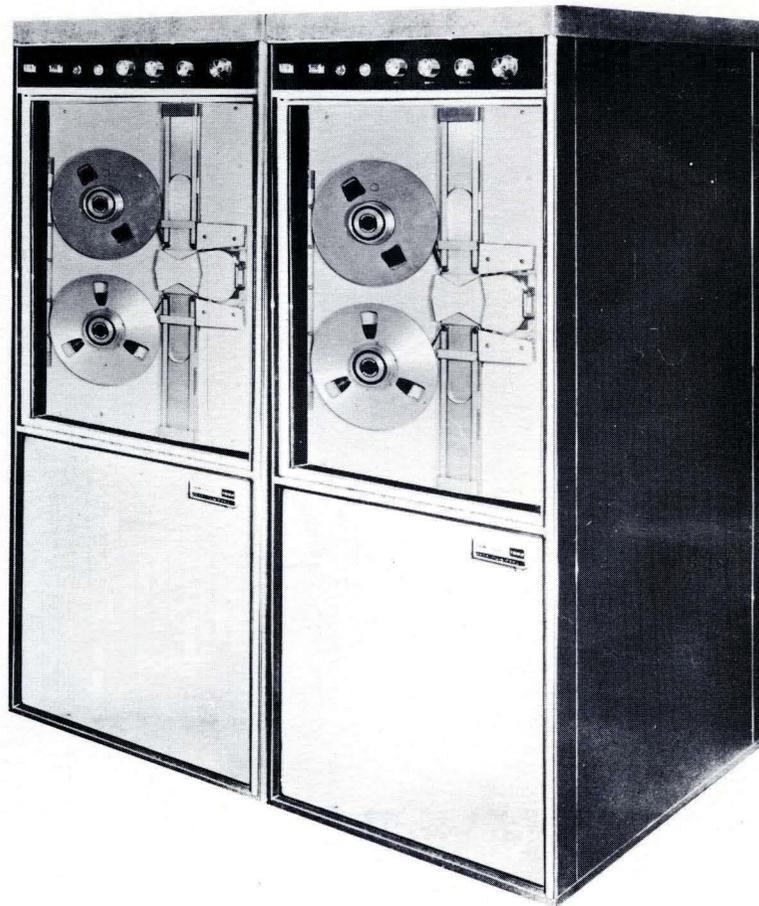# GENERAL DESCRIPTION

UNIVAC® 1004 III
MAGNETIC TAPE SYSTEM

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 one 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 can 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 - 68", Width - 27-1/8", Depth -
                                    31-1/2".
    Dual Magnetic Tape Unit -- Height - 68", Width - 54-1/4", Depth -
                                    31-1/2".

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

Recommended Working Area:
    Single Magnetic Tape Unit -- 6' 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 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 PPI   8540 characters per second   .117 ms per character
    556 PPI   23741 characters per second   .042 ms per character
    800 PPI   34160 characters per second   .029 ms per character

Start & Stop Times:
              Read Start   13.0 ms
              Read Start after Backspace   9.0 ms
              Read Stop   7.5 ms
              Write Start   12.0 ms
              Write Check   7.0 ms
              Write Stop   6.0 ms
              Backspace Start   9.0 ms
              Backspace Stop   7.5 ms
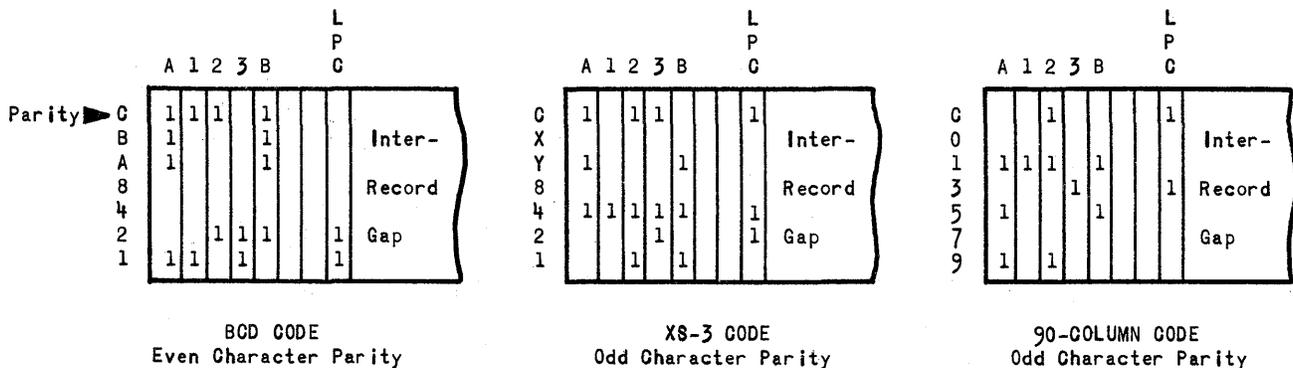
Transport Select Time:- 4 ms

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 ac-
    cepting UNIVAC Compatible with IBM, IBM, and IBM Compatible tape
    reels.

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

BCD CODE	XS-3 CODE	90-COLUMN CODE
Even Character Parity	Odd Character Parity	Odd Character Parity

<u>Mode of Recording</u>:- Non-Return to Zero 1.

<u>Densities</u>:- 200, 556, or 800 PPI.

<u>Channels</u>:- 7 channels; 6 data and 1 parity.

<u>Load Point Mark</u>:- 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".

<u>End-of-Tape Warning Mark</u>:- 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

<u>Write Checking</u>:- 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.

<u>Bad Spot Detection</u>:- 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 bypass the defective tape area.

<u>Parity Check</u>:- A parity bit included as the seventh or outer tracks 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.

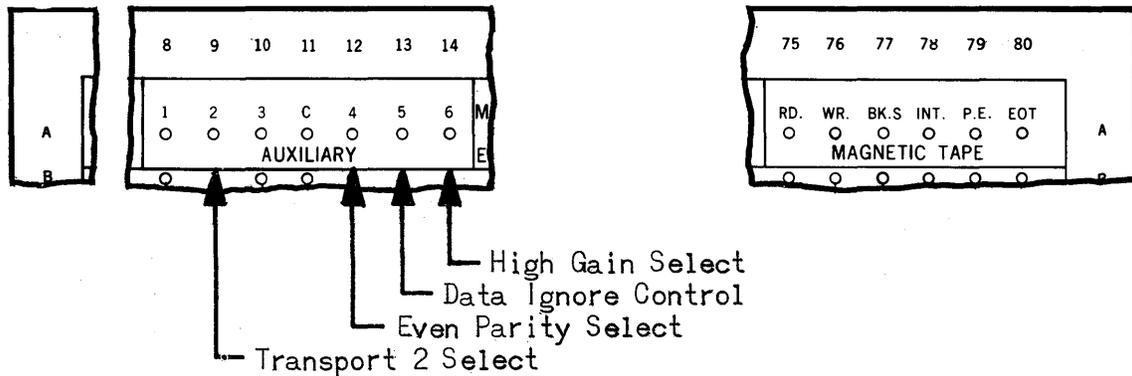<u>Longitudinal Parity Check</u>:- After the last character of a block has been recorded, the write operation will automatically record a one-bit count of each of the seven channels in which the sum of bits in the related channel is odd to make the count even. This becomes a record checking character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

<u>Normal/High Gain Read</u>:- 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.

— High Gain Select
— Data Ignore Control
— Even Parity Select
— Transport 2 Select

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 stored in memory 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.

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 se-
   quence change.

7. Transport 2 Select
   (Auxiliary 2) (A,9)

   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 pres-
   ent 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. 90/80Δ (ff,69)

   Wiring the character generator hub, 90/80Δ, 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)

    When wired 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.

It should be noted that no two tape operations may take place on con-
secutive steps.

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)

    Operands:

    a) To read tape, an operand of one character should be specified by
       OP1 and OP2. The OP2 starting location specifies the location
       for storing the first character of a record. The remainder of
       the record will go into adjacent memory locations regardless of
       the record length. The step will be released after the longi-
       tudinal parity character has been stored in memory.

       The same effect would take place if OP2 was greater than one
       character but smaller than the tape record.

    b) If it is necessary to examine the characters as they are being
       read, then overlapping operands must be specified with OP1 off-
       set one location to the left of OP2.

For example:

```
            ·C1 · 2 · 3 · 4 · 5 · 6 · 7 · 8 · 9 ·
OP1  R12   ┌───┬───┬───┬───┬───┬───┬───┬───┐
           │   │   │   │   │   │   │   │   │
           └───┴───┴───┴───┴───┴───┴───┴───┴───┐
OP2  R12       │ D │ D │ D │ D │ D │ D │ D │ D │
               └───┴───┴───┴───┴───┴───┴───┴───┘
```

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

   It may be desirable in this case to clear that portion of read storage unused by shorter records.

   This may be accomplished by designating OP2 as the largest expected record.

   This will result in filling the unused portion of read storage with spaces.

d) If the possibility exists that a record may exceed the maximum length allocated for read storage, the location immediately following the read storage area should be wired to initiate Data Ignore, thereby preventing excess tape characters from entering and destroying other portions of memory.

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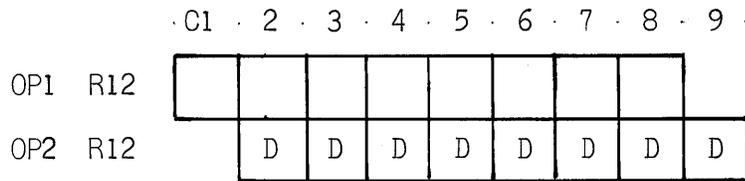
   INS (Insert) Descending
   CMPS ST (Compress Start)

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

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

Operand 1:

Row Start   Row End

| T | T | T | T | T | T | T | T | Δ | Δ |

Column Start   Column End

Operand 2:

Row Start   Row End

| R | R | R | R | R | R | R | R | Δ | Δ | Δ | Δ | Δ |

Column Start   Column End

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

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 to by-pass a bad
spot by backspacing two blocks and reading forward one before
writing 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).

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)

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

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.

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 char-
acter tape record contain information required by the program.
The D.I. can be used to prevent entry into storage of the 150 char-
acters that are not required by the program; thus conserving mem-
ory capacity.

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

An example of how a 1500 character record can be read and processed
is explained below. In actual practice, the segments would be tai-
lored 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 mem-
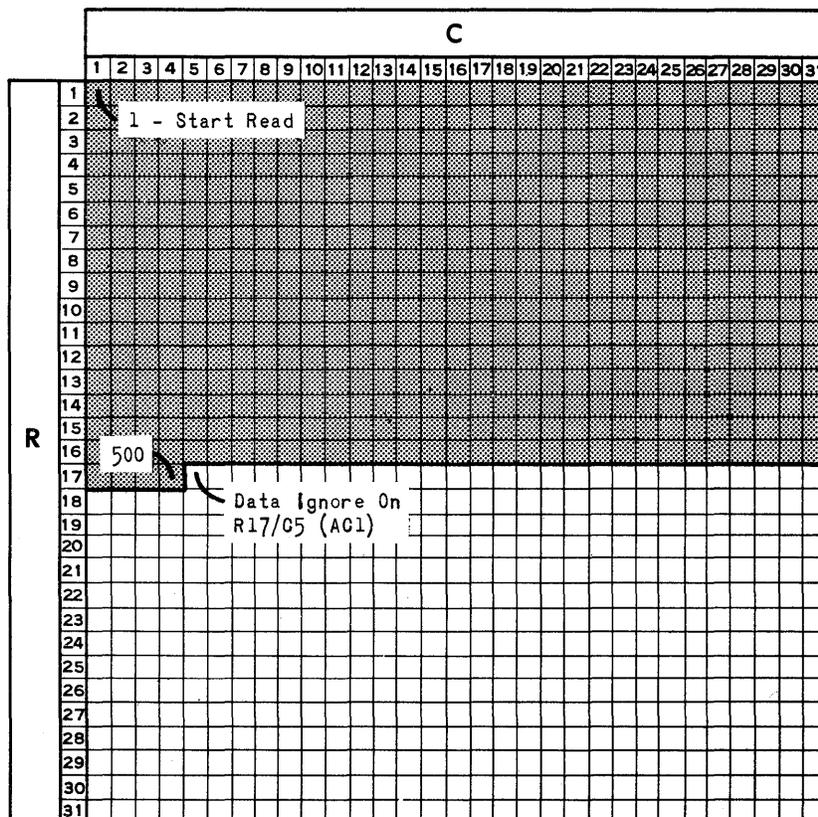ory.

Since the address combines controlling the pick up of the program se-
lect 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 char-
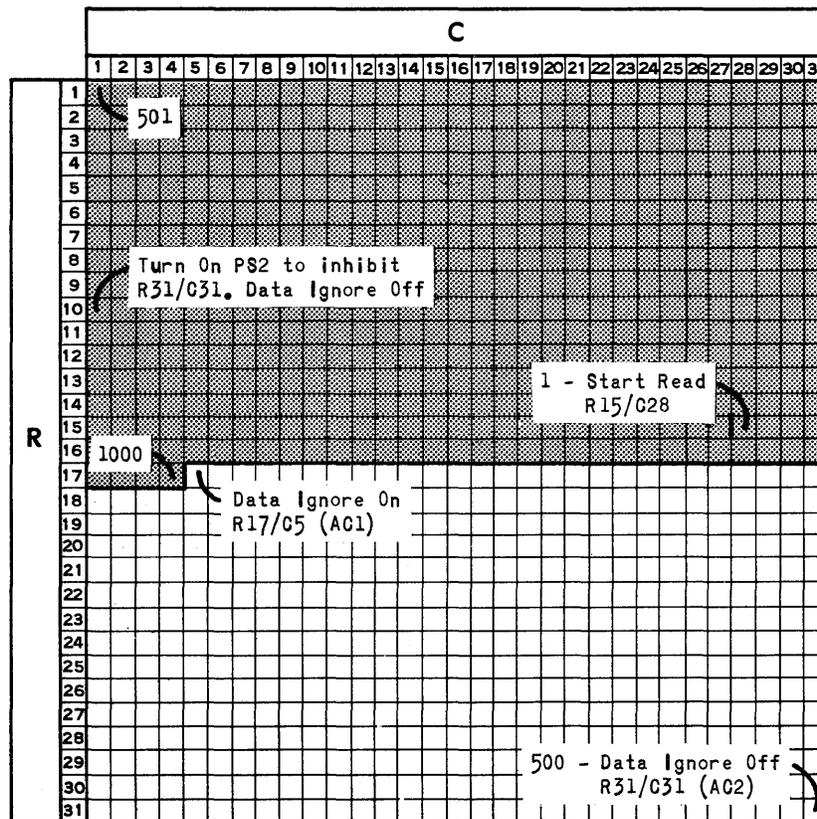acter read from tape will be stored.

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 char-
acters read from tape starting with the 501st will be prevented
from entering storage. The Storage Address will continue to ad-
vance 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 guaran-
       teed, and should be considered indeterminate. For example,
       the contents of location R17/C5 during the first read de-
       scribed above may be altered or destroyed.

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.

The basic time components of tape operation are as follows:

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

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

<u>Write-Check Time</u> - 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.

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

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

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

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

<u>Processor Interlock</u> - 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.
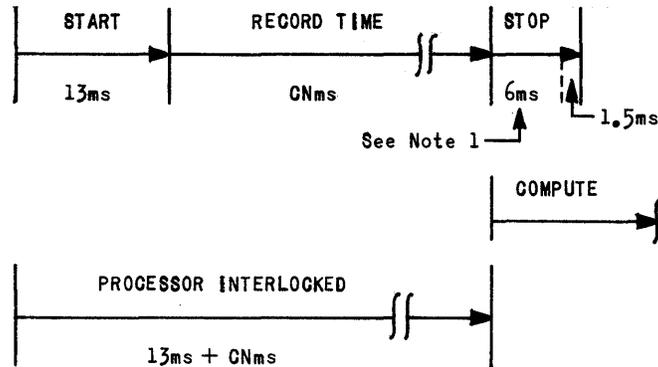
READ OPERATION TIMING

Read Start	13.0 ms
Read Stop	7.5 ms

The start time for the first read operation following a backspace is of a shorter duration:

Read Start After Backspace   9.0 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.

```
        |  START   |        RECORD TIME        )(        | STOP  |
        |----------|---------------------------)(-------→|------→
        |          |                           )(        | 6ms   ↑|
         13ms                  CNms                                └1.5ms
                                             See Note 1─┘
```

```
                                             | COMPUTE      )
                                             |-------------→)
```

```
        |      PROCESSOR INTERLOCKED        )(       |
        |----------------------------------)(------→|
        |          13ms + CNms             )(       |
```

NOTE 1: If another read instruction is given to the same tape unit within 6 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.

```
    READ    |    INTER-    |   READ   )(    INTER-    |   READ
   RECORD   | RECORD GAP   |  RECORD  )(  RECORD GAP  |  RECORD
  )---------|--------------|---------→)(-------------|---------→)
    CNms         17.6ms        CNms   )(    17.6ms       CNms
```

```
  PROCESSOR |            |                 |                    |
  INTERLOCK |  PROCESSOR INTERLOCKED       |  PROCESSOR INTERLOCKED
  )---------→|-------------------------→|   |--------------------→)
```

```
            | COM- |                        | COM- |
            | PUTE |                        | PUTE |
            |-----→|                        |-----→|
            | 6ms↑ |                        | 6ms↑ |
               ↓                                ↓
            └──Tape Read instruction given──┘
```

<u>WRITE OPERATION TIMING</u>

```
Write Start      12.0 ms
Write-Check       7.0 ms
Write Stop        6.0 ms
```

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.

```
          +-----------+------------------+~~~+--------+------+
          |   START   |    RECORD TIME   )(  | WRITE  | STOP |
          |           |                  )(  | CHECK  |      |
          +-----------+------------------+~~~+--------+------+
              12ms            CNms               7ms    6ms

                                           +------------+
                                           |  COMPUTE   )
                                           +------------+

          +-------------------------------------------+
          |           PROCESSOR INTERLOCKED           |
          +-------------------------------------------+
                      12ms + CNms + 7ms
```
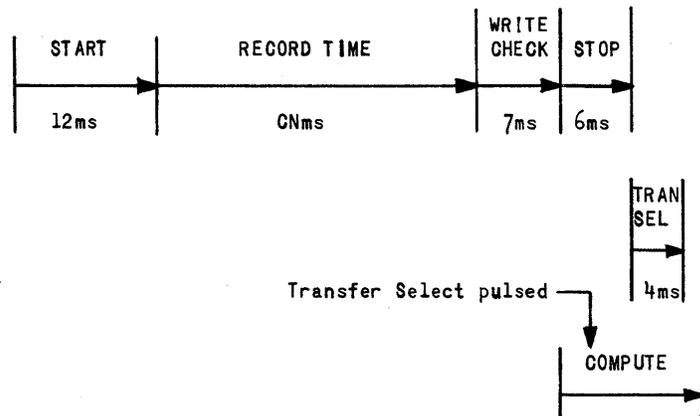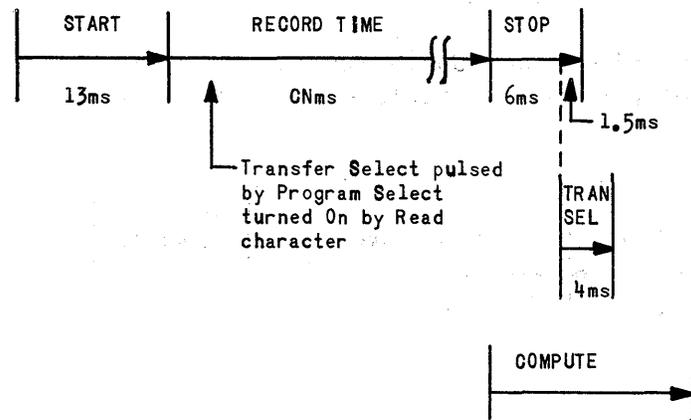
<u>TRANSPORT SELECT TIMING</u>

```
     Transport Select Time      4.0 ms
```

The 4 ms required to switch tape units may be overlapped with processing or input-output operations since it is possible to initiate tape selection prior to the tape operation for which it is to be effective. If less than 4 ms have elapsed between beginning of tape selection and the initiation of a tape operation, the tape operation will not begin until tape selection is completed.

If transport selection is pulsed during or immediately after a write tape operation, tape selection will not begin until after write stop has been completed.

```
          +-----------+------------------+--------+------+
          |   START   |   RECORD TIME    | WRITE  | STOP |
          |           |                  | CHECK  |      |
          +-----------+------------------+--------+------+
              12ms            CNms           7ms    6ms

                                              +------+
                                              | TRAN |
                                              | SEL  |
                                              +------+
                                                4ms
                        Transfer Select pulsed ---

                                          +-----------+
                                          |  COMPUTE  )
                                          +-----------+
```
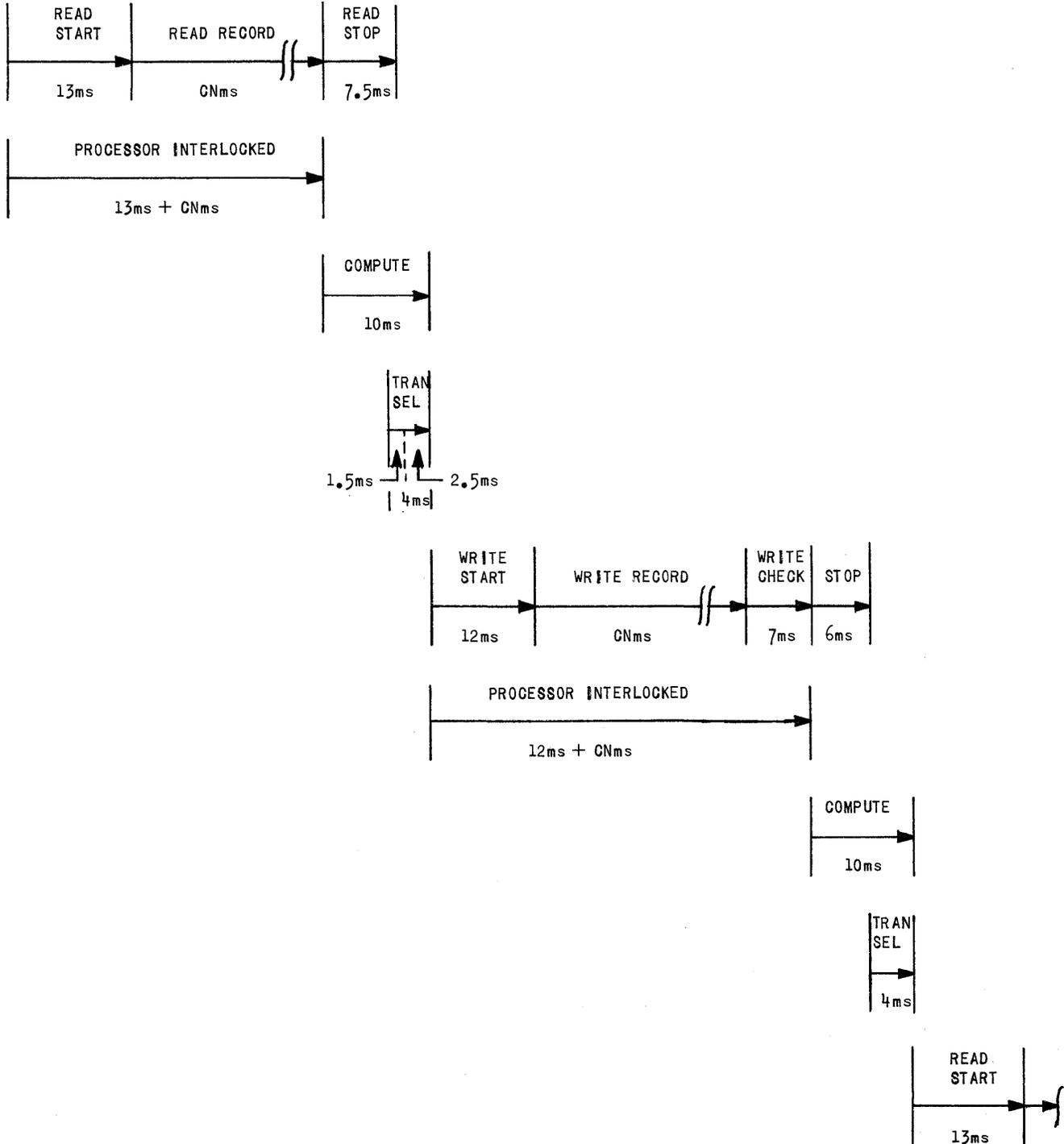
If transport selection is pulsed during or immediately after a read tape operation, the tape selection operation will begin after 6 ms of read stop time have elapsed.
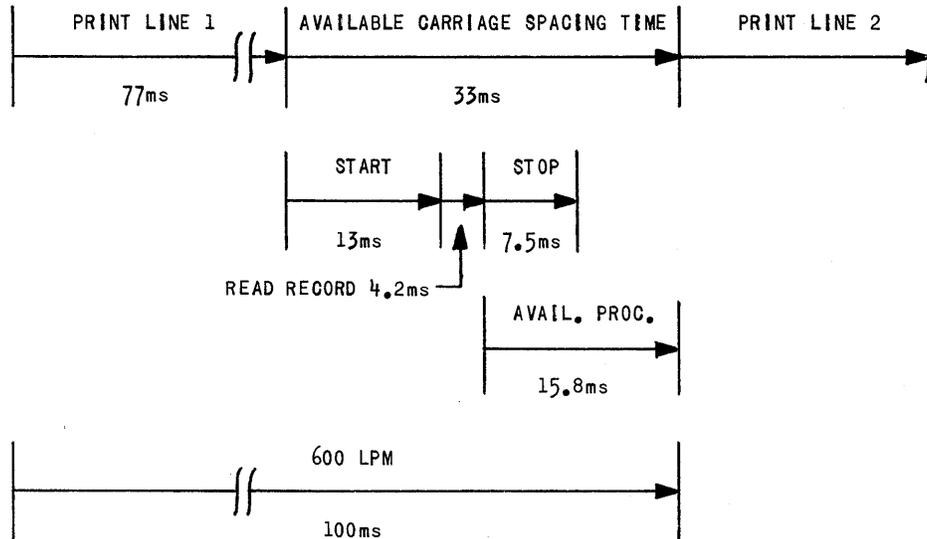
```
|        START        |         RECORD TIME         ))    |  STOP   |
|-------------------->|------------------------~~~------>|-------->|
|                     |                                  |         |
  13ms                  CNms                               6ms    1.5ms
                        ↑                                           
                        |                                   |TRAN|
                   Transfer Select pulsed                   |SEL |
                   by Program Select                         |----->
                   turned On by Read                        |     |
                   character                                 4ms

                                 |  COMPUTE           )
                                 |---------------->
```

TAPE READ AND WRITE

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

READ START	READ RECORD	READ STOP
13ms	CNms	7.5ms

PROCESSOR INTERLOCKED

13ms + CNms

COMPUTE
10ms

TRAN SEL

1.5ms ──── 2.5ms

| 4ms |

WRITE START	WRITE RECORD	WRITE CHECK	STOP
12ms	CNms	7ms	6ms

PROCESSOR INTERLOCKED

12ms + CNms

COMPUTE
10ms

TRAN SEL

4ms

READ START
13ms

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 100 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.

```
|  PRINT LINE 1    )|→| AVAILABLE CARRIAGE SPACING TIME |→  PRINT LINE 2      |
|------------------( |------------------------------------|--------------------|
|     77ms              33ms                              |
```

```
        |  START     |  STOP  |
        |----------→|→|------→|
        |   13ms    | | 7.5ms |
                    ↑
  READ RECORD 4.2ms─┘
                      |  AVAIL. PROC.  |
                      |--------------→|
                      |    15.8ms      |
```

```
|              600 LPM              |
|--------)|------------------------→|
|         (      100ms              |
```

BACKSPACE

        Backspace Start   9.0 ms
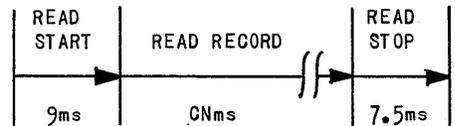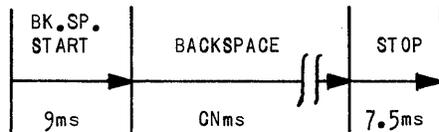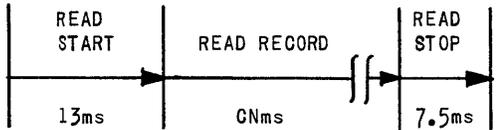   Backspace Stop   7.5 ms

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.
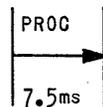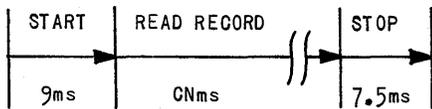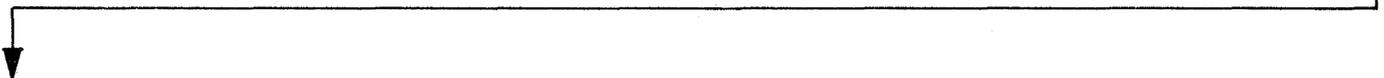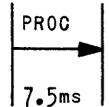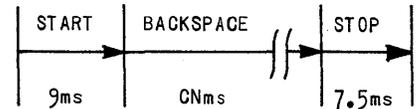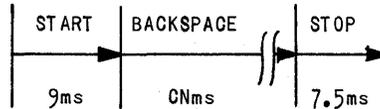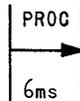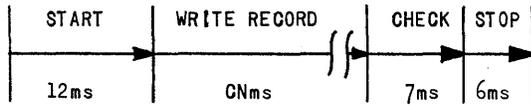
BACKSPACE AFTER READ

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

Note that the start time of the first read operation after a backspace is 9 ms.

```
| READ    |                    | READ   |
| START   |   READ RECORD   )) | STOP   |
|---------►|----------------( (►|--------►|
|         |                    |        |
| 13ms    |      CNms          | 7.5ms  |


                                | PROC.  |
                                |--------►|
                                |        |
                                | 7.5ms  |


              | BK.SP.  |                    | STOP   |
              | START   |   BACKSPACE     )) |        |
              |---------►|----------------( (►|--------►|
              |         |                    |        |
              | 9ms     |      CNms          | 7.5ms  |


                                         | PROC.  |
                                         |--------►|
                                         |        |
                                         | 7.5ms  |


                        | READ    |                    | READ   |
                        | START   |   READ RECORD   )) | STOP   |
                        |---------►|----------------( (►|--------►|
                        |         |                    |        |
                        | 9ms     |      CNms          | 7.5ms  |
```

BACKSPACE AFTER WRITE

To rewrite a record, signaled as incorrectly written by the write-check, it is necessary to perform the following operations; two successive backspaces, a read operation to position the incorrect record in front of the write head, and a write operation to re-write the tape record. The following diagram indicates this sequence of operations.

START	WRITE RECORD		CHECK	STOP
12ms	CNms		7ms	6ms

	PROC
	6ms

START	BACKSPACE		STOP
9ms	CNms		7.5ms

	PROC
	7.5ms

START	BACKSPACE		STOP
9ms	CNms		7.5ms

	PROC
	7.5ms

START	READ RECORD		STOP
9ms	CNms		7.5ms

	PROC
	7.5ms

START	WRITE RECORD
12ms	

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