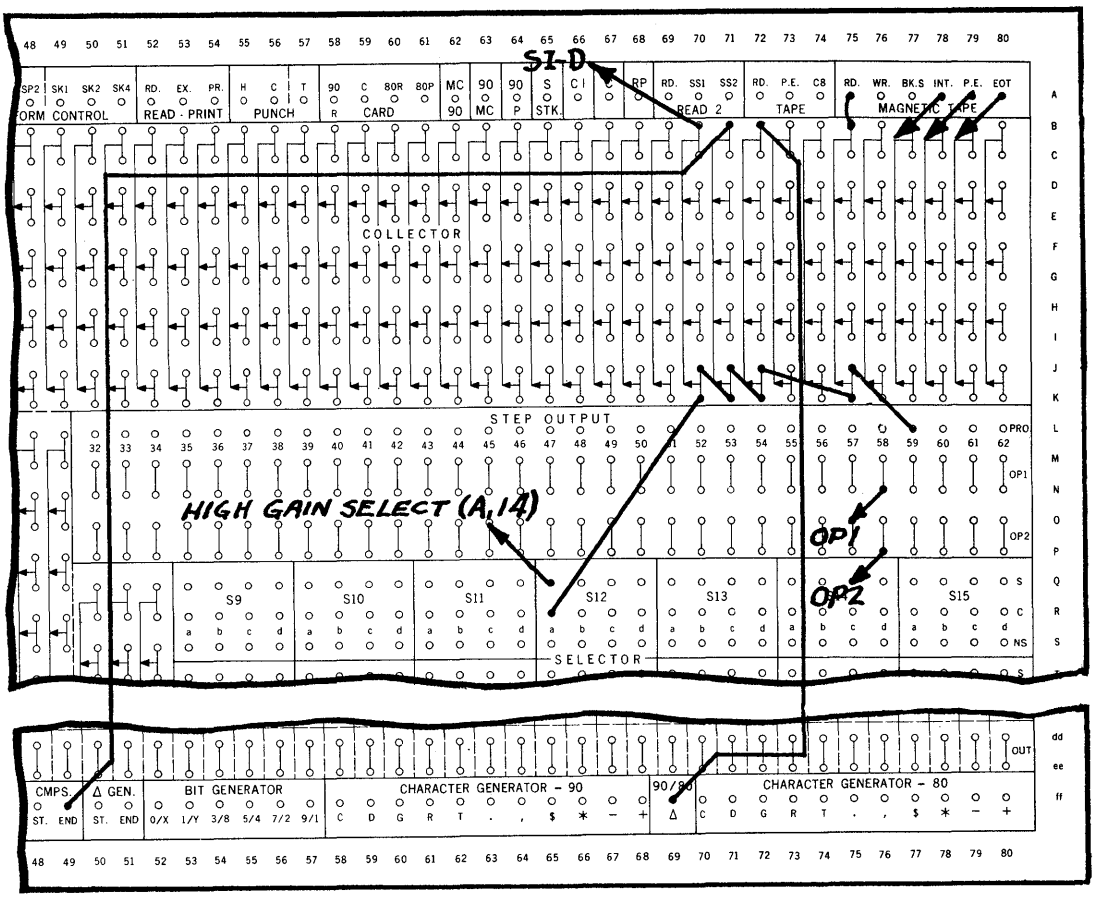
S.I. (Superimpose) Descending
RD (A,75) Magnetic Tape Read
CMPS (Compress) END
90/80 Δ

The wiring of the INT (A,78) Tape Interlock hub to:

INS (Insert) Descending
CMPS ST (Compress Start)

The data from the tape is entered in the OP2 storage locations. The Superimpose Space is used to prevent the transfer of data from OP1 to the OP2 storage locations. Any data from OP1, if allowed to transfer, would combine with tape data to cause the entry of incorrect information.

If, however, the OP1 locations are known to contain only spaces before starting the Tape Read operation, a Transfer process instead of Superimpose can be used.



STEP	PROCESSES AND OPERATIONS: BASIC	AUXILIARY	OPERAND 1: MSL R	MSL C	LSL R	LSL C	DESCRIPTION	OPERAND 2: MSL R	MSL C	LSL R	LSL C	DESCRIPTION
59	SI-D	MT RD.	CMPS. END	90/80 Δ	COMSTA *		6	6	6	6	Magnetic Tape Read	6	6	9	3	Info. enters storage starting with location R6/C6.
						* NOTE:- If Selector S12 is in the Select position, reading will be done at high gain.										

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Operands:

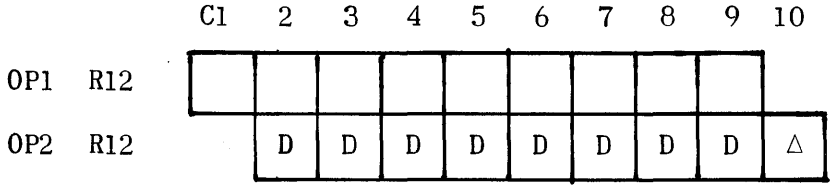
a) The OP2 starting location specifies the location for storing the first character of a tape block. Tape reading and storing will continue until the inter-record gap is reached regardless of the number of locations specified for OP2. Therefore, specifying a single location is all that is required to read a tape block. If, however, an OP2 is specified which contains a number of locations greater than the number of characters in the tape block, the excess locations will be cleared to spaces.

Tape reading and storing will continue until the inter-unit gap is reached. For this reason, the Read Step will continue until terminated by the end of the OP2 or upon reaching the inter-record gap, whichever occurs last.

An Operand One is not required for a Tape Read operation. Wiring an OP1 is required, however, to prevent a plugboard check error. Therefore, an OP1 of one or more locations must be specified. The contents of the OP1 locations will not be disturbed.

b) If it is necessary to examine the characters as they are being read, overlapping operands must be specified with OP1 containing a number of locations equal to or greater than the number of characters in the tape block and offset one location to the left of OP2. It would still be permissible to specify OP2 as one location.

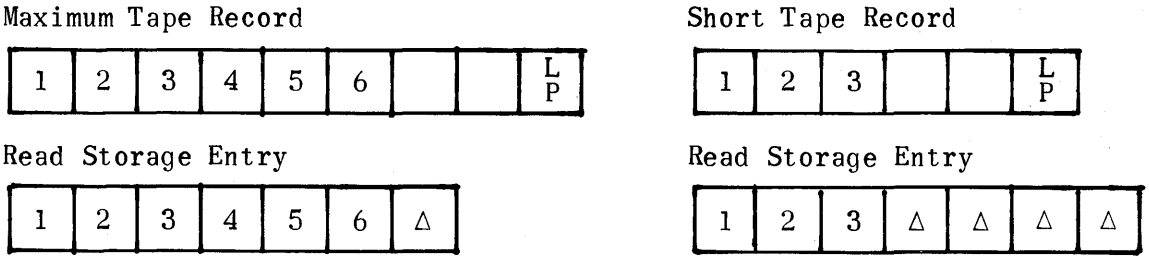
For example:



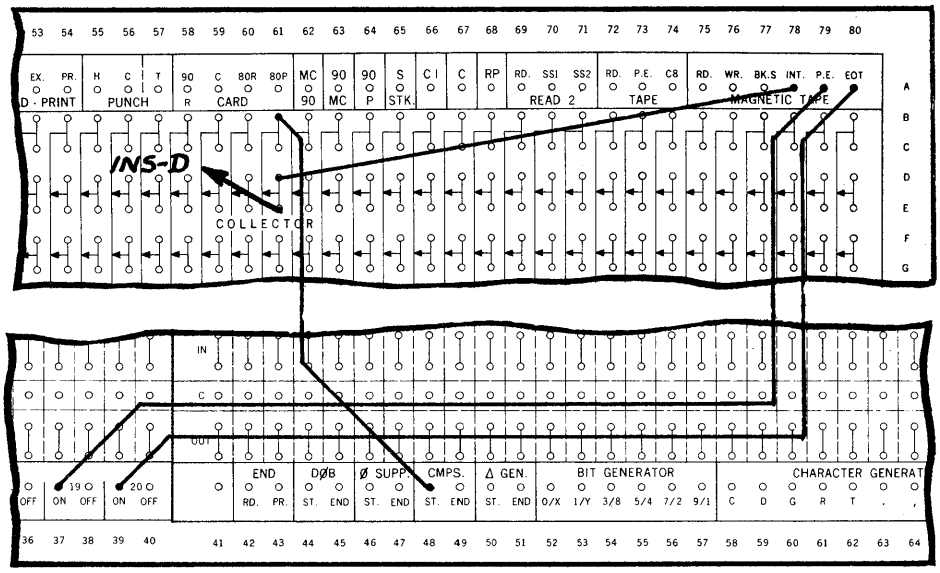
c) When reading variable length records, it is necessary to allocate enough read storage locations to accommodate the longest expected record.

If the record is shorter than the maximum record size designated by the OP2 address, the record data characters will enter storage followed by spaces in the unused portion of read storage.

NOTE:- The Longitudinal Parity character will always be entered into storage as a Space code immediately following the last data character.



The three emitting hubs for Magnetic Tape operation; INT, (Interlock), P.E. (Parity Error), and EOT (End of Tape) are wired on all Magnetic Tape Connection Panels. These hubs are not associated with any particular tape step. They emit signals sent from the Tape Unit to the Processor.



MAG. TAPE	
INT	
INS-D	
CMPS. ST.	

MAG. TAPE	
P.E.	EOT
PSC 19 ON	PSC 20 ON

PROGRAM SELECT CONTROL		
	ON	OFF

PROGRAMMER NOTATION

19	MT P.E.	
20	MT EOT	

UP-3315.3 Rev. 2 **FUNCTION CHART**

PSP 19-Pick Up Sel. 512
PSP 20-Pick Up Sel. 527

MAGNETIC TAPE WRITE

The purpose of this step is to control the issuance of characters from UNIVAC 1004 III memory to the Magnetic Tape Unit and write them on tape.

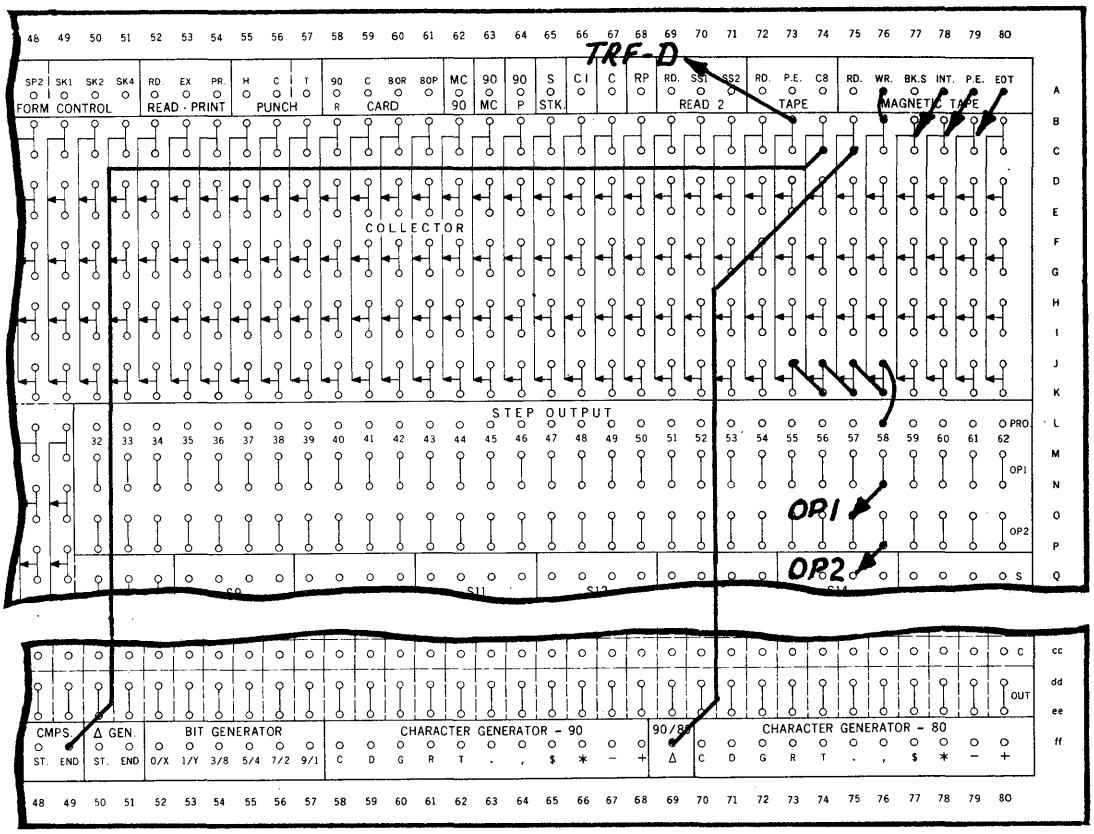
This step must include the following connection panel wiring:

The wiring of its step output PRO hub to:

TRF Descending
WR (A,76) Magnetic Tape Write
CMPS (Compress) END
90/80 Δ

The wiring of the INT (Tape Interlock hub) is to:

INS (Insert) Descending
CMPS ST (Compress Start)



STEP	PROCESSES AND OPERATIONS		OPERAND 1					OPERAND 2				
	BASIC	AUXILIARY	MSL R	MSL C	LSL R	LSL C	DESCRIPTION	MSL R	MSL C	LSL R	LSL C	DESCRIPTION
58	TRF-D	MT WR 90/80Δ CMPS. END	14	1	19	7	Write 160 characters	14	1	19	10	To tape

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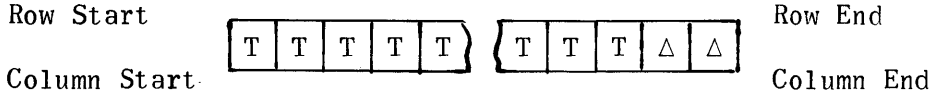
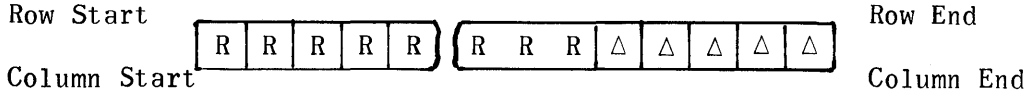
Operand 1 of the tape write instruction consists of consecutive storage locations containing the data to be written followed by two (2) additional locations.

Operand 2 of the tape write instruction consists of the number of data locations to be written followed by five (5) additional locations. (The Operands may be the same or different locations and may be anywhere in memory.)

Operand 1:



Operand 2:



Only "T" will write to tape. "R" and "Δ" can be any characters.

During the Tape Write operation, the contents of OP1 will be transferred to OP2.

ERASE-BEFORE-WRITE/FIRST RECORD WRITE

This instruction is used to delay the writing of a record on a tape, to insure that a portion of tape is erased before writing on it. Therefore, the first Tape Write order should alert the Backspace and Write hubs. This will permit a few inches of tape to move beneath the erase head before writing of the first record occurs. This operation can be used to continue an old file or by-pass a bad spot by backspacing and then writing again with the Erase-before-Write instruction.

All wiring described in the tape write instruction is duplicated in this one with the addition of a wire to Backspace (A,77).

If consecutive Erase-before-Write tape instructions are given, a minimum time delay of 35 milliseconds should be provided between the Erase-before-Write instructions to insure consistent erase length. If less time is allowed, the length of tape erased will be shorter.

MAGNETIC TAPE BACKSPACE ORDER

The purpose of this step is to move the tape backwards one block.

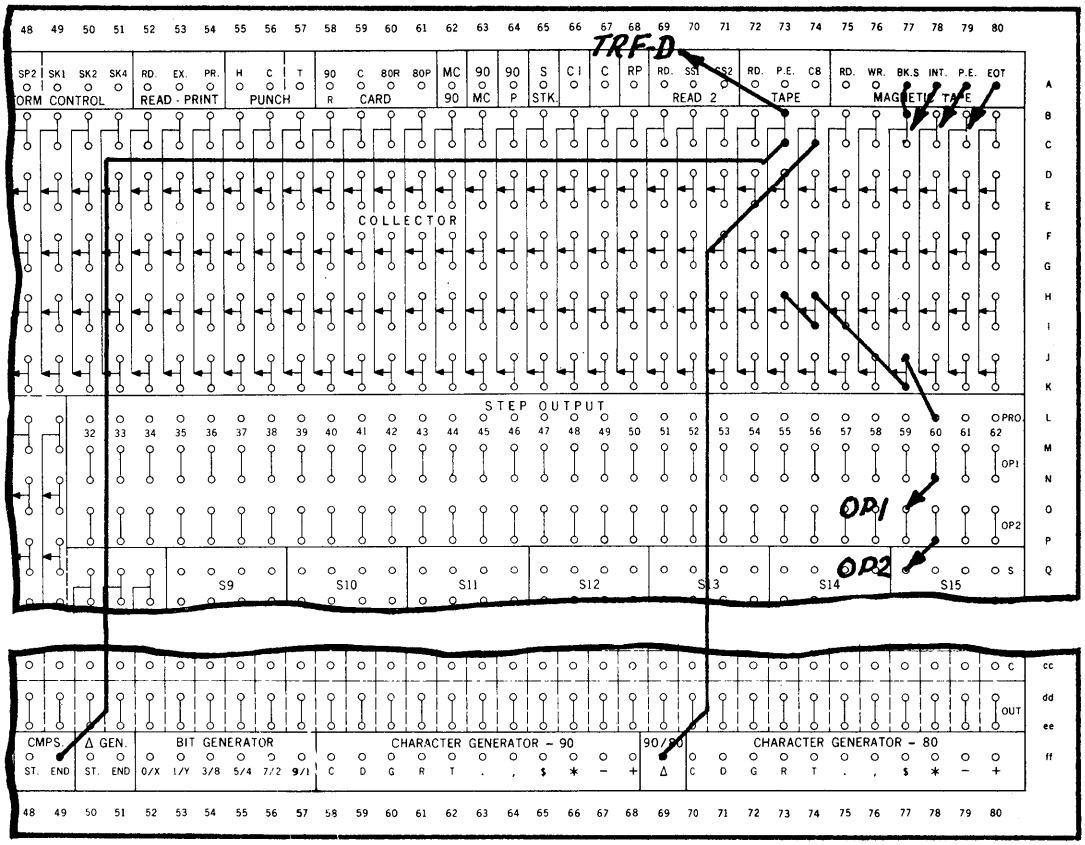
The following connection panel wiring must be included on this step.

Step PRO to:

BK.S (Backspace) (A,77)
TRF Descending
90/80 Δ
CMPS (Compress) END

INT (Tape Interlock) wired to:

INS D (Insert Descending)
CMPS ST (Compress Start)



STEP	PROCESSES AND OPERATIONS: BASIC	PROCESSES AND OPERATIONS: AUXILIARY	OPERAND 1: MSL R	OPERAND 1: MSL C	OPERAND 1: LSL R	OPERAND 1: LSL C	OPERAND 1: DESCRIPTION	OPERAND 2: MSL R	OPERAND 2: MSL C	OPERAND 2: LSL R	OPERAND 2: LSL C	OPERAND 2: DESCRIPTION
60	TRF-D	MT BKS 90/80A CMPS. END	1	1	1	1	One location operand	1	1	1	1	OP1 & OP2 should be the same

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Operands:

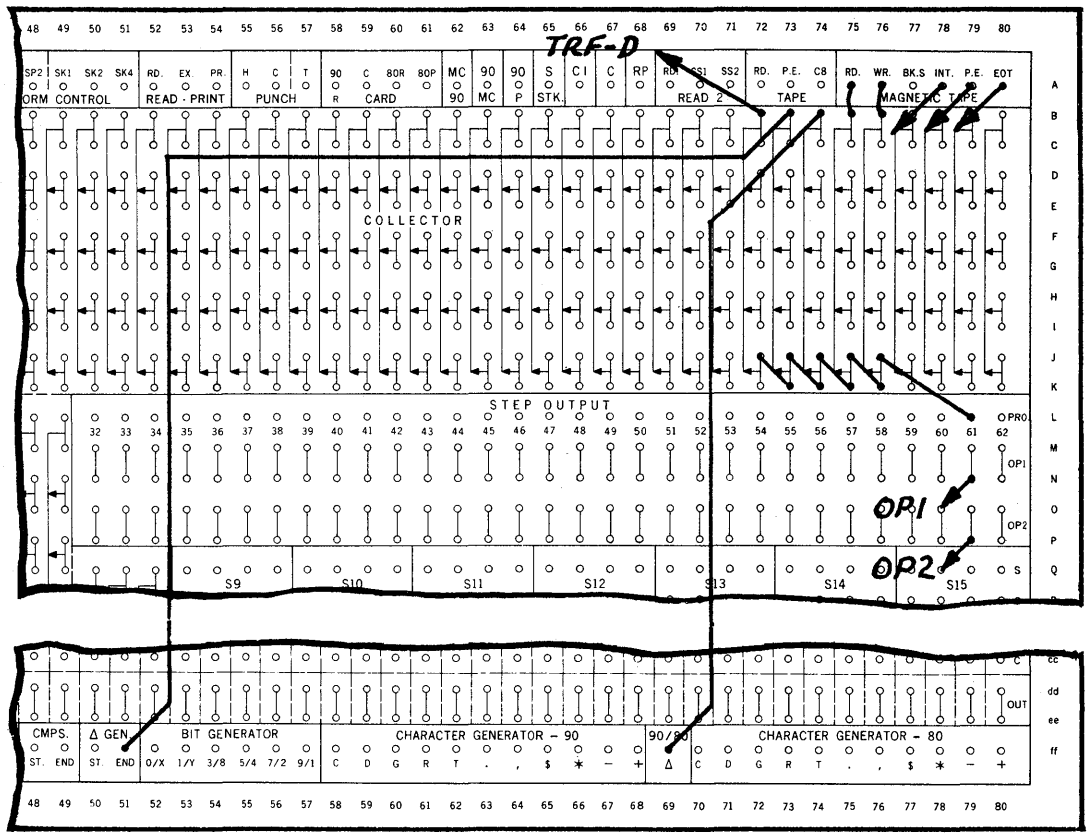
An operand of one location should be wired to OP1 and OP2. The same location is used for both operands. The contents of the location is not altered.

MAGNETIC TAPE REWIND ORDER

The purpose of this step is to cause tape to rewind.

The step output PRO hub is wired to:

RD (Magnetic Tape Read)
WR (Magnetic Tape Write)
TRF Descending
90/80 Δ
CMPS (Compress) END



STEP	PROCESSES AND OPERATIONS: BASIC	PROCESSES AND OPERATIONS: AUXILIARY	OPERAND 1: MSL R	OPERAND 1: MSL C	OPERAND 1: LSL R	OPERAND 1: LSL C	OPERAND 1: DESCRIPTION	OPERAND 2: MSL R	OPERAND 2: MSL C	OPERAND 2: LSL R	OPERAND 2: LSL C	OPERAND 2: DESCRIPTION
61	TRF-D	MT RD. MT WR. 90/80Δ CMPS END	1	1	1	1	Single OP1 & OP2	1	1	1	1	Same location as OP1

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INT (Tape Interlock) wired to:

INS D (Insert Descending)
CMPS ST (Compress Start)

Operands:

An operand of one location should be wired to OP1 and OP2. The same location is used for both operands. The contents of the location is not altered.

A Tape Rewind Step will interlock the Processor for approximately 50 microseconds if:

The Transport Select is complete when the Tape Rewind Order is given, and

A minimum of 9 ms has elapsed following the last tape order.

Tape rewind will then be completed without Processor interlock.

DATA IGNORE

The Data Ignore is a useful, powerful tape instruction. "A" power to the D.I. hub during a Tape Read instruction inhibits the transfer of data from tape to memory while allowing the Address Counters to continue to advance.

Among the uses of the Data Ignore instruction are the following:

Prevent the transfer of unwanted data to memory. For example, in a particular program only the first 50 characters of a 200 character tape record contain information required by the program. The D.I. can be used to prevent entry into storage of the 150 characters that are not required by the program; thus conserving memory capacity.

Accommodate tape records larger than the available memory capacity by entering segments of the record into memory. An illustration of this use follows.

NOTE:- More complete information regarding control during a Read Step in which Data Ignore is included follows this example.

An example of how a 1500 character record can be read and processed is explained below. In actual practice, the segments would be tailored to fit the data involved. In this example, the record is read in three 500 character segments.

Once the tape read order is given the tape unit will proceed to read the entire 1500 character record.

Wired from a program select power controlled by address combines, the Data Ignore Control regulates the transfer of these characters to memory.

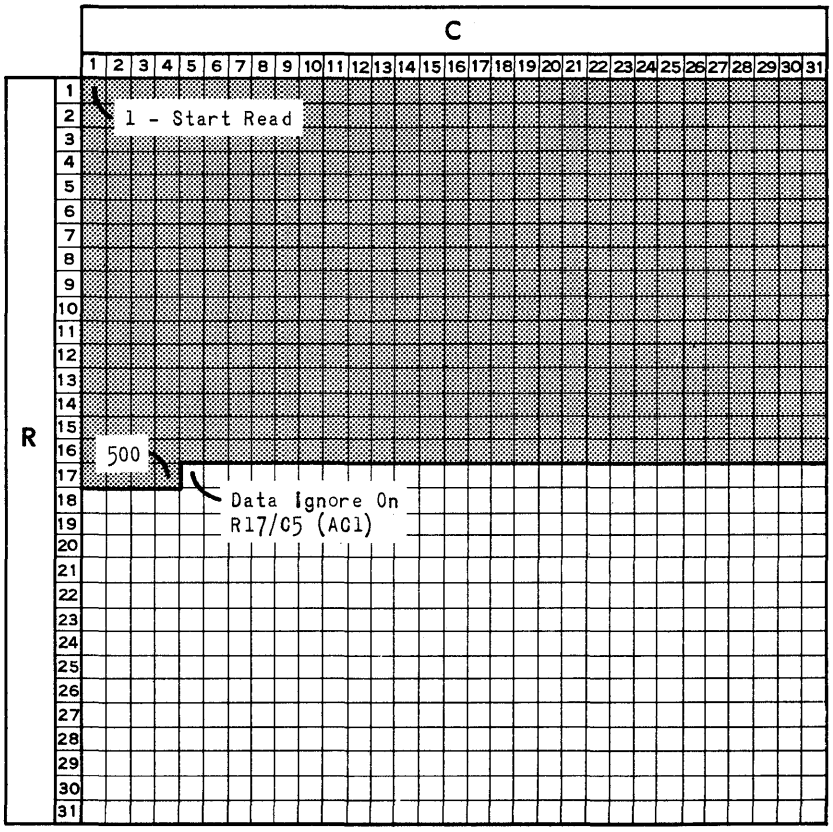
Since the address combines controlling the pick up of the program select play such an important part in these steps, their input is shown below.

A/C Address	Use	Step Used On	Inhibited By
1. R17/C5	Turn on PS1 to start data ignore	1, 2, 3.	
2. R31/C31	Turn off PS1 to allow data to enter memory	2, 3.	Step 1, PSC2 On
3. R10/C1	Turn on PS2 to inhibit turn off of PS1 (Data Ignore Control) as last characters are read.	2	Step 1, 3
4. R10/C1	Turn off PS2 to allow PS1 (Data Ignore Control) to turn off at AC2 time.	3	Step 1, 2

A. First Read

OP2 R1/C1 - R1/C1

The OP2 MSL address specifies the location where the first character read from tape will be stored.



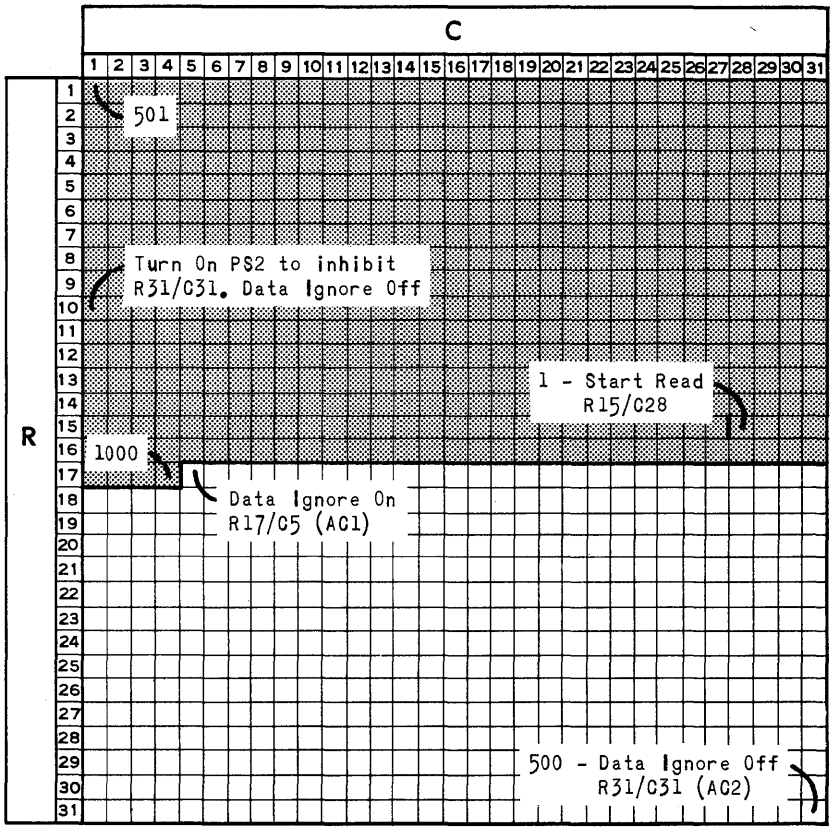
The first 500 characters are read and stored. The 501st memory location R17/C5 (AC1) is wired to turn on Program Select 1. The Program Select Power is wired to the Data Ignore hub. All characters read from tape starting with the 501st will be prevented from entering storage. The Storage Address will continue to advance until the end of the tape record is reached at which time the read step will terminate.

The first 500 characters of the tape record have now been read and stored in memory for processing.

B. Second Read

OP2 R15/C28 - R15/C28

Data Ignore is on from the previous read step. Reading starts at R15/C28 and the first 500 characters are read but not stored. The memory address is now at R31/C31 (AC2) and Data Ignore is turned off.



Characters 501 to 1000 are then stored in locations R1/C1 to R17/C4. At location R17/C5 (AC1) Data Ignore is once more turned on. Characters 1001 to 1500 are then read but not stored. When location R10/C1 (AC3) was passed, while reading characters 501 to 1000, PS2 was turned on. This prevented Data Ignore being turned off at location R31/C31 (AC2) when it was passed the second time during the reading of the last 500 characters.

The second 500 characters have now been read and stored in memory for processing.

C. Third Read

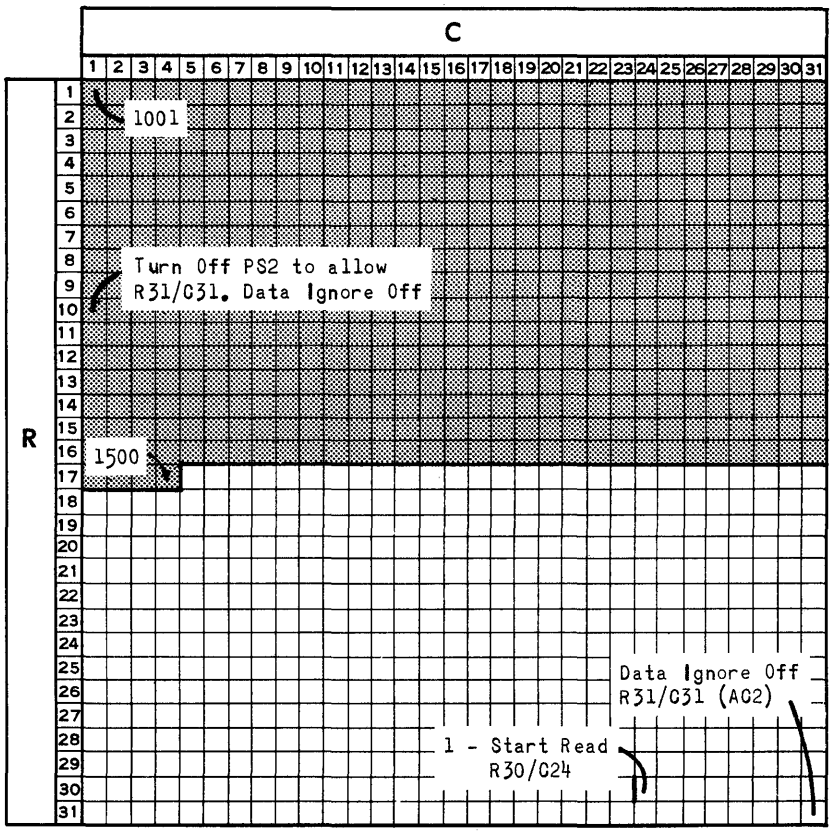
OP2 R30/C24 - R30/C24

Data Ignore is on from the previous Read step.

PS2 is still on inhibiting R31/C31 (AC2) from turning off Data Ignore. Reading starts at R30/C24 and the first 1000 characters are read but are not stored. During this time, memory addressing has circulated completely through memory and is now at R31/C31. When R10/C1 (AC4) was passed PS2 was turned off, therefore at R31/C31 (AC2) Data Ignore will be turned off.

Reading continues and characters 1001 through 1500 are read and stored in the first 500 memory locations.

The third and last 500 characters are now stored in memory for processing.



NOTE:- The contents of the memory location at which a change in the status of Data Ignore takes place cannot be guaranteed, and should be considered indeterminate. For example, the contents of location R17/C5 during the first read described above may be altered or destroyed.

When the Data Ignore becomes effective during a Tape Read step, the transfer of data from the tape to the OP2 locations is suspended until Data Ignore is made ineffective. During the interval in which Data Ignore is effective, the locations bypassed will be cleared unless an OP1 to OP2 transfer is allowed.

If Superimpose is used on the Tape Read step, the Transfer process and the Superimpose would both be wired. When Data Ignore is made effective, the Superimpose must be made ineffective to allow the OP1 to OP2 transfer; accomplished by the Transfer process functioning alone. If Superimpose is not disabled at this time, the OP2 storage locations passed while Data Ignore is effective would be cleared to spaces. (This may be a desired result on some applications.)

If only the Transfer process is used on the Tape Read step because the OP1 locations are known to contain only spaces, the above disabling operation would, of course, not be necessary.

When the contents of the storage locations outside the area in which the data read from tape is to be entered is not to be altered, it is necessary that the OP1 and OP2 addresses start at the same location and advance together so that, when Data Ignore is effective, the OP1 to OP2 transfer will be from and to the same location. To assure the addresses being the same, OP1 and OP2 must start at the same location and OP1 must not end before OP2.

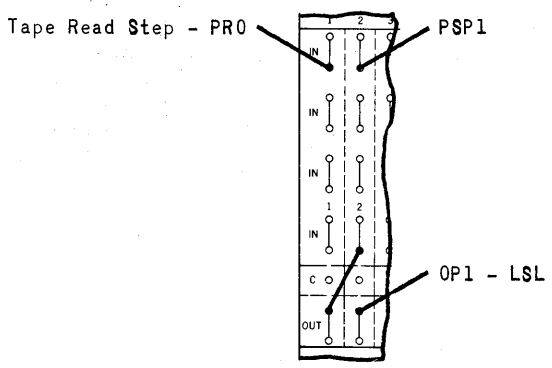
Operand Two can be specified as a single location (the location for storing the first character read from tape). The Tape Read step address controls keep the OP2 address advancing until the end of the tape block is reached.

If the number of characters in the tape block is less than 961; the Operand One address would be specified to start with the same location used for OP2, the ending address would be specified to include a minimum of one location for each character in the tape block plus one. Specifying more than the required number of locations is permissible:

If the number of characters in the tape block is 961 or greater, it is necessary to disable the OP1 ending address after ICD of the Tape Read step and before the ending address location is reached. The ending address must be present during the ICD to prevent a "plugboard check" error; it must be disabled before reaching the ending location to prevent a "1 Equal" condition which would stop the OP1 address advance.

When a tape block contains 961 or more data characters, the "wrap-around" effect in storage will cause the ending address to be accessed more than once. If the advance of the OP1 Address Control is stopped the first time the ending address is reached, any subsequent Data Ignore operation will result in space filling the storage. Disconnecting the OP1 ending address wiring prevents an OP1 address equal condition (1EC) from occurring; the OP1 Address Control is thus allowed to continue its advance.

A method which can be used to control the OP1 ending address is to specify OP1 as two or more locations rather than one. Because of processor timing, this will permit a Program Select, turned on from the Step Output (PRO) hub, to be used to disable the OP1 ending address. This Program Select would be turned off on the following step.



Tape Timing

The various elements of timing in the operation of a Magnetic Tape Unit are given below. These include; Read Start and Stop, Write Start and Stop plus the Data Transfer. When both units of a Dual Magnetic Tape Unit are to be used on one application, an additional timing element, Transport Select, must be considered.

NOTE:- With a Dual Magnetic Tape Unit, but one of the two units can be reading, writing, or backspacing; the other unit can be used when the operation being performed on the active unit is completed.

Definitions of the basic time components of tape operation are as follows:

Start Time - The time required for the tape unit to accelerate to operating speed and advance to the first character location of the record.

Stop Time - The time required for the tape unit to decelerate and stop following the last character in the record.

Write Check Time - The time required to check the last character. During this interval, the last character written advances from the Write Head to the Read Head for checking.

Transport Select Time - The time required to switch from one Magnetic Tape Unit to the other.

C (Character Rate) - The time required to read or write a character based on the Tape Density Switch setting.

200 CPI	.117 ms per character
556 CPI	.042 ms per character
800 CPI	.029 ms per character

CN - The time required to read or write the record data (number of characters in record multiplied by the character rate).

Processor Interlock - During this time (see charts below), processing or other input-output operations cannot take place with the exception of card punching, read-punching by the Read-Punch Unit, paper tape punching, and magnetic tape rewind.

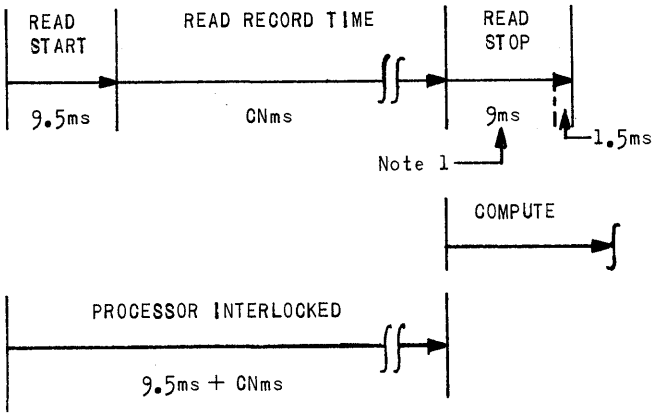
READ OPERATION TIMING

Read Start	9.5 ms
Read Stop	10.5 ms

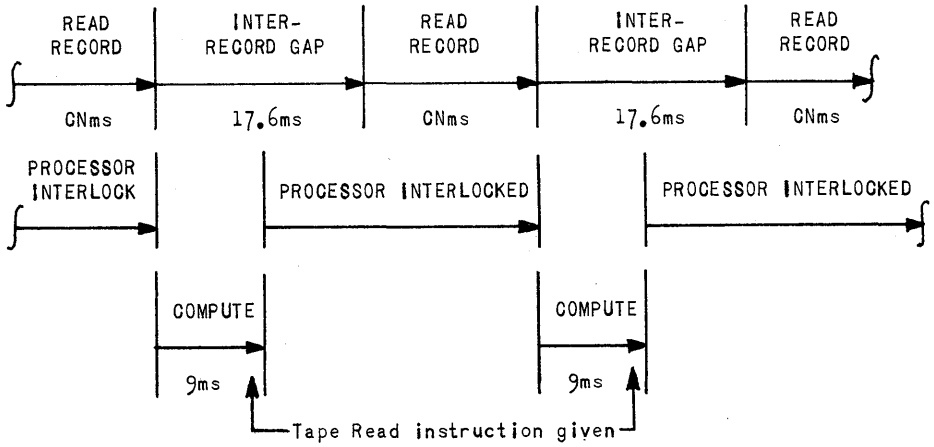
The start time for the first read operation following a Backspace is of a longer duration:

Read Start After Backspace	12.0 ms

During a Read operation, the processor is interlocked during read start and Read Record times. The processor interlock is released at the end of the Read Record time.



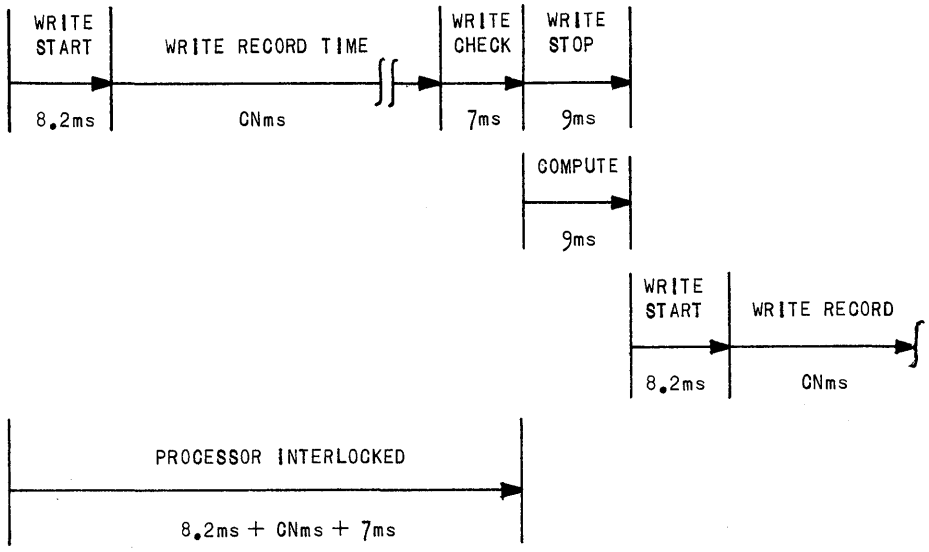
NOTE 1:- If another Read instruction is given to the same tape unit within 9 ms after processor interlock is released, the tape unit does not stop and the tape travels over the inter-record gap at maximum speed. This time is 17.6 ms. The following diagram illustrates this sequence of events.



WRITE OPERATION TIMING

Write Start	8.2 ms
Write Check	7.0 ms
Write Stop	9.0 ms (no interlock)

The processor is interlocked during Write Start, Write Record, and Write Check times. The processor interlock is released at the end of Write Check time and processing can proceed during the 9.0 ms Write Stop time. The next tape operation, with the exception of Transport Select, cannot begin until the stop time has elapsed.

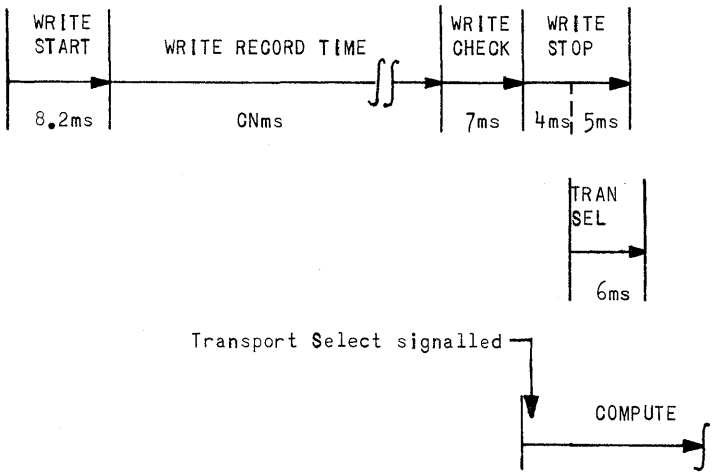


TRANSPORT SELECT TIMING

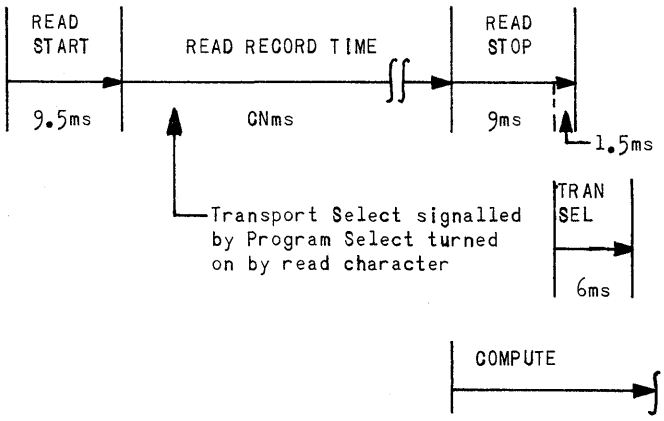
Transport Select Time 6.0 ms

The 6 ms required to switch tape transports may be overlapped with processing or input-output operations since it is possible to initiate transport selection prior to the tape operation for which it is to be effective. If less than 6 ms have elapsed between beginning of transport selection and the initiation of a tape operation, the tape operation will not begin until transport selection is completed.

If transport selection is signalled during or immediately after a write tape operation, transport selection will begin after 4 ms of the Write Stop time have elapsed.

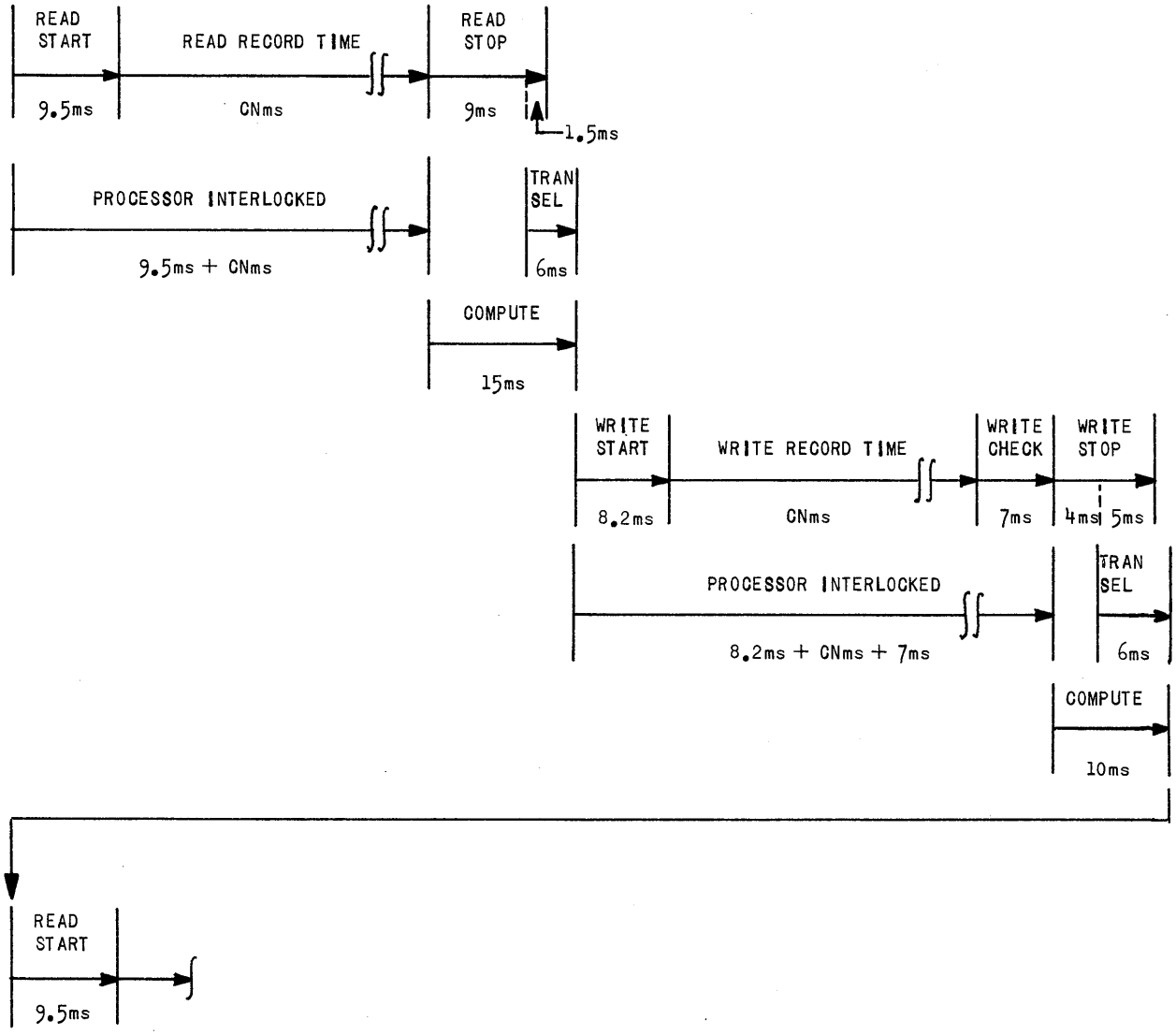


If transport selection is signalled during or immediately after a read tape operation, the tape selection operation will begin after 9 ms of Read Stop time have elapsed.



TAPE READ AND WRITE

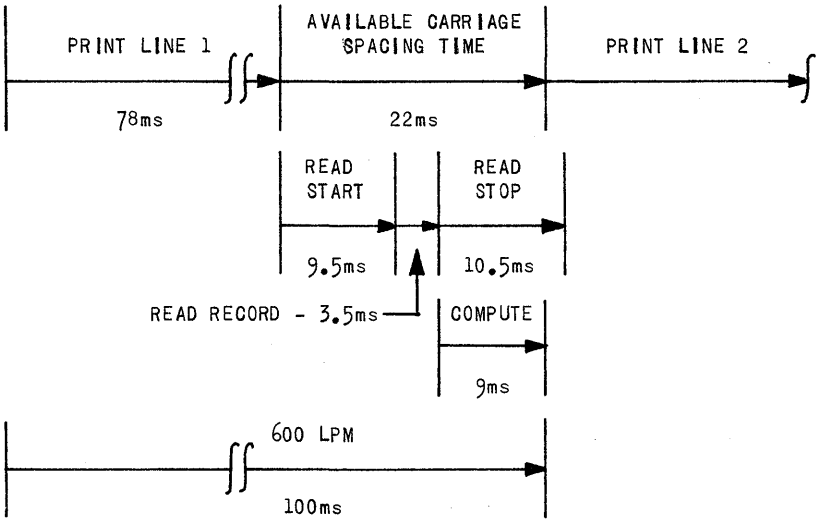
The following diagram illustrates the time required to read from one tape followed by a write on another tape.



This shows the computing time available when tape unit switching is performed in minimum possible time. If the application requires additional computing time, the overall time would be increased by that amount.

TAPE TO PRINT OPERATION

The following diagram illustrates the time required to read 80 character records from tape at a density of 556 ppi and to print one line for each tape record. The character font being printed consists of 48 adjacent characters including the numerals 0-9, letters A-Z and 12 special characters.



BACKSPACE

Backspace Start after Read	12.0 ms
Backspace Start after Write	7.2 ms
Backspace Stop	10.5 ms

NOTE:- If another Backspace instruction is given to the same tape unit within 9 ms after processor interlock is released, the tape unit does not stop and the tape travels over the inter-record gap at maximum speed. This time is 17.6 ms.

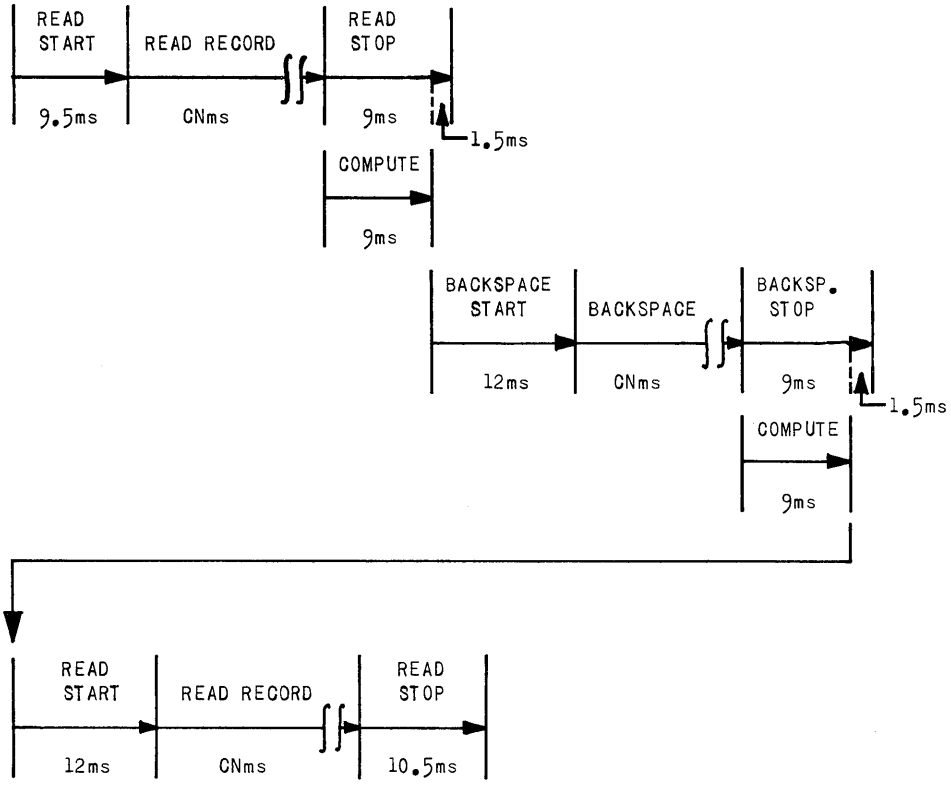
The Backspace instruction causes the tape unit to backspace over one tape record.

The processor is interlocked during backspace start and record times. The processor interlock is released at the end of the record time.

BACKSPACE AFTER READ

The following diagram shows the time required to read a record, backspace, and re-read the record.

Note that the start time of the first read operation after a backspace is 12 ms.



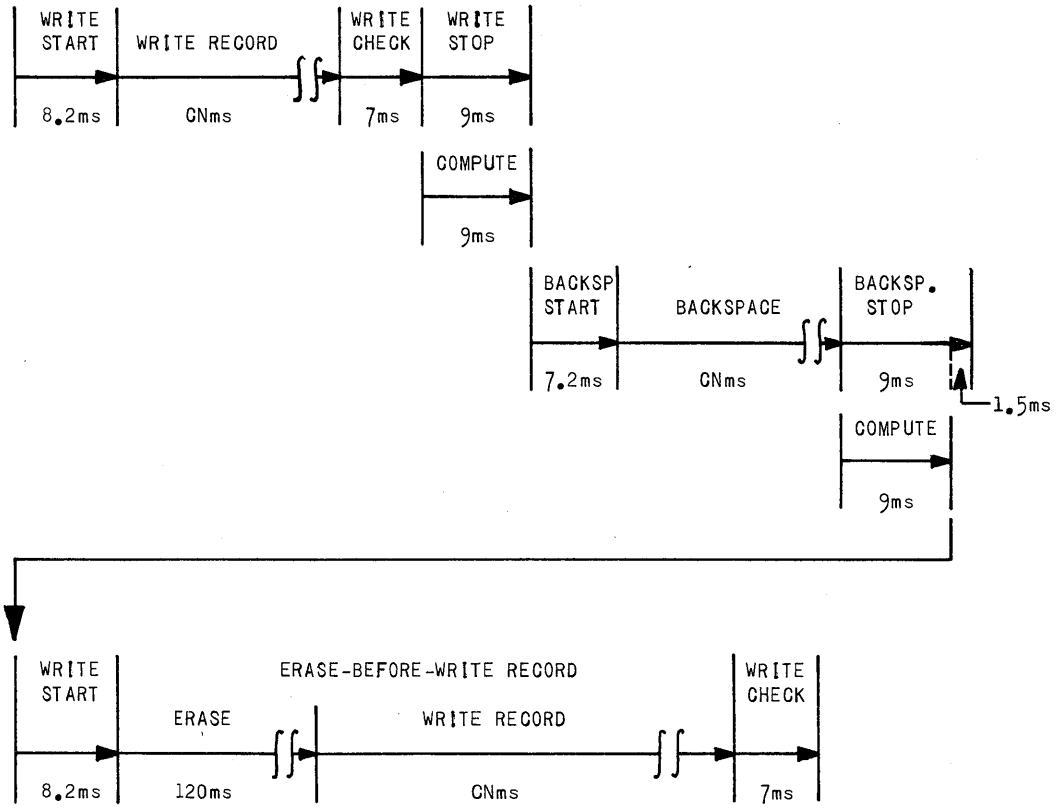
ERROR CORRECTION

When the Write Check indicates a block incorrectly written as a result of a bad spot on the tape, two operations are necessary to correct the tape being written:

1. A Backspace operation to re-position the tape at the beginning of the block.

2. An Erase-before-Write operation to bypass the bad spot and to write the tape record correctly. At this time after the Write Start, an automatic Erase operation of 120 ms duration takes place before the Write operation starts.

The following diagram indicates this sequence of operations.



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