8TU04C

TAPE MOTION TEST

MODELS 729 II and 729 IV

March 1, 1962

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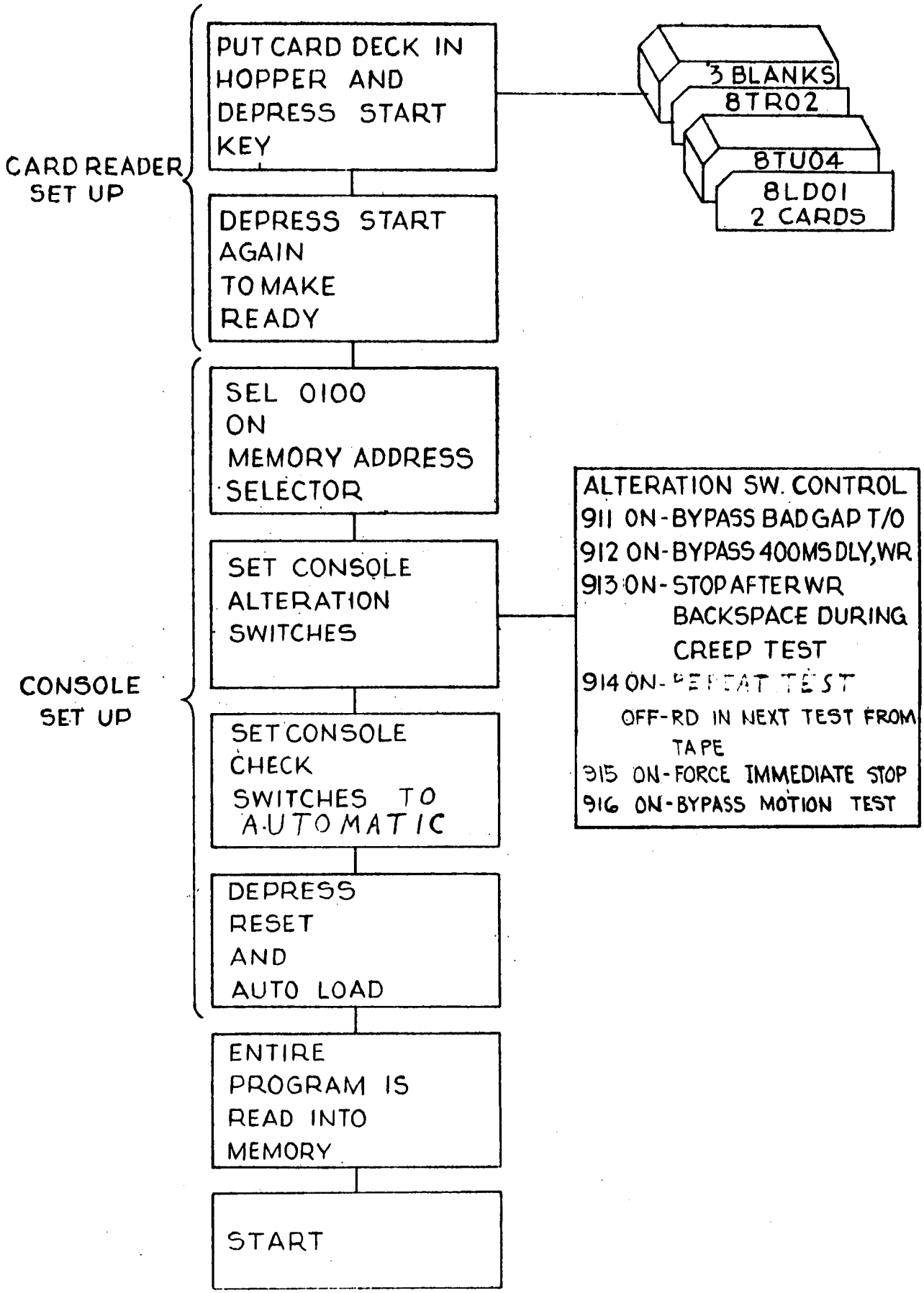


FIG. 1 MACHINE SET UP FOR DIAGNOSTIC PROGRAM 8TU04

8TU04

729 II and IV TAPE MOTION TEST

A. PURPOSE OF TEST

This Diagnostic Program is to be used with the 7621 Tape Control, to measure the inter-record gaps on tape, on 729 II and 729 IV magnetic tape drive units. For valid results, this test is to be used only on a 7080 system operating at a 2.0 microsecond memory cycle.

This program is to be used as a check to determine when a tape drive has gone out of adjustment to the point where it requires preventive maintenance, and to be used only as a guide to check the tape drive adjustments after they have been made by other means.

Before running this test, TAU timings should be checked to be sure they meet specifications. This test is dependent on the following TAU timings:

	729 II	729 IV
D 50	7.5 ms	5.0 ms
WDD 20	3.0 ms	2.0 ms
WC 1	24 usec - high density	16 usec - high density
WDD 60	90 usec - high density	60 usec - high density
RDD 152	22.5 ms	15.2 ms
D 160	24.0 ms	16.0 ms
RDD 22 + RDD 38	5.7 ms (RDD 38)	2.2 ms (RDD 22)
BSP 180	27.0 ms	18.0 ms

B. METHOD OF TEST

This program assumes that CPU is running continuously. Therefore, half stepping or depressing stop key can cause erroneous results.

This program calculates the length of time required for an inter-record gap on tape to pass over the read head of the tape drive unit. The test is in two sections, the normal gap section and the long GO down gap section.

1. In the first section this time is calculated while operating the tape drive under four conditions.

a. With the "GO" line up almost continuously between two writes "NO DELAY WHILE WRITING."

b. With the "GO" line down for about .8 milliseconds "MIN DELAY WHILE WRITING."

c. With the "GO" line down a varying amount of time (.8 to 6.8 milliseconds) "VARIABLE DELAY, WRITING."

d. With the "GO" line down for 10.8 milliseconds prior to each write operation "DELAY 10 MILLISECONDS, WRITING."

The time to cross 224 groups of inter-record gaps is measured and the minimum, range, and average are computed. The results are typed out or printed out. (Operators option. See Section F-3).

2. In the second section of the test, the time is calculated while operating the tape drive under a long GO down time. (Long GO down time is 00400 milliseconds for normal operation).

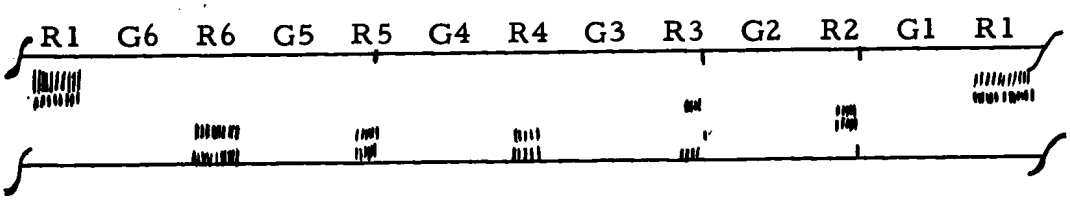
With the "GO" line down for 400 milliseconds prior to each write operation "DELAY 400 MILLISECONDS, WR."

The time to cross 50 groups of inter-record gaps is measured and the MIN, RNG, AND AVE are computed. The results are typed or printed out and the delay may be varied from 5 milliseconds up to 60,000 milliseconds (operators option - see Section F-3.)

C. THEORY OF OPERATION AND EXPLANATION OF TEST

1. Measure Gap Lengths:

In the first part of the test 224 groups of records are written; each group appears as follows:



R1 A 400 Character reference record of Y's, which marks the start of a group.

G1 The GO Line is held up almost continuously between writing R1 and R2. This is done by using the record counter.

R2 Marker consists of 5 characters - 16666.

G2 The GO Line is allowed to fall for a minimum time by bringing up write call for R3 as soon as TCU is ready after R2.

R3 Marker, consists of 5 characters - 29999.

G3 A variable delay is taken after TCU is ready following the writing of R3. This delay varies from 5 microseconds to 6.0 msec.

R4 Marker, consists of five 3's.

G4 A fixed delay of 10 msec is taken after TCU is ready following the writing of R4.

R5 Marker, consists of 5 characters - 46666.

G5 Gap which exists for the reference record.

R6 Reference record consisting of ten 5's.

G6 Gap in which the program stops for calculation and error typeouts. It backspaces across R6 and R5 to find the read after backspace time.

After the tapes are all written and rewound, the blocks of records are read back using the Record Counter and measured as follows:

1	RCV	X
2	RD	X-0004
3	TR	20004

At 20004 to 39969 there are 3993 Transfer Zero Bits on C (TZB 07). Each TZB 07 transfers to a Send and Transfer. The Send sends its own address which is its location to the present RCV address. There

There are 3996 Send and Transfers. At 39974 there is an Add 1 to the Acc and at 39979 a Transfer to 20004 to loop in the table. A sample of the table is as follows:

20004	TZB	07	39984	SND	39984
				TR	Y
20009	TZB	07	39994	SND	39994
				TR	Y
39974	ADD	00	1	SND	79944
39979	TR		20004	TR	Y

The point Y where the table returns is modified before going into the table. The table is used for all timings.

After reading is completed, the lengths of the gaps are converted to milliseconds and printed out. Gaps are printed in milliseconds to emphasize the fact that the program cannot measure distance. It can estimate changes in speed. This also makes it easier to relate these figures to "TAU" timings and "START-STOP" time.

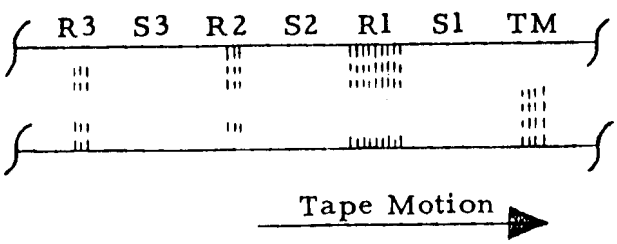
2. Long Go Down Test:

When the normal Gap test results have been computed and typed out, alteration switch 912 is interrogated and if it is off, the long "GO" down test will be performed. This section writes (1) 400 character reference record of "X's," (50) 5 character records of " @ 's," with a long "GO" down time of 00400 milliseconds between writes and then a tape mark is written. The tape is backspaced, and the record counter set for 51 records. Read is initiated and 50 gaps are measured, converted to milliseconds and typed out as Line 8 of the typeout.

Instructions telling the operator how to vary the Long "GO" down time are given in Section F-3.

3. Backspace Write Creep Test:

The backspace write creep is performed after the previous results are printed. The pattern on tape is set up as follows:



Two tape marks are used to start the creep pattern.

S1	A skip to isolate R1
R1	A reference record of 9A's from which S2 is measured
S2	A basic skip which is measured
R2	A test record of 3B's
S3	A skip
R3	A reference record of 3C's

After the initial skip (S2) is timed, the test record R2 is backspaced and written ten times. The skip (S2) is remeasured and the difference taken between the initial and the new S2. This procedure is done three times, and then the average for one backspace is computed and typed out.

4. Tape Motion Test:

The tape motion test moves varying quantities of tape in and out of the tape vacuum columns. The amount of tape varies from about 48 inches to about 25 inches in 1 inch increments. If there is a malfunctioning in the vacuum controls or the clutches, tape should pile in one of the columns. The only indication is that the program hangs because the tape drive is not ready and tape has spilled in the columns.

D. AREA OF MACHINE REQUIRED

1. Units:

7080 CPU operating at 2.0 microsecond memory cycle
7621 Tape Control (one or more)
729 II and/or 729 IV Tape Drives

Those tape drives that are ready will be automatically tested.

Exception: Tape address 0200 - reserved for tape input of program.

2. Memory Locations:

00000 - 09169 - actual program location
20000 - 79944 table area

E. LOADING PROCEDURES

1. Card:

   a. The load cards 8LD01 are to be used if input is from the 714 Card Reader.

   b. The load cards 8LD10 are to be used if input is from the 7502 Console Card Reader.

2. Tape:

   This program may be put on tape under the control of 8TR06.

   The cards are to be loaded in the following order:

Input from Tape Created Off Line, from 714	On Line Direct Generation Input from 714
8LD02	8LD01
8TU04	8TU04
8TR06 (Card # 11-02)	8TR06 (Card #11-01)
8LD02	8LD01
Next Test Program	Next Test Program
8TR06 (Card # 11-02)	8TR06 (Card #11-01

   The tape now being omitted from the ready table is 0200 as this is the tape that 8TR06 is set up to use. This tape address is located at 00004.

F. PROGRAM CONTROL

This program will be run in 705 III Mode

1. Card Deck:

   2 cards - 8LD01 (for 714) or 8LD10 (for 7502 Console CD RDR)
   120 cards - 8TU04
   1 card - 8TR02
   3 cards - Blanks

2. Switch Settings:

   a. Alteration Switches

911	ON	Bypass bad gap typeouts
912	ON	Bypass 400 millisecond delay, Wr
913	ON	Stop after write backspace during creep
914	ON	Stop after one pass of program
	OFF	Read in next test from tape
915	ON	Force immediate stop after writing or reading a group of records
916	ON	Bypass motion test

b. Error Switches

All error switches set to automatic.

3. Manual Controls:

The program uses the typewriter to typeout the results. At HLT 11111 the operator may choose to use the 717 Printer instead of the typewriter by storing (4) at location 00991, also the operator may change the long GO down time by storing a five (5) digit number in milliseconds at location 06044 - 06048. 6069-6073 This figure may be varied from 00005 to 60,000 milliseconds.

G. NORMAL STOPS

66666- Set check switches to automatic.

11111 - Store 4 for printer and 5 digit number to change long GO down delay. (See Manual Controls, Section F-3)

22222 - Force stop. Turn 915 OFF and start.

33333 - Force stop after write creep. Turn 913 OFF and start.

19999 - End of gap test. Start to repeat.

H. ERROR STOPS

0002 - Out of step check stop. Press start to continue. The program will read forward until it is in step before measuring any gaps. If this stop occurs the number of groups in Line 1 of the gap typeouts will be less than 224.

0003 - End of file and out of step. If preceded by a stop 0002, it is a good indication of a solid read, write, or CPU failure, and would not be advisable to continue with the test. If stop 0003 occurs and is not preceded by a stop 0002, press START to procede with test.

0004 - No tapes are ready. Make sure TCU is on Line and that tapes are in ready status. RESET and START.

0005 - CHL check while writing records for creep test. Pressing start will restart the creep test on the present tape drive.

0006 - Tape out of step with program while timing skip. The tape has stepped backward. Press start to place back in step and proceed with test.

0007 - Tape out of step with program. While timing skip the tape has stepped forward. Press start to place back in step and proceed with test.

0008 - Undetermined error after backspace. Start will restart the creep test on the present drive.

0009 - Tape out of step while timing creep. Tape has stepped forward. Press start to place back in step and to proceed with test.

0010 - Tape out of step while timing creep. Tape has stepped forward. Press start to place back in step and to proceed with test.

I. ERROR TYPEOUTS

Example: 0201 3.0 MSEC 8.4 MSEC

The above typeout occurs for each gap outside the specified limits of the tape drive. (Ref. Section M).

The first number is the tape frame address.

The second is the time in milliseconds that the GO line was down between successive writes to form the gap being measured.

The third is the time it took to cross the gap at full speed.

Example: BACKSPACE TOO FAR

After backspacing, if the record read is directly behind the one that should have been read, the above typeout will appear. If the tape were to skip forward to exactly the right place in the next group, it would be possible for this typeout to occur and be wrong. Therefore, although a definite error is indicated, it cannot be absolutely pinned down.

Example: BACKSPACE NOT FAR ENOUGH

The same considerations apply to this as to the previous example.

Example: UNDETERMINED ERROR AFTER BACKSPACE

If the record read after backspace does not compare with the one behind the right one, or the one ahead, the above typeout appears. This typeout also occurs for the same reasons during the backspace-write creep test. If typeout occurs more than twice it should be assumed that there is a solid trouble. Ready should be dropped on that drive and a transfer made to 01089 to continue the test on the next drive.

Example: CHL CHECK ON WR, DURING CREEP TEST

If the pattern is written incorrectly, the above typeout occurs. It is necessary for the pattern to be written correctly when testing for creep. Depressing the start key will restart the creep test.

Example: UNEXPECTED E. O. F., RESTARTING CREEP TEST

An end of file has occured while measuring creep. The tape will rewind and the creep test restarted.

Example: The tape has stepped backward or forward (check error stop) during the creep test.

J. NORMAL TYPEOUTS

729 II

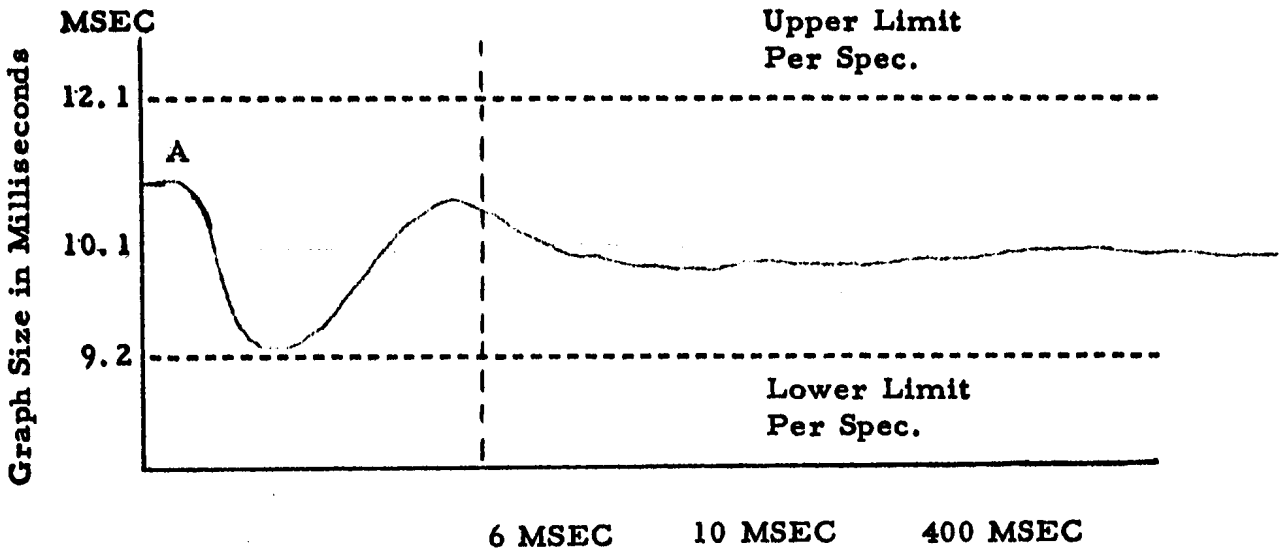
Line 1	0201 - 729 II 224 Groups			
Line 2	Low	RNG	Average	
Line 3	11.2	.2	11.3	MSC No delay while WR
Line 4	11.1	.2	11.2	MSC Min. delay while WR
Line 5	9.2	2.3	10.1	MSC Variable delays WR
Line 6	9.7	.5	10.1	MSC Delay 10 msec, WR
Line 7	9.4	.8	9.5	MSC RD after backspace
Line 8	9.9	.5	10.1	MSC Delay 400 msec
Line 9	BSP WR Creep .11 in.			

ALL READY TAPES WILL BE USED AT HIGH DENSITY

Line 1: The first number is the tape address. The second is the model of the tape drive, and the third is the number of groups successfully read back. If a stop 0002 or an overflow at 39974 occurs, the number of groups will be less than 224. (Ref. Section N).

Line 2: Lines 3, 4, 5, 6, 7, and 8 are divided into three columns, LOW, RNG, and AVERAGE. Low indicates the shortest time to cross a gap, RNG is the range between the shortest time and the longest time to cross a gap, and AVERAGE shows the average time to cross a series of gaps.

The use of the figures in the typeouts is important in determining the need for P. M. More important than the values of the range and average is a substantial CHANGE IN THESE VALUES. By keeping a history of the tape unit (the typeout), it is possible to tell when a drive needs P. M.



The above is a graph form of the average inter-record gap versus GO down time for a 729 II. All drives will not look exactly the same, but should have the same general plot and should stabilize at about 10 milliseconds. The important thing is that the drive should be within the upper and lower tape specifications of 3/4" ∔ 5/32" - 1/16" or 12.1 msec. upper and 9.2 msec. lower.

Line 3: These figures are obtained by writing two records in each group, using the record counter, 224 times. Under these conditions tape slows down but does not stop, and as it is moving at almost full speed which causes the inter-record gap to be toward the upper limit of specifications. See point A on graph. The length of the gap depends on:

a. Record counter write delay
b. Write stop delay
c. Forward start stop time
d. Condition of the drive capstan
e. Prolay response

The average should be about the same for all tape units of the same model on the same channel. If the average exceeds either the upper or lower limits, check for fast or slow stop time. The difference between drives of the same type on the same channel would be the adjustment of the stop time.

The range is a measure of the condition of the drive mechanism with GO up almost continuously and normally should be very low. When the range becomes significant, P. M. should be given with attention to:

a. Eccentric, drive capstan or idler
b. Cuts, dirt, or oxide on the drive capstan
c. Worn Bearings in capstan motor
d. Worn or binding nylon idler

The low should not be lower than 9.2 milliseconds.

Line 4: These figures are obtained from gaps generated by two consecutives writes in each of the 224 groups. Between the writes there is a minimum GO down time of about 0.8 milliseconds. Under this condition tape will slow down but will not stop. This condition closely approximates Line 3 and therefore the figures in the typeout will be about the same. See point A on Graph. The length of the gap depends on:

a. Write delay
b. Write stop delay
c. Forward start stop time
d. Condition of the drive capstan
e. Prolay response

The range and average should be almost the same as the range and average of Line 3. If not, P. M. should be given with specific attention to the prolay and adjustment of the Stop Time.

The low should not be lower than 9.2 milliseconds.

Line 5: These figures are obtained from gaps produced by WR, SET (a variable number), WR. The time delay produced by the set instruction varies from 5 microseconds to 6 milliseconds, in steps of approximately 24 microseconds.

The low for this line should be compared with the low in specifications (9.2 ms) as there is a tendency for short gaps to be written under these conditions. See B on graph.

The range is a result of the things mentioned for line 4 plus recovery of driving circuits and inertia of the prolay for critical values of GO down time when the prolay has maximum accelleration either toward or away from neutral. This range gives a measure of the overshoot through neutral toward the stop capstan.

Line 6: These figures are obtained from gaps produced by WR, SET, WR. The time delay produced by the set instruction is 10 milliseconds for each of the 224 gaps measured. See point C on graph.

The range and average are a result of things mentioned for Line 4. Since GO down time is 10 milliseconds, a good prolay will stabilize in the stop status and the range should be relatively low.

More important than the actual value of the range and average is a significant change in the values. If the range or average show a significant change from the values obtained after a thorough P. M. The frame is ready for P. M.

A large range might indicate a need for P. M. on start stop adjustments, or that tape has a speed variation.

Line 7: This line is obtained from 100 operations of: BSP followed by RD. The times are measured during the RD, and is the time from "GO" to the first character in the record. The times depend on:

a. BKWD stop delay
b. Backward coast
c. Backward stop time and forward start time

The important value in this line is the range. Intermittent trouble in backspace may show here before it shows any place else or effects the average. The range should not be larger than the range in Line 6.

By comparing the typeouts for several drives on the same 7621 tape control, it can be seen that the larger the average of Line 7, the smaller the forward creep in Line 9. This is true as they both depend on backward stop time plus forward start time.

This applies only if Lines 4, 5, 6, and 8 are correct. A slow forward start time could effect this relationship but it would also show in Lines 4, 5, 6, and 8.

Line 8:

This line is obtained from gaps produced by using WR, SET, WR, 50 times. The time delay produced by the set instruction is 400 milliseconds for each of the 50 gaps measured. See point D on graph. This time delay may be varied from 5 milliseconds to 60,000 milliseconds by storing a five (5) digit number in milliseconds, at 06069 - 06073.

The average should not be significantly higher or lower than the average for Line 6. As it is characteristic of a prolay to shorten the gap slightly as "GO" down time increases. Therefore, this line will indicate binding in prolay motion.

When the low in Line 8 drops below the low in Lines 4, 5, and 6, this may also indicate prolay binding. Although, a binding condition is suspected it cannot always be verified by Line 8 with "GO" down for 400 ms only, since a "GO" down time of 4 - 6 seconds or more may be necessary to definitely show this condition. This is referred to as "COUNT FIVE".

Line 9:

This figure is obtained from 30 backspace write operations and represents the average amount of creep forward (if backward, it will be signed minus) in one backspace write. The specifications on this are that forward creep should not exceed 0.2 inch or be less than 0.05 inch.

1.835 ms

.67 ms

.112 = 1 ms

729 IV

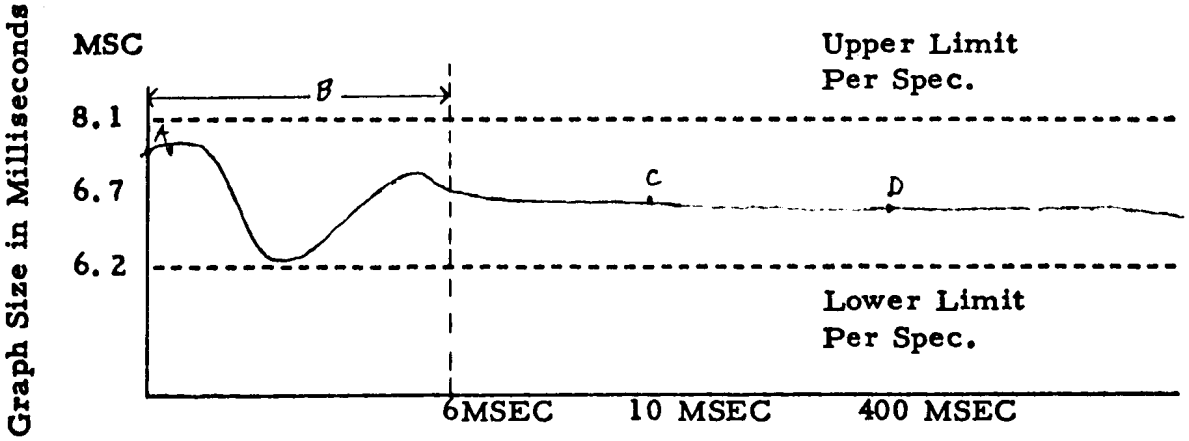
Line 1	0201 - 729 IV,	224 Groups		
Line 2	Low	RNG	Average	
Line 3	7.0	.7	7.6	MSC No delay while write
Line 4	6.8	.8	7.5	MSC Min. delay while write
Line 5	6.2	1.5	7.0	MSC Variable delay, WR
Line 6	6.5	.6	6.8	MSC Delay 10 msec, WR.
Line 7	6.1	.7	6.3	MSC RD after backspace
Line 8	6.9	.3	7.1	MSC Delay 0400 MS, WR
Line 9	BSP	WR	Creep .12 in.	

ALL READY TAPES WILL BE USED AT HIGH DENSITY

Line 1: The first number is the tape frame address. The second is the model of tape drive and the third is the number of groups successfully read back. If a stop 0002 or an overflow at 39974 occurs, the number of groups will be less than 224 (Refer to Section N).

Line 2: Lines 3, 4, 5, 6, 7 and 8 are divided into three columns, LOW, RNG, and AVERAGE. LOW indicates the shortest time to cross a gap. RNG is the range between the shortest time and the longest time to cross a gap. AVERAGE shows the average time to cross a series of gaps.

The use of the figures in the typeouts is important in determining the need for P. M. More important than the values of the range and average is a substantial change in these values. By keeping a history of the tape unit (the typeout), it is possible to tell when a drive needs P. M.



The above is a graph form of the average inter-record gap versus GO down time for a 729 IV. All drive will not look exactly the same, but should have the same general plot and should stabilize at about 10 milliseconds. The important thing is that the drive should be within the upper and lower tape specifications of 3/4" ± 5/32" - 1/16" or 8.1 msec upper and 6.2 msec lower.

Line 3: These figures are obtained by writing two records in each group, using the record counter 224 times. Under these conditions tape slows down but does not stop, and as it is moving at almost full speed, which causes the inter-record gap to be toward the upper limit of specifications. See point A on graph. The length of the gap depends on:

a. Record counter write delay
b. Write stop delay
c. Forward start stop time
d. Condition of the drive capstan
e. Prolay response

The average should be about the same for all tape units of the same model on the same channel. If an average exceeds either the upper or lower limits, check for fast or slow stop time. The difference between drives of the same type on the same channel would be the adjustment of the Stop Time.

The range is a measure of the condition of the drive mechanism with "GO" up almost continuously and normally should be very low. When the range becomes significant, P. M. should be given with attention to:

a. Eccentric drive capstan or idler
b. Cuts, dirt, or oxide on the drive capstan
c. Worn bearings in capstan motor
d. Worn or binding nylon idler

The low should not be lower than 6.2 milliseconds.

Line 4: These figures are obtained from gaps generated by the consecutive writes in each of the 224 groups. Between writes there is a minimum "GO" down time of about 0.8 milliseconds. Under condition tape will slow down but will not stop. This condition closely approximates line 3 and therefore the figures in the typeout will be about the same. See point A on graph. The length of the gap depends on:

a. Write delay
b. Write stop delay
c. Forward start stop time
d. Condition of the drive capstan
e. Prolay response

The range and average should be almost the same as the range and average of Line 3. If not, P. M. should be given with specific attention to the prolay and adjustment of the stop time.

The low should not be lower than 6.2 milliseconds.

Line 5: These figures are obtained from gaps produced by WR, SET (a variable number), the time delay produced by the set instruction varies from 5 microseconds to 6 milliseconds, in steps of approximately 24 microseconds.

The low for this line should be compared with the low in specifications (6.2 ms) as there is a tendency for short gaps to be written under these conditions. See B on graph.

The range is a result of the things mentioned for Line 4 plus recovery of driving circuits and inertia of the prolay for critical values of down time when the prolay has maximum accelleration either toward or away from neutral. This range gives a measure of the overshoot through neutral toward the stop capstan.

Line 6: These figures are obtained from gaps produced by WR, SET, WR. The time delay produced by the set instruction is 10 milliseconds for each of the 224 gaps measured. See point C on graph.

The range and average are a result of things mentioned for Line 4. Since "GO" down time is 10 milliseconds, a good prolay will stabilize in the stop status and the range should be relatively low.

More important than the actual value of the range and average is significant change in the values. If the range or average show a significant change from the values obtained after a thorough P. M., the frame is ready for P. M.

A large range might indicate a need for P. M. on start stop adjustments or that tape has a speed variation.

Line 7: This line is obtained from 100 operations of: BSP followed by RD. The times are measured during the RD and is the time from "GO" to the first character in the record. The times depend on:

a. BDWD stop delay
b. Backward coast
c. Backward stop time and forward start time

The important value in this line is the range. Intermittent trouble in backspace may show here before it shows any place else or effects the average. The range should not be larger than the range in Line 6.

By comparing the type-outs for several drives on the same 7621 tape control, it can be seen that the larger the average of Line 7, the smaller the forward creep in Line 9. This is true as they both depend on backward stop time plus forward start time.
This applies only if lines 4, 5, 6, and 8 are correct. A slow forward start time could effect this relationship but it would also show up in lines 4, 5, 6, and 8.

Line 8: This line is obtained from gaps produced by using WR, SET, WR 50 times. The time delay produced by the set instruction is 400 milliseconds for each of the 50 gaps measured. See point D on graph. This time delay may be varied from 5 , milliseconds by storing a five (5) digit number in milliseconds at 06069 - 06073.

The average should not be significantly higher or lower than the average for line 6. As it is characteristic of a prolay to shorten the gap slightly as "GO" down time increases. Therefore, this line will indicate binding in prolay motion.

When the low in Line 8 drops below the low in Lines 4, 5, and 6, this may also indicate prolay binding. Although a binding condition is suspected, it cannot always be verified by Line 8 with "GO" down for 400 ms only, since a "GO" down time of 4-6 seconds or more may be necessary to definitely show this condition. This is referred to as "COUNT FIVE".

Line 9: This figure is obtained from 30 backspace write operations and represents the average amount of creep forward in one backspace write.

Forward creep should be greater than .05 inch and less than 0.2 inch.

K. COMMENTS

1. With reference to Line 8:

The "GO" down time may be varies by storing a five digit number in milliseconds at location 06069 - 06073. The limits of this stored value are from 5 milliseconds to 60000 milliseconds.

For a "GO" down time greater than 5 seconds, the program can be stopped in a gap by storing a halt (J) at location 05515. This will cause the program to stop in the first of the 50 gaps used in Line 8, leaving the other 49 gaps at the "GO" down time of 400 ms (or some stored value). This halt would then occur once per tape drive, and could be bypassed along with Line 8 for a particular tape drive by throwing the 912 switch on during the typeout of Lines 1, 2, etc.

2. Extreme cases of short gaps:

a. May lead to bit packing by starting to write before tape speed has settled on constant speed.
b. May cause failure to read the first characters in a record. Depending on the value of RD RD DELAY or RD DELAY, relative to the gap length, the read gate may not come up in time to read the beginning of the record.

Either a or b could cause a 904 check at location 39974 and necessitate the use of the restart procedure described in Section N.

L. USE OF TEST

This test should be run once a week to determine whether any tape frames require mechanical P. M. It should also be used if tape motion trouble is suspected; however, little would be gained by running it daily.

There are three main applications for the use of this program:

1. a. To indicate when a drive is ready to turn over to the customer during the installation period.

   b. When the customer is having trouble that the C. E. suspects is caused by tape motion.

   c. As a guide to indicate when a drive needs P. M.

   The use of the program differs slightly for each of the above applications.

2. a. When a drive can be considered to be installed. After adjusting the tape drive, run this test for verification. The typeouts should be retained to establish a history and a reference point for future comparison to determine when the unit is ready for P. M. Comparing a drive to others of the same type on the same channel will also help to determine a bad drive.

   b. If the customer is having trouble, run the test to determine if it is tape motion trouble. Keep the conditions the same as the customer has. Do not clean tape transport. Cleaning the transport may temporarily remedy the trouble, but this is not a permanent condition. CORRECT THE TROUBLE BY ADJUSTING THE TAPE DRIVE.

M. RUNNING TIME

130 seconds per 729 II and 110 seconds per 729 IV when more than one frame is being tested, excluding typeout time. Normal typeout time is 30 seconds per drive.

N. OPERATING HINTS

1. Overflow check at 39974:

   The overflow check trigger may be turned on while measuring gaps, if for some reason the information read into memory is incorrect. The following procedure will permit continuation of the test:

   a. Depress machine stop
   b. Reset

c. Display memory location 02394, if the address of the instruction is:

(1) 02514 - The program is in normal Gap Test -TR 02319
(2) 05704 - The program is in long go down Gap Test TR 05414
(3) 07649 - The program is in the Creep Test - TR07619
07684
07979

d. Depress start

2. Bypass a Tape Drive:

To bypass a tape drive, drop ready on the drive and transfer to 01089 each time the TCU hangs up with that tape drive selected. This will omit that tape drive from the test. By doing this the test need not be restarted.

3. To Generate New Ready Table of Tape Drives and Restart Test.

"Reset and Start"

O. EXPLANATION OF LIMITS

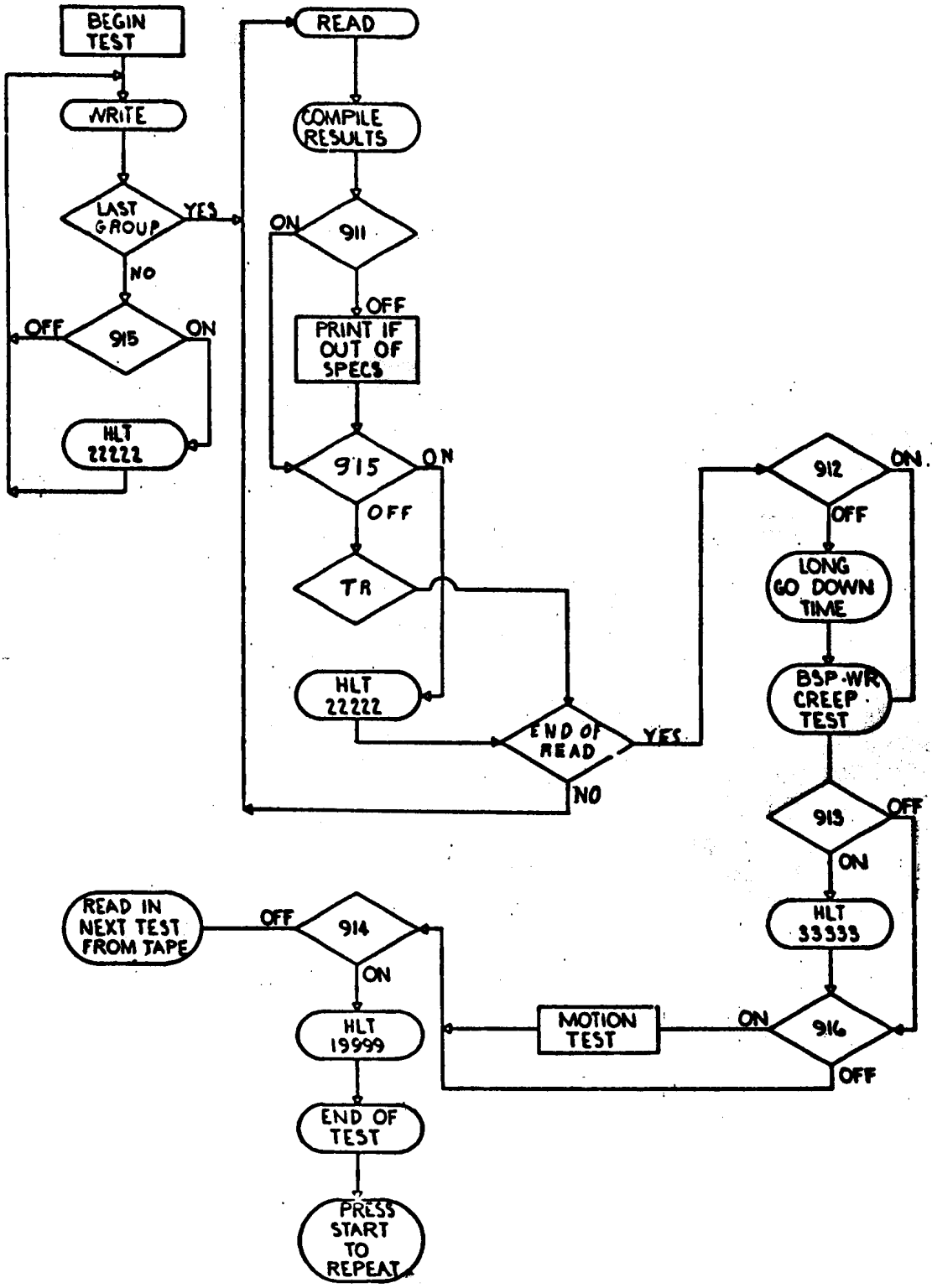
The first error typeout occurs, (Refer Section F), if an individual gap (G1, G2, G3, or G4) is outside a specified limits. The limits are taken from the functional specifications as follows:

729 II Functional Specifications, part #896496 change level #244317.
729 IV Functional Specifications, part #896497 change level #244317.

The maximum and minimum acceptable inter-record gap limits were taken from the above specifications. These limits, for mylar tape in inches and milliseconds are:

	Maximum	Minimum
729 II	3/4 inch plus 5/32	3/4 inch - 1/16
729 IV	3/4 plus 5/32 ,	3/4 inch - 1/16
729 II	12.1 milliseconds	9.2 milliseconds
729 IV	8.1 milliseconds	6.2 milliseconds

The numbers are converted to microseconds, based on a constant tape speed, and stored in memory position 04828 ot 04855. Consult page 15 of the listing if changes are to be made in the program.



THIS FIGURE IS ONLY USED TO EXPLAIN ALTERNATION SWITCH SETTINGS

FIGURE II

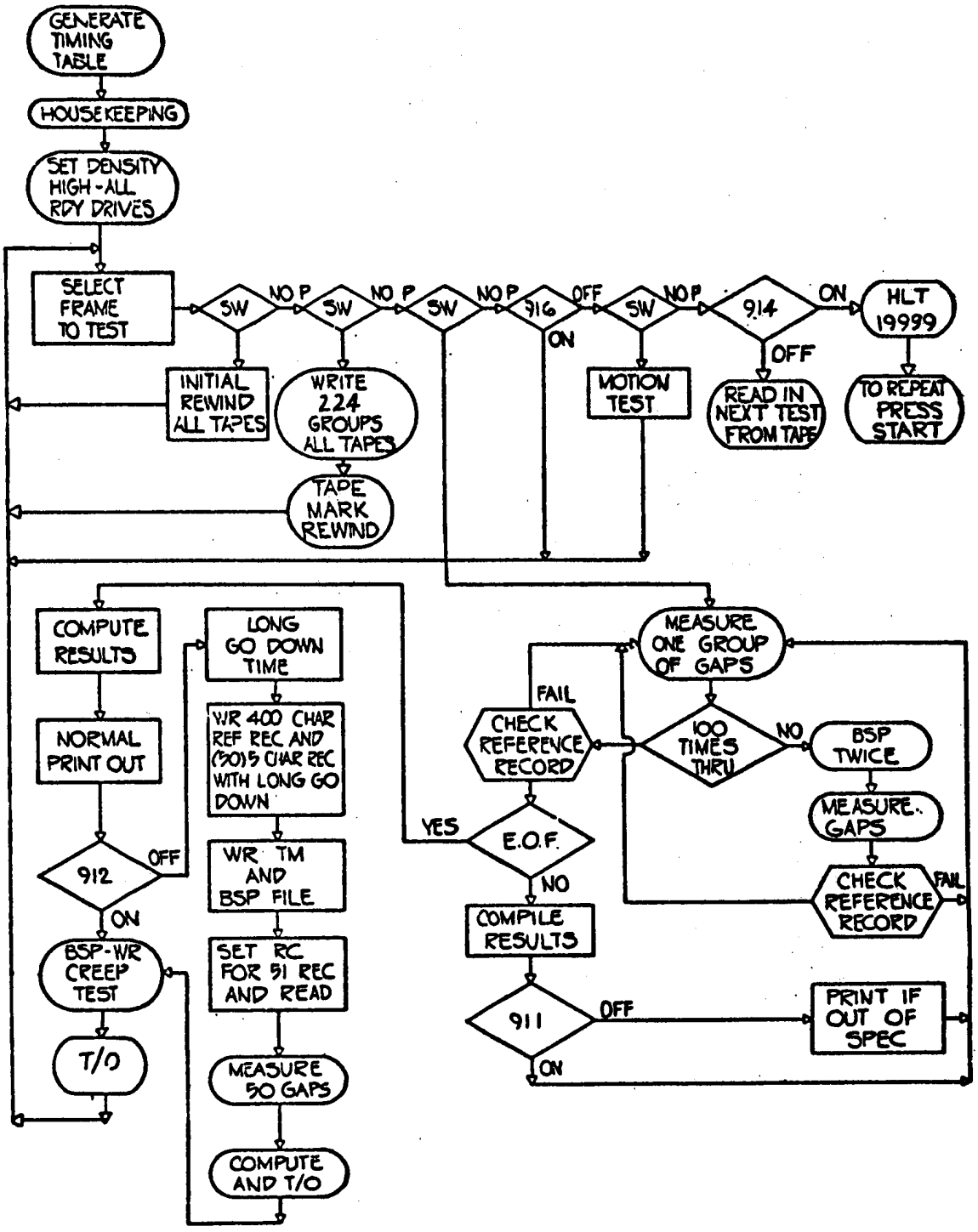


FIGURE III BTU04

MILLISECONDS TO INCH CONVERSION TABLE

(Sec) (In/Sec) = IN

M Sec	729 II 75 In/Sec	729 IV 112.5 In/Sec	M Sec	279 II 75 In/Sec	729 IV 112.5 In/Sec
0.0	0.0000	0.00000	3.8	0.2850	0.42750
0.1	.0075	.01125	3.9	.2925	.43875
0.2	.0150	.02250	4.0	.3000	.45000
0.3	.0225	.03375	4.1	.3075	.46125
0.4	.0300	.04500	4.2	.3150	.47250
0.5	.0375	.05620	4.3	.3225	.48375
0.6	.0450	.06750	4.4	.3300	.49500
0.7	.0525	.07875	4.5	.3375	.50625
0.8	.0600	.08900	4.6	.3450	.51750
0.9	.0675	.10025	4.7	.3525	.52875
1.0	.0750	.11250	4.8	.3600	.54000
1.1	.0825	.12375	4.9	.3675	.55125
1.2	.0900	.13500	5.0	.3750	.56250
1.3	.0975	,14625	5.1	.3825	.57375
1.4	.1050	.15750	5.2	.3900	.58500
1.5	.1125	.16875	5.3	.3975	.59625
1.6	.1200	.18000	5.4	.4050	.60750
1.7	.1275	.19125	5.5	.4125	.61875
1.8	.1350	.20250	5.6	.4200	.63000
1.9	.1425	.21375	5.7	.4275	.64125
2.0	.1500	.22500	5.8	.4350	.65250
2.1	.1575	.23625	5.9	.4425	.66375
2.2	.1650	.24750	6.0	.4500	.67500
2.3	.1725	.25875	6.1	.4575	.68625
2.4	.1800	.27000	6.2	.4650	.69750
2.5	.1875	.28125	6.3	.4725	.70875
2.6	.1950	.29250	6.4	.4800	.72000
2.7	.2025	.30375	6.5	.4875	.73125
2.8	.2100	.31500	6.6	.4950	.74250
2.9	.2175	.32625	6.7	.5025	.75375
3.0	.2250	.33750	6.8	.5100	.76500
3.1	.2325	.34875	6.9	.5175	.77625
3.2	.2400	.36000	7.0	.5250	.78750
3.3	.2475	.37125	7.1	.5325	.79875
3.4	.2550	.38250	7.2	.5400	.81000
3.5	.2625	.39375	7.3	.5475	.82125
3.6	.2700	.30500	7.4	.5550	.83250
3.7	.2775	.41625	7.5	.5625	.84375

M Sec	729 II 75 In/Sec	729 IV 112.5 In/Sec
7.6	0.5700	0.85500
7.7	.5775	.86625
7.8	.5850	.87750
7.9	.5925	.88875
8.0	.6000	.90000
8.1	.6075	.91125
8.2	.6150	.92250
8.3	.6225	.93375
8.4	.6300	.94500
8.5	.6375	.95625
8.6	.6450	.96750
8.7	.6525	.97875
8.8	.6600	.99000
8.9	.6675	1.00125
9.0	.6750	1.01250
9.1	.6825	1.02375
9.2	.6900	1.03500
9.3	.6975	1.04625
9.4	.7050	1.05750
9.5	.7125	1.06875
9.6	.7200	1.08000
9.7	.7275	1.09125
9.8	.7375	1.10250
9.9	.7425	1.11375
10.0	.7500	1.12500
10.1	.7575	1.13625
10.2	.7650	1.14750
10.3	.7725	1.15875
10.4	.7800	1.17000
10.5	.7875	1.18125
10.6	.7950	1.19250
10.7	.8025	1.20375
10.8	.8100	1.21500
10.9	.8175	1.22625
11.0	.8250	1.23750
11.1	.8325	1.24875
11.2	.8400	1.26000
11.3	.8475	1.27125
11.4	.8550	1.28250
11.5	.8625	1.29375
11.6	.8700	1.30500
11.7	.8775	1.31625
11.8	.8850	1.32750
11.9	.8925	1.33875
12.0	.9000	1.35000

8TU04C MEASURE RECORD GAPS
FEBRUARY-1-1962
USE ONLY ON SYSTEM OPERATING
AT 2.0 MICROSECOND
MEMORY CYCLE
SWITCH SUMMARY
911 ON DONT TYPE BAD GAPS
912 ON BYPASS 400 MS DLY
913 ON STOP AFTER BACKSPACE
914 ON LOOP IN TEST
914 OFF READ NEXT TEST FROM TP
915 ON FORCE IMMEDIATE STOP
916 ON BYPASS MOTION TEST

```
00004 NOP A      0200
00009 NOP A      0034------+
00014 SEL 2      0500      |
00019 WR  R      0185      |
00024 SGN T      0005      |
00029 HLT J      6666-     |  TR-
00034 NOP A      0179------+-----B02
00039 SGN T      0030
00044 SET B 01   0004 00 4
00049 LOD 8 01   0134 01T4
00054 LDA # 02   0184 01Q4
00059 RCV U     20004 -004
00064 SND /      0129
00069 CMP 4 01   0129 01S9
00074 AAM @ 02   0129 01K9
00079 TRE L      0089------+
00084 TR  1      0064      |
00089 LOD 8 01   0149 01U9
00094 SET B      0002
00099 RCV U     39984 I984
00104 SND /      0139
00109 CMP 4 01   0139 01T9
00114 AAM @ 02   0139 01L9
00119 TRE L      0164------+-------A02
00124 TR  1      0104      |
00129 TZB . 07 39984 IZH4
00134 TZB .     39ZDM IZDM
00139 SND /     39984 I984
00144 TR  1      2394------+-------V10
00149 SND /     3994M I94M
00154 ADD G      0750
00159 TR  1     20004 -004
```

SW ONE TIME

ALL CHK SW TO AUTO

10004

SW. ONE TIME
HOUSEKEEP GENERATOR #1

0010

GENERATOR #1 TZB 07 TABLE

HOUSEKEEP GEN #2

GENERATOR #2 SND AND TR
FOR TABLE

INITIAL TZB FOR TBL
UPPER LIMIT FOR TZB 79944

INITIAL SND AND TR FOR TBL
UPPER LIMIT FOR SND 79944

COUNTER FOR TZB TABLE

```
A01.....  00164 SET B      0010
          00169 LOD 8      0159
          00174 UNL 7    39979 I979
B01.....  00179 TR  1      0224------+
                                     I
                                     I
                                     I
```

PLACE LOOPER

CONSTANTS

```
2 005 00184                 0010
2 031 00215               ALL CHECK SWITCHES TO AUTOMATIC
2 001 00216               
```

```
          00224 NOP A      0324-------+------C03
          00229 SGN T      0220
          00234 SET B 01   0004 00 4
          00239 SET B 02   0001 00-1
          00244 LOD 8 02   0305 03-5
          00249 SET B 03   0001 00&1
          00254 LOD 8 03   0314 03A4
          00259 SET B 04   0001 0 01
          00264 LOD 8 04   0306 0T06
          00269 SET B 05   0004 0  4
          00274 LOD 8 05   0310 0T/0
          00279 SET B 06   0004 0 -4
          00284 SET B 07   0004 0 &4
          00289 SET B 08   0004 0-04
          00294 LOD 8 08   0314 0L14
          00299 LOD 8 07   0318 0TA8
          00304 TR  1      0324------+------C03
```

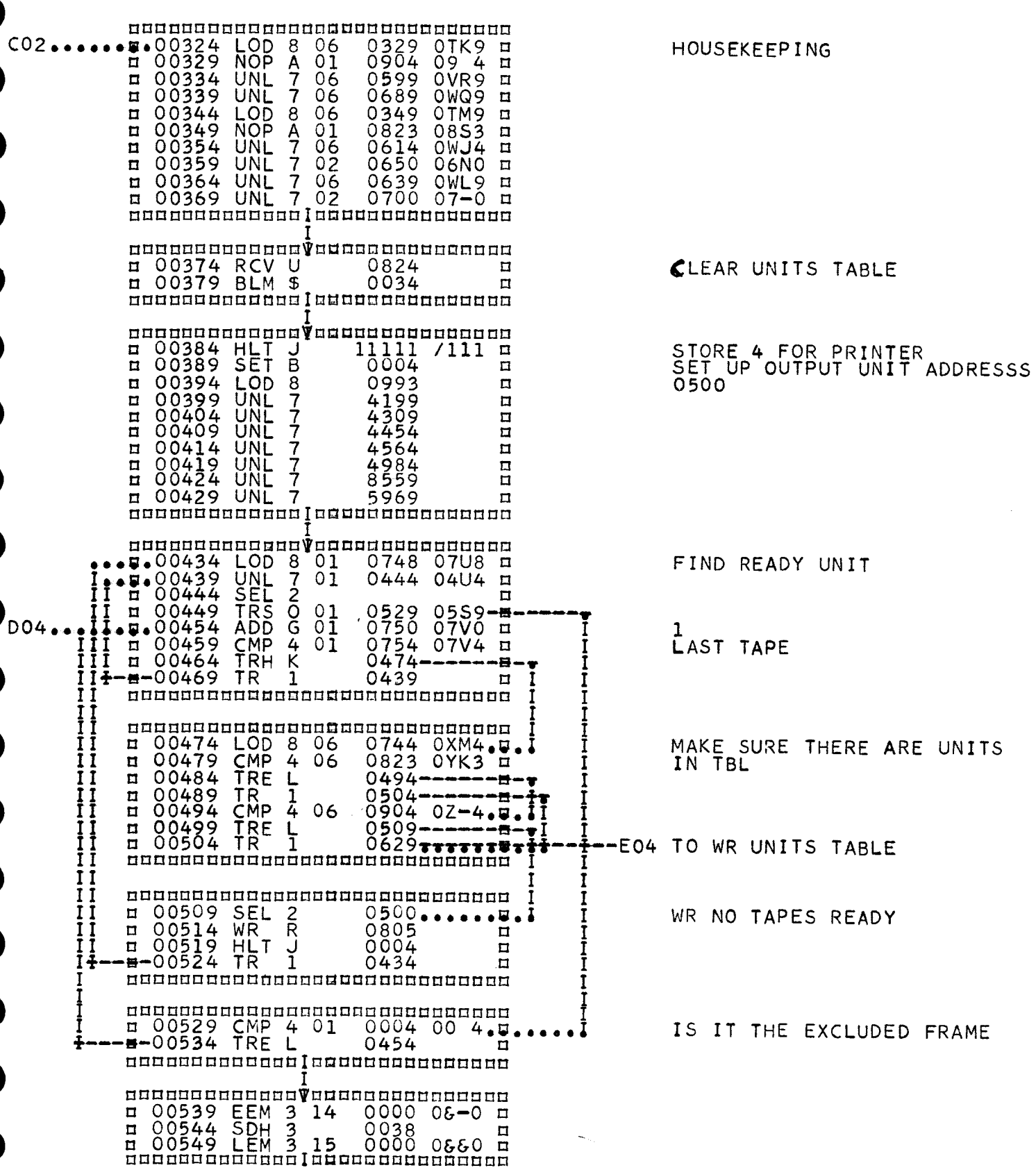
SW. HOUSEKEEP ASU S
FOR UNIT IN TEST
A
1
R
0005

0001
0004

CONSTANTS

```
2 001 00305                 A
2 001 00306                 R
2 004 00310                 0005
2 004 00314                 0001
2 004 00318                 0004
```

CREATE TAPE UNIT READY TABLE

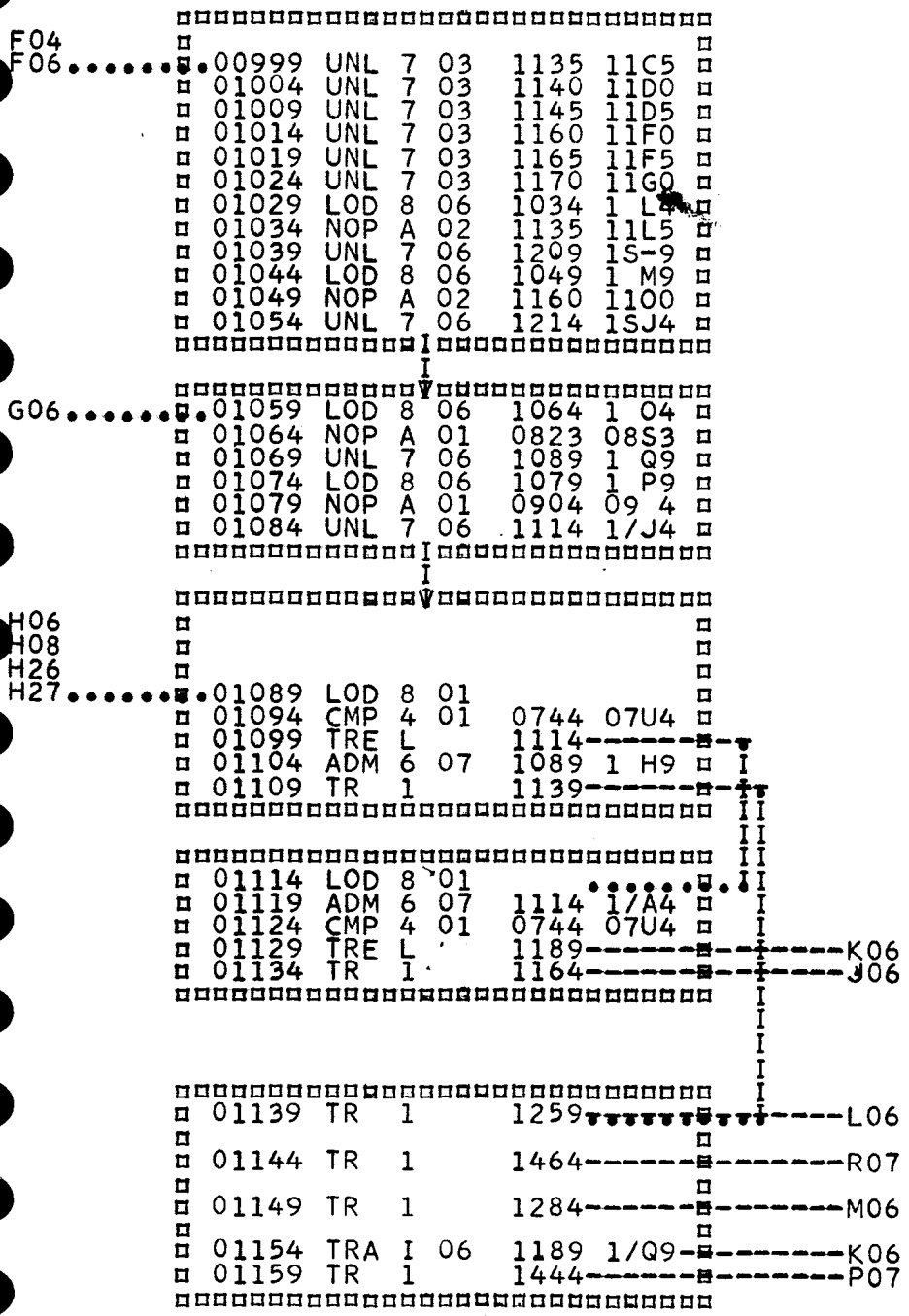


```
                                I
            ¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤V¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤
            ¤ 00554 RAD H 09   0759 0PV9 ¤                    DETERMINE TYPE OF DRIVE
            ¤ 00559 WR  R 01 19995 Z9Z5 ¤
            ¤ 00564 WR  R 01 19800 Z8 0 ¤
         ...¤.00569 TRS 0 01   0584 05Y4-¤-.
         I  ¤ 00574 ADD G 09   0768 0PW8 ¤ I                  0001
         +-¤-00579 TR  1      0569      ¤ I
            ¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤ I
                                             I
            ¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤ I
            ¤ 00584 TRZ N 09   0454 0MV4...+------D03
            ¤ 00589 CMP 4 09   0763 0PW3 ¤                    0724
            ¤ 00594 TRH K      0614------¤-.
            ¤ 00599 UNL 7 01             ¤ I                  UNL INTO 729 IV TABLE
            ¤ 00604 ADM 6 07   0599 0VI9 ¤ I                  0004
            ¤ 00609 TR  1      0454------¤-+------D03
            ¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤ I
                                             I
            ¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤ I
            ¤ 00614 UNL 7 01       ......¤..
            ¤ 00619 ADM 6 07   0614 0WA4 ¤                    UNL INTO 729 II TBL
            ¤ 00624 TR  1      0454------¤--------D03         0004
            ¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤

            ¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤
E03.......¤.00629 SEL 2        0500      ¤                    TYPEOUT UNITS IN TABLE
            ¤ 00634 WR  R      0769      ¤                    729 II
         ...¤.00639 LOD 8 01             ¤
         I  ¤ 00644 CMP 4 01   0744 07U4 ¤
         I  ¤ 00649 TRE L      0689------¤--.
         I  ¤ 00654 NOP A      0669------¤-.I                 SW. ON TIME
         I  ¤ 00659 WR  R      0784      ¤ II
         I  ¤ 00664 UNL 7 03   0650 06E0 ¤ II                 1
         I  ¤ 00669 UNL 7 01   0803 08 3.¤.II
         I  ¤ 00674 ADM 6 07   0639 0WC9 ¤  I                 0004
         I  ¤ 00679 WR  R      0798      ¤  I
         +-¤-00684 TR  1      0639      ¤  I
            ¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤  I
                                              I
            ¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤  I
         ...¤.00689 LOD 8 01       ......¤...                 TYPEOUT UNITS TABLE
         I  ¤ 00694 CMP 4 01   0744 07U4 ¤                    729 IV
         I  ¤ 00699 TRE L      0999------¤--------F05
         I  ¤ 00704 NOP A      0719------¤-.                  SW. ONE TIME
         I  ¤ 00709 UNL 7 03   0700 07E0 ¤ I                  1
         I  ¤ 00714 WR  R      0791      ¤ I
         I  ¤ 00719 UNL 7 01   0803 08 3.¤.I
         I  ¤ 00724 ADM 6 07   0689 0WH9 ¤                    0004
         I  ¤ 00729 WR  R      0798      ¤
         +-¤-00734 TR  1      0689      ¤
            ¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤

                                                              CONSTANTS & WORK AREA
 2 010 00744
 2 004 00748                         0201 FIRST AVAILABLE TAPE
 2 002 00750                        & 1
 2 004 00754                         0299 LAST POSSIBLE TAPE
 2 005 00759                        & 0000
 2 004 00763                         0724 COUNT FOR TAPE RDY LOOP
 2 005 00768                        & 0001
 2 014 00782                         UNITS IN TABLE
 2 001 00783                         ¤
 2 006 00789                         729 II
 2 001 00790                         ¤
 2 006 00796                         729 IV
 2 001 00797                         ¤
 2 006 00803
 2 001 00804                         ¤
 2 014 00818                         NO TAPES READY
 2 001 00819                         ¤
 5 170 00989  00
 2 004 00993                         0500 CHANGE TO 0400 FOR 717 OUT
```

MASTER SELECT AND SEQUENCE

SW•1-729 II REWIND
SW•2-729 II WRITE RECORDS
SW•3-729 II MEASURE GAPS
NONE SET-TO MOTION

SW•5-729 IV REWIND
SW•6-729 IV WRITE RECORDS
SW•7-729 IV MEASURE GAPS
NONE SET-TO MOTION



1 RESET SWITCHES

HOUSEKEEP SELECT LOADS

SELECT 729 II TAPE DRIVE BLANKS

0004

SELECT 729 IV TAPE DRIVE
0004
BLANKS

SEQUENCE TR• SWITCHES FOR 729 II

TO INITIAL REWIND

TO WRITING OF RECORDS

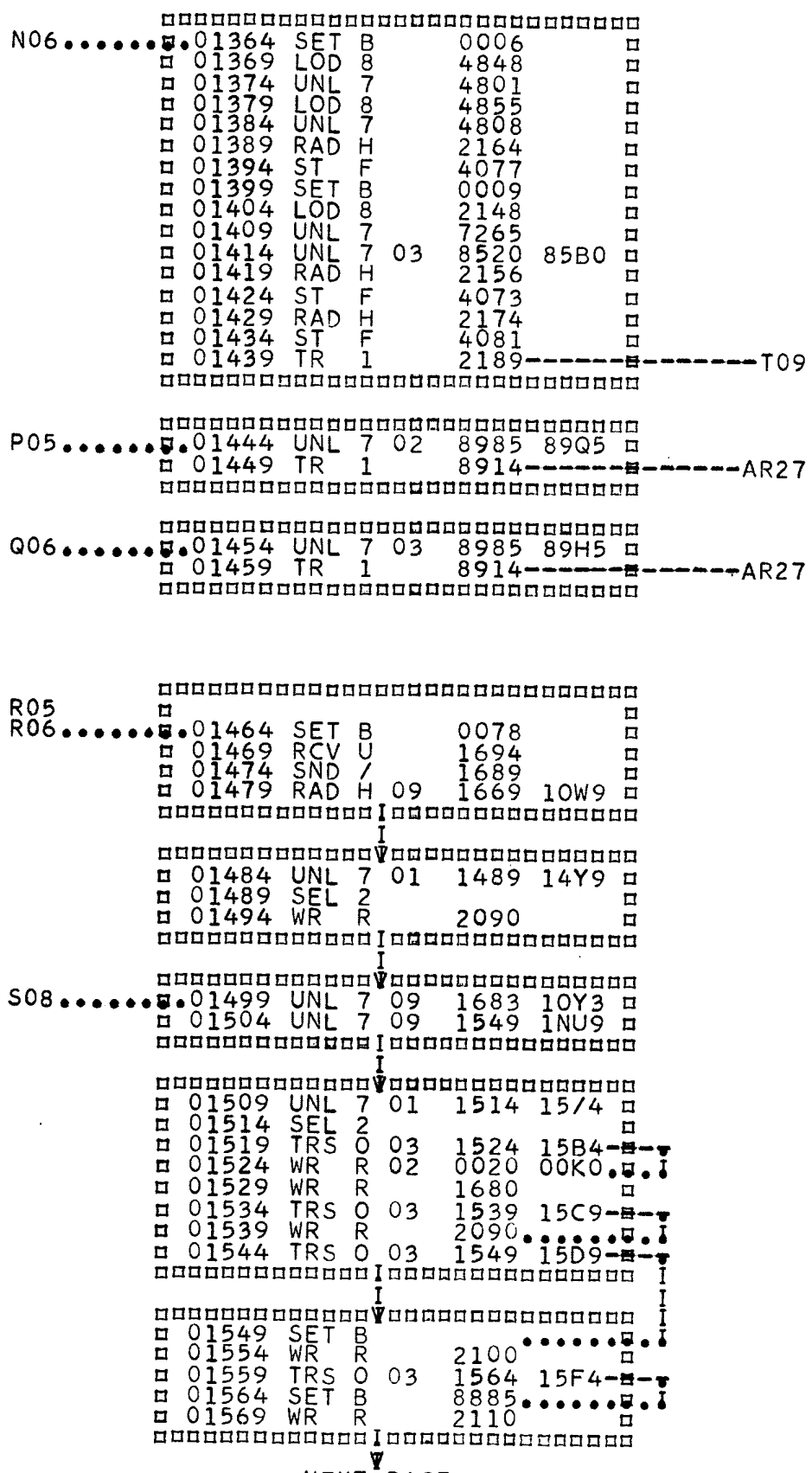
TO MEASURING OF GAPS

BYPASS MOTION TEST

TO MOTION TEST

SEQUENCE TR. SWITCHES FOR 729 IV

```
J05.....01164 TR  1      1259------------------  TO INITIAL REWIND
       01169 TR  1      1464------------------R07 TO WRITING OF RECORDS
       01174 TR  1      1364------------------N07 TO MEASURING GAPS
       01179 TRA I 06   1189 1/Q9-----------     BYPASS MOTION TEST
       01184 TR  1      1454------------------Q07 TO MOTION TEST
                                                  AS EACH OF THE STEPS ARE
                                                  COMPLETED THE ABOVE TR.
                                                  BECOME NOPS
K05.....01189 LOD 8 06   1194 1/R4.....         CHECK FOR END OF TEST
       01194 NOP A 02   1150 11N0
       01199 CMP 4 06   1209 1S-9
       01204 TRE L      1234------------------
       01209 UNL 7 02                           STEP SEQUENCE TR.
       01214 UNL 7 02
       01219 ADM 6 05   1209 1S 9               0005
       01224 ADM 6 05   1214 1S/4               0005
       01229 TR  1      1059------------------G05
       01234 SEL 2      0914.....
       01239 TRS O      1249------------------  END OF TEST
       01244 TR  1     18219 Y219
       01249 HLT J     19999 Z999.....
       01254 TR  1      0999------------------F05
                                                  INITIAL REWIND
                                                  ENTRY FROM SW. S 1 AND 5
L05.....01259 UNL 7 01   1264 12W4.....
       01264 SEL 2                              MAKE SURE ALL I.O. INDICATORS
       01269 IOF 3      0000                    ARE OFF AND TAPE IS
       01274 RWD 3      0002                    AT LOAD POINT
       01279 TR  1      1089------------------H05
M05.....01284 SET B      0006                    SET UP FOR 729 II
       01289 LOD 8      4834                    UPPER LIMIT
       01294 UNL 7      4801
       01299 LOD 8      4841                    LOWER LIMIT
       01304 UNL 7      4808
       01309 RAD H      2160                    CORRECTION FOR BSP RD
       01314 ST  F      4077
       01319 SET B      0009
       01324 LOD 8      2139                    729 II
       01329 UNL 7      7265
       01334 UNL 7 02   8520 85K0
       01339 RAD H      2152                    CHECK CHARA. DELAY
       01344 ST  F      4073
       01349 RAD H      2178                    MOD II
       01354 ST  F      4081
       01359 TR  1      2189------------------T09
```



SET UP FOR 729 IV
UPPER LIMIT

LOWER LIMIT
CORRECTION FOR BSP RD

729 IV

CHECK CHARA DELAY

MOD IV

729 II MOTION TEST

729 IV MOTION TEST

WRITE 224 GROUPS OF RECORDS
ON MOD II AND IV

SET UP RECORD # 1

0000

MOVE FROM LP

29999

UP DATE DELAY
TO VARIABLE DELAY

WRITE FIRST AND SECOND
RECORD THROUGH THE
RECORD COUNTER

400 Y,S AND 16666
TO NEXT WR
WRITE THIRD RECORD 29999

VARIABLE DLY
WRITE FOURTH RECORD 33333

10 MILLISECOND DLY
WRITE FIFTH RECORD 46666

FROM PREVIOUS PAGE

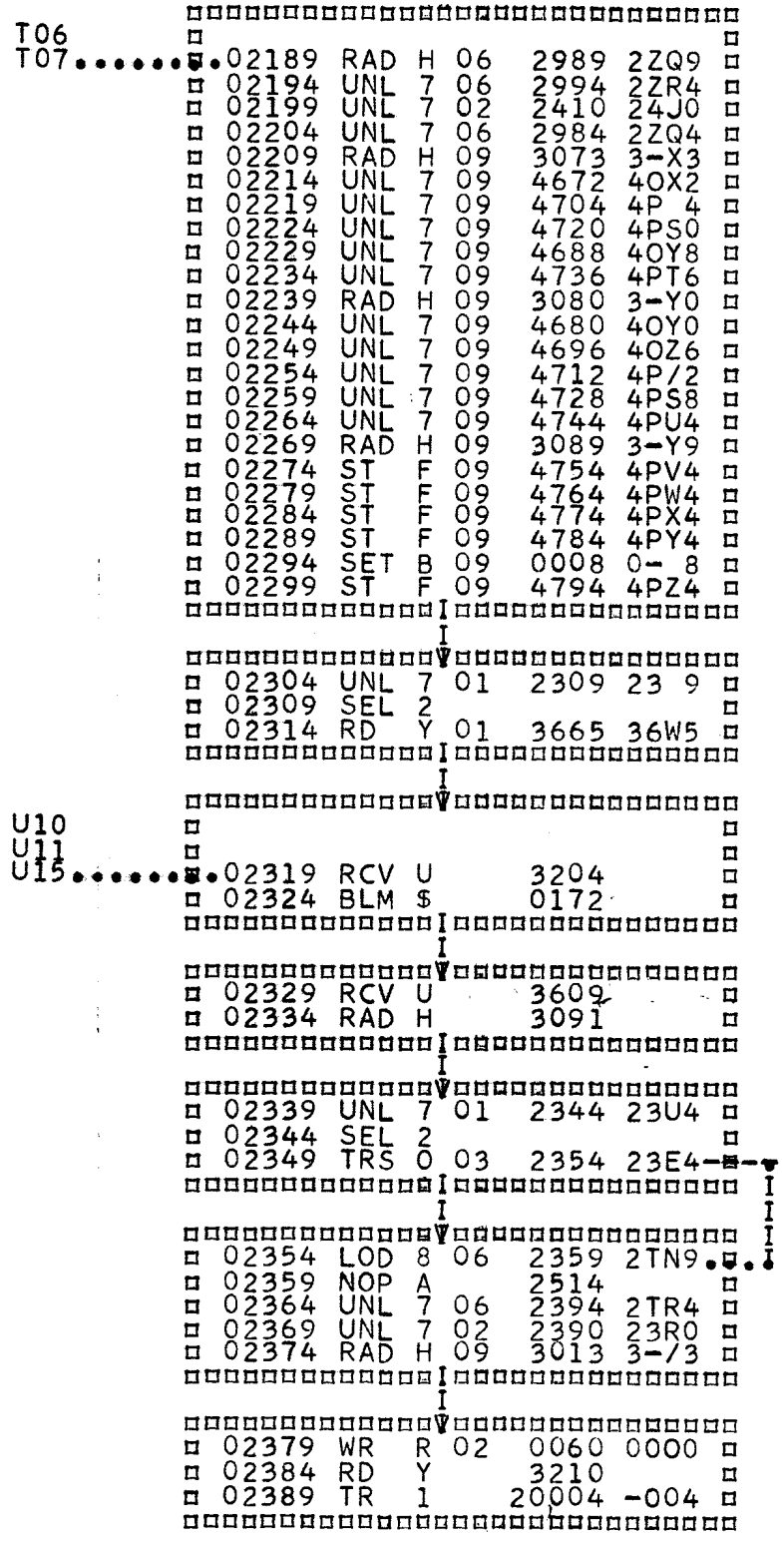
```
                                                    CHECK FOR END OF WRITE
 01574 LOD 8 06   1549 1VM9                         5335 DELAY 6 MSEC
 01579 CMP 4 06   1675 1WP5                         TO REWIND
 01584 TRH K      1619------+
                           I
                           V
 01589 WR  R      2120                              REFERENCE RECORD 10 5,S
                           I
                           V
 01594 ADD G 09   1671 1OX1                         24 STEP VAR DLY
 01599 TRA I 05   1609 1W 9-+
 01604 TR  1      1499------+-----S07
 01609 HLT J    22222 K222..+.                      FORCE STOP
 01614 TR  1      1499------+-----S07

 01619 WTM 3      0001.....+...                     WRITE TAPE MARKS AND REWIND
 01624 WTM 3      0001
 01629 WTM 3      0001
 01634 WTM 3      0001
 01639 WTM 3      0001
 01644 WTM 3      0001
 01649 WTM 3      0001
 01654 IOF 3      0000
 01659 RWD 3      0002
 01664 TR  1      1089------+-------H05              WR ON NEXT UNIT
```

CONSTANTS & WORK AREA

```
2 005 01669                 & 0000
2 002 01671                 &24 INCREMENT FOR VARIABLE DLY
2 004 01675                  5335 DELAY 6 MILLISECOND
2 010 01689 00               YYYYYYYYYY
5 390 02079
2 001 02080                  
2 005 02085                  16666
2 001 02086                  
2 005 02094 00               29999
2 001 02095                  
2 005 02104 00               33333
2 001 02105                  
2 005 02114 00               46666
2 001 02115                  
2 010 02129 00               5555555555
2 001 02130                  
2 009 02139                  -729 II,
2 009 02148                  -729 IV,
2 004 02152                 & 090 CHECK CHAR DLY MOD II MICROSEC
2 004 02156                 & 060 CHECK CHAR DLY MOD IV MICROSEC
2 004 02160                 & 120 CORR FOR BSP-RD MOD II USEC
2 004 02164                 & 080 CORR FOR BSP-RD MOD IV USEC
2 003 02167                 &000
2 003 02170                 &001
2 004 02174                 & 100 MOD IV 07E
2 004 02178                 & 200 MOD II 096
2 002 02180                 & 1
```

READ AND TIME GAP DELAY
FOR ONE GROUP OF RECORDS
WRITTEN ON A 729

GAPS MEASURED IN 5 MICRO-
SECOND INCREMENTS



INITIAL HOUSEKEEPING

000000

999999

000000000

MOVE FROM LP

BLANK READ FIELD

SET RCV FOR TZB 07
AND SEND

SELECT UNIT

RESET RETURN TRANSFER

5

SET RECORD COUNTER
READ 6 RECORDS
TO TABLE

```
V01.....  02394 NOP A      2514------------  SW. RETURN FROM TABLE TO
          02399 SUB P 09   3014 3-/4          THIS POINT. MODIFIED MANY
          02404 TRZ N 09   2414 2M/4-         TIMES
          02409 TR  1     20004 -004          1
                                              BACK TO TABLE
          02414 NOP A      2654------------W11  SW 100 BSP RDS DONE
          02419 UNL 7 03   2390 23I0
          02424 UNL 7 01   2429 24S9
          02429 SEL 2
          02434 BSP 3      0004
          02439 BSP 3      0004
          02444 RCV U      3664                SET RCV FOR TABLE
          02449 LOD 8 06   2994 2ZR4           GROUP COUNTER
          02454 CMP 4 06   2998 2ZR8           0098
          02459 TRH K      2484------
          02464 RD  Y      3660
          02469 SET B      0024                DLY 32 USEC
          02474 RAD H      3091                0
          02479 TR  1     20004 -004
          02484 UNL 7 03   2410 24A0           SET 100 TIMES THROUGH
          02489 LOD 8 06   3002 3 -2           SWITCH AND MOVE TAPE
          02494 UNL 7 06   2984 2ZQ4           FORWARD
          02499 RD  Y 01   3660 36W0
          02504 RD  Y      3660
          02509 TR  1      2529------
          02514 RD  Y      3665..........      READ IN REFERANCE RECORD
          02519 LOD 8 06   3664 3W04
          02524 UNL 7 06   2984 2ZQ4
          02529 LOD 8 06   2129 2/K9
          02534 TRS 0 03   2539 25C9-
          02539 CMP 4 06   3669 3W09
          02544 TRE L      2654------------W11  OK
          02549 SET B      0001
          02554 LOD 8      3665
          02559 CMP 4      3004                4
          02564 TRE L      2609------
          02569 CMP 4      3005                3
          02574 TRE L      2609------
          02579 SET B      0004                IF FIRST RECORD IS READ
          02584 LOD 8      3668                CHECK IF BACKWARD OR
          02589 CMP 4      3213                FORWARD
          02594 TRE L      2609------
          02599 TRH K      2624------
          02604 TR  1      2639------
          02609 SEL 2      0500..........      BACKSPACE ERROR TYPEOUTS
          02614 WR  R      3118                BACKSPACE TOO FAR
          02619 TR  1      2654------W11
          02624 SEL 2      0500..........
          02629 WR  R      3136                BACKSPACE NOT FAR ENOUGH
          02634 TR  1      2654------W11
          02639 SEL 2      0500..........
          02644 WR  R      3161                UNDETERMINED ERROR AFTER BSP
          02649 TR  1      2319------------U09 TIME NEXT GROUP
```

```
W10.....  02654 SET  B       0005
          02659 ADM  6 08    2994 2R94
          02664 TRS  O 03    2669 26F9-----.
          02669 TRS  O       2759.........-.
          02674 LOD  8       3639          I
          02679 CMP  4       2129          I
          02684 TRE  L       2759------.---X
                I                        I
                V                        I
          02689 HLT  J       0002          I
          02694 UNL  7 01    2699 26Z9     I
          02699 SEL  2                     I
     ....02704 RD   Y       3260          I
     I...02709 TRS  O 01    2719 27/9-.   I
     I+--02714 TR   1       2709      I   I
     I    02719 TRS  O       2749.....-.-.I
     I    02724 SET  B       0001      II
     I    02729 LOD  8       3260      II
     I    02734 CMP  4       3003      II
     I    02739 TRE  L       2319------.--+---U09
     +--02744 TR   1       2704          II
          02749 HLT  J       0003.....-..II
          02754 TR   1       4894------.---+--AB16
                                           I
                                           I
          02759 RCV  U       2964.....-....I
          02764 SET  B       0004          I
          02769 SND  /       3614          I
          02774 TR   1       2779------.-  I
                                       I   I
                                       I   I
                                       I   I
          02779 LOD  8 06    2784 2XQ4.-.I
          02784 NOP  A       2964          I
          02789 UNL  7 06    2834 2YL4     I
          02794 LOD  8 06    2799 2XR9     I
          02799 NOP  A       3095          I
          02804 UNL  7 06    2889 2YQ9     I
          02809 LOD  8 06    2814 2YJ4     I
          02814 NOP  A       3029          I
          02819 UNL  7 06    2904 2Z-4     I
          02824 NOP  A       2989          I
          02829 LOD  8 06    2824 2YK4     I
                I                        I
                V                        I
     ....02834 LDA  #                    I
     I    02839 CMP  4       3066          I
     I    02844 TRE  L       4099------.-------Y13
     I    02849 SUB  P       3012          I
     I    02854 SHR  C       0001          I
     I    02859 MPY  V       3018          I
     I    02864 ADD  G       3021          I
     I    02869 SUB  P       4081          I
     I    02874 SUB  P       4073          I
     I    02879 ST   F       3199          I
     I    02884 SET  B       0001          I
     I    02889 LOD  8                     I
     I    02894 MPY  V       3117          I
     I    02899 ADD  G       3199          I
     I    02904 ST   F                     I
     I    02909 ADM  6 05    2834 2YT4     I
     I    02914 ADM  6 07    2904 2Z&4     I
     I    02919 ADM  6 07    2904 2Z&4     I
     I    02924 ADM  6 07    2889 2YH9     I
     I    02929 CMP  4 06    2834 2YL4     I
     I    02934 TRE  L       2944------.-------X12
     +--02939 TR   1       2834          I
```

CHECK R6
COUNT GROUPS

CHECK FOR END OF READ

5,S

OUT OF STEP-READ FORWARD
TO NEXT GROUP

EOF AND NOT IN STEP

MEASURE NEXT GROUP

EOF AND NOT IN STEP

MOVE RECORDS FROM READ AREA

TO COMPUTE

CHANGE ADDRESS COUNTERS TO
MICRO SECONDS

HOUSEKEEPING

LOD COUNTER
100 TIMES THROUGH

39974
DIVIDE BY 10
05 TZB TIME
032 DLY BEFORE ENTERING TBL

CHECK CHARACTER DELAY

TIMES THRU TZB TABLE
19977 TZB TBL TIME

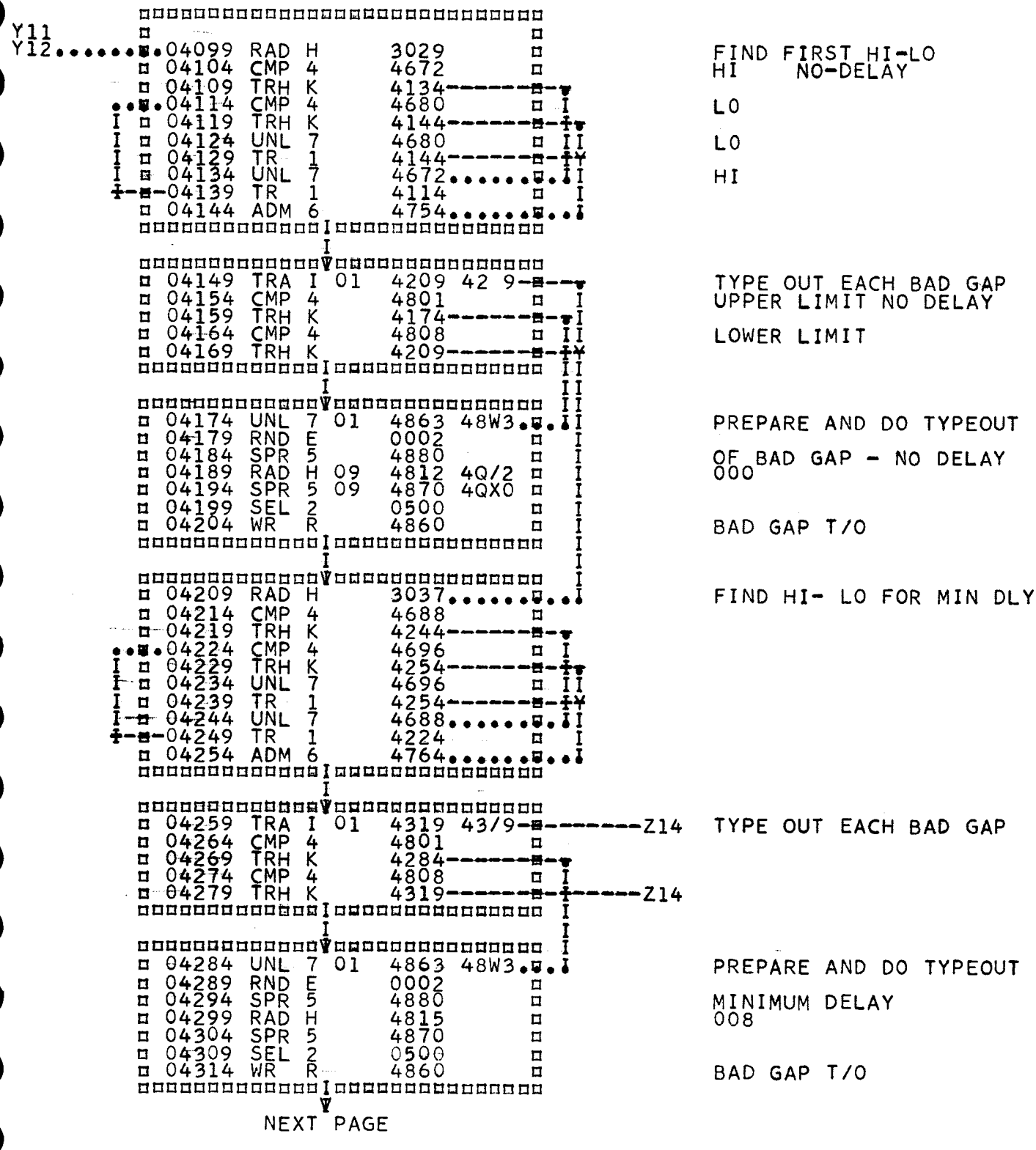
STEP LDA 0005
STEP ST 0004
STEP ST 0004
STEP LOD 0004

```
X11.....02944 RAD H    3061
        02949 SUB P    4077
        02954 ST  F    3061
        02959 TR  1    4099--------Y13
```

CORRECT FOR BSP READ

```
                                                    CONSTANTS & WORK AREA
2 005 02964 00                    00000 NO DELAY COUNTER
2 005 02969                       00000 MIN DELAY COUNTER
2 005 02974 00                    00000 VARIABLE DELAY
2 005 02979 00                    00000 FIXED DELAY
2 005 02984 00                    00000 BSP. RD DELAY
2 005 02989                      & 0000
2 005 02994                        0000 GROUP COUNTER
2 004 02998                       0098
2 004 03002                       AAA0
2 001 03003                       5
2 001 03004                       4
2 001 03005                       3
2 001 03006                       2
2 006 03012                      & 39974 ADDR OF ADD INST
2 001 03013                      &5
2 001 03014                      &1
2 001 03015                      &5
2 003 03018                      & 05 TZB INSTRUCTION TIME
2 003 03021                      &032 DLY BEFORE ENTERING TBL
2 008 03029                      A0000000 NO DELAY MICRO SEC
2 008 03037                       A0000000 MIN DELAY MICRO SEC
2 008 03045                       A0000000 VAR DELAY MICRO SEC
2 008 03053                       A0000000 FIX DELAY MICRO SEC
2 008 03061                       A0000000 BSP RD MICRO SEC
2 005 03066                       31110
2 007 03073                      & 000000
2 007 03080                      & 999999
2 009 03089                      &000000000
2 002 03091                      & 0
2 004 03095                         00 TIMES
2 004 03099                         00
2 004 03103                         00      THRU
2 004 03107                         00         TZB
2 004 03111                         00               TABLE
2 006 03117                      & 19977 TZB TBL TIME
2 017 03134                       BACKSPACE TOO FAR
2 001 03135                       ¤
2 024 03159                       BACKSPACE NOT FAR ENOUGH
2 001 03160                       ¤
2 028 03188                       UNDETERMINED ERROR AFTER BSP
2 001 03189                       ¤
5 010 03199                       WORK AREA
5 010 03209 00                    READ AREA
5 450 03659                       READ AREA
5 410 04069                       READ AREA OVERHANG.
5 004 04073                       CHECK CHARACTER DELAY
5 004 04077                       CORRECTION FOR BSP READ
5 004 04081
2 008 04089
5 002 04091                      &A8
```

CALCULATE AND CMP
GAP TIMINGS



FIND FIRST HI-LO
HI NO-DELAY

LO

LO

HI

TYPE OUT EACH BAD GAP
UPPER LIMIT NO DELAY

LOWER LIMIT

PREPARE AND DO TYPEOUT

OF BAD GAP - NO DELAY
000

BAD GAP T/O

FIND HI- LO FOR MIN DLY

TYPE OUT EACH BAD GAP

PREPARE AND DO TYPEOUT

MINIMUM DELAY
008

BAD GAP T/O

FROM PREVIOUS PAGE

```
Z13.....  04319 RAD H      3045
          04324 CMP 4      4704
          04329 TRH K      4354------
          04334 CMP 4      4712
          04339 TRH K      4364------
          04344 UNL 7      4712
          04349 TR  1      4364------
          04354 UNL 7      4704.....
          04359 TR  1      4334
          04364 ADM 6      4774.....

          04369 TRA I 01   4464 44W4-
          04374 CMP 4      4801
          04379 TRH K      4394------
          04384 CMP 4      4808
          04389 TRH K      4464------

          04394 UNL 7 01   4863 48W3.
          04399 RND E      0002
          04404 SPR 5      4880
          04409 SET B      0004
          04414 LOD 8      3213
          04419 UNL 7      4089
          04424 DIV W      4091
          04429 AAM @      4089
          04434 LDA #      4089
          04439 ADD G      4827
          04444 RND E      0002
          04449 SPR 5      4870
          04454 SEL 2      0500
          04459 WR  R      4860

          04464 RAD H      3053.....
          04469 CMP 4      4720
          04474 TRH K      4499------
          04479 CMP 4      4728
          04484 TRH K      4509------
          04489 UNL 7      4728
          04494 TR  1      4509------
          04499 UNL 7      4720.....
          04504 TR  1      4479
          04509 ADM 6      4784.....

          04514 TRA I 01   4574 45X4-------AA15
          04519 CMP 4      4801
          04524 TRH K      4539------
          04529 CMP 4      4808
          04534 TRH K      4574------AA15

          04539 UNL 7 01   4863 48W3.
          04544 RND E      0002
          04549 SPR 5      4880
          04554 LOD 8 06   4821 4YK1
          04559 SPR 5 06   4870 4YP0
          04564 SEL 2      0500
          04569 WR  R      4860
```

FIND HI-LO FOR VAR. DELAY
HI VAR DELAY

LO

LO

HI

TYPE OUT EACH BAD GAP
UPPER LIMIT - VAR DELAY

LOWER LIMIT

PREPARE AND DO TYPEOUT

BAD GAP - VAR. DEL

DELAY

BAD GAP T/O

FIND HI-LO
10 MSEC DELAY

LO

LO

HI

TYPEOUT EACH BAD GAP
UPPER LIMIT 10 MSEC DELAY

LOWER LIMIT

PREPARE AND DO TYPEOUT

OF BAD GAP-10 MSEC DELAY

0100

BAD GAP T/O

NEXT PAGE

```
AA14 04574 CMP 4 02  2983 29Q3          FIND HI-LO
     04579 TRE L     4634               RD AFTER BSP
     04584 RAD H     3061
     04589 CMP 4     4736
     04594 TRH K     4619
     04599 CMP 4     4744
     04604 TRH K     4629
     04609 UNL 7     4744
     04614 TR  1     4629
     04619 UNL 7     4736
     04624 TR  1     4599
     04629 ADM 6     4794

     04634 TRA I 05  4644 4WU4          TEST FOR 915 HALT
     04639 TR  1     4649
     04644 HLT J    22222 K222          915 OFF AND START
     04649 UNL 7 01  4654 46V4
     04654 SEL 2
     04659 TRS 0     4894-------AB16    CHECK FOR END OF READ
     04664 TR  1     2319-------U09     DO NEXT TIMING
```

CONSTANTS AND WORK AREA

```
2 008 04672   000000 HI NO DELAY
2 008 04680   999999 LO NO DELAY
2 008 04688   000000 HI MIN DELAY
2 008 04696   999999 LO MIN DELAY
2 008 04704   000000 HI VAR DELAY
2 008 04712   9999999 LO VAR DELAY
2 008 04720   000000 HI FIXED DELAY
2 008 04728   999999 LO FIXED DELAY
2 008 04736   000000 HI BSP-RD DELAY
2 008 04744   999999 LO BSQ-RD DELAY
2 010 04754  &A000000000 MEMORY COUNTER ND
2 010 04764   A000000000     MIN DELAY
2 010 04774  &A000000000                V.D.
2 010 04784  &A000000000                F.D.
2 010 04794  &A000000000             B.R.D.
2 007 04801   0000000 UPPER LIMIT
2 007 04808   0000000 LOWER LIMIT
2 004 04812  & 000
2 003 04815  &008 MIN GO DOWN MICRO-SEC
2 002 04817  &24 VARIABLE DLY INCREMENT
2 004 04821   0100
2 006 04827  & 00753
                                  UPPER LIMIT OF ACCEPTABLE
2 007 04834   0012080 729 II GAP TIME MYLAR
                                  LOWER LIMIT OF ACCEPTABLE
2 007 04841   0009173 729 II GAP TIME MYLAR
                                  UPPER LIMIT OF ACCEPTABLE
2 007 04848   0008053 729 IV GAP TIME MYLAR
                                  LOWER LIMIT OF ACCEPTABLE
2 007 04855   0006115 729 IV GAP TIME MYLAR
2 004 04859
2 025 04884   0200, 00.0 MSEC 00.0 MSEC
2 001 04885   □
```

DO FINAL CALCULATIONS
AND PREPARE TYPEOUT

```
AB11
AB15.....04894  SGN  T 14   7297  7BR7   HOUSEKEEPING
         04899  ADM  6 14   7297  7BR7   SIGN HI-LOWS
         04904  ADM  6 14   4672  4FP2
         04909  ADM  6 14   4680  4FQ0
         04914  ADM  6 14   4704  4G-4
         04919  ADM  6 14   4712  4GJ2
         04924  ADM  6 14   4720  4GK0
         04929  ADM  6 14   4728  4GK8
         04934  ADM  6 14   4736  4GL6
         04939  ADM  6 14   4744  4GM4
         04944  ADM  6 14   4688  4FQ8
         04949  ADM  6 14   4696  4FR6
         04954  SET  B 15   0019  0&A9
                       I
                       V
         04959  UNL  7 01   7255  72V5   WRITE FIRST TWO LINES
         04964  SET  B      0004         GROUP COUNTER
         04969  LOD  8      2994         TO T/O
         04974  SET  B      0003         SPACE
         04979  UNL  7      7269
         04984  SEL  2      0500
         04989  WR   R      7451
         04994  WR   R      7251
         04999  WR   R      7278
                       I
                       V
         05004  RCV  U      7412         CALCULATE NO DELAY AND
         05009  TMT  9 15   7298  7BI8   PREPARE TYPEOUT
         05014  TMT  9 15   7317  7CA7
         05019  RAD  H      4680
         05024  RND  E      0002
         05029  SPR  5      7417         LOW
         05034  RAD  H      4672
         05039  SUB  P      4680
         05044  RND  E      0002
         05049  SPR  5      7422         RANGE
         05054  SET  B      0004
         05059  LOD  8      2994         GROUP COUNTER
         05064  SET  B      0003
         05069  ST   F      4859
         05074  RAD  H      4754
         05079  DIV  W      4859
         05084  RND  E      0002
         05089  SPR  5      7427         AVERAGE
         05094  WR   R      7412
                       I
                       V
         05099  RCV  U      7412         CALCULATE MIN. DELAY AND
         05104  TMT  9 15   7298  7BI8   PREPARE TYPEOUT
         05109  TMT  9 15   7336  7CC6
         05114  RAD  H      4696
         05119  RND  E      0002
         05124  SPR  5      7417         LOW
         05129  RAD  H      4688
         05134  SUB  P      4696
         05139  RND  E      0002
         05144  SPR  5      7422         RANGE
         05149  RAD  H      4764
         05154  DIV  W      4859
         05159  RND  E      0002
         05164  SPR  5      7427         AVERAGE
         05169  WR   R      7412
                       I
                       V
```

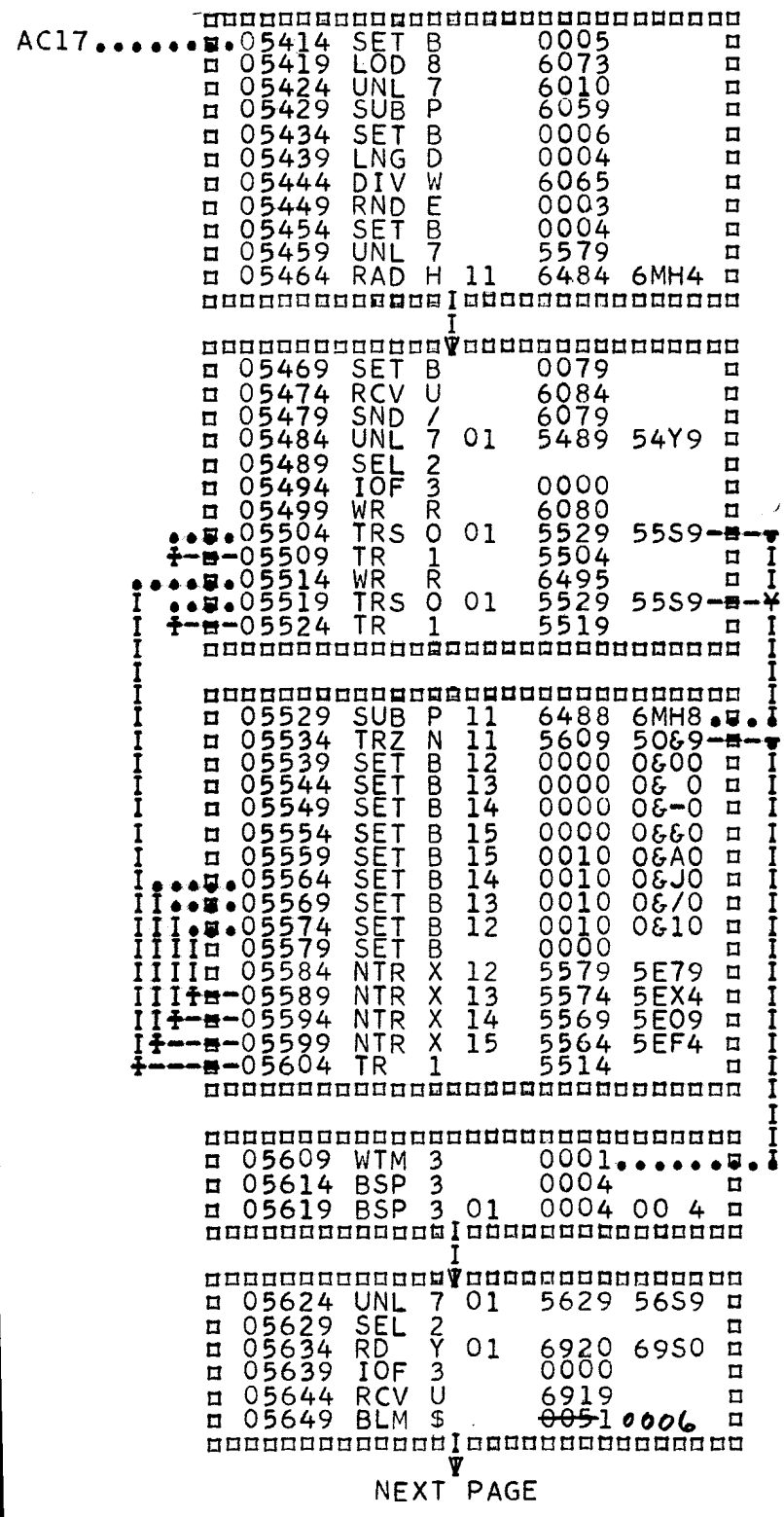
NEXT PAGE

FROM PREVIOUS PAGE

```
05174 RCV U      7412
05179 TMT 9 15   7298 7BI8   CALCULATE VARIABLE DELAY
05184 TMT 9 15   7355 7CE5   AND PREPARE TYPOUT
05189 RAD H      4712
05194 RND E      0002
05199 SPR 5      7417        LOW
05204 RAD H      4704
05209 SUB P      4712
05214 RND E      0002
05219 SPR 5      7422        RNG
05224 RAD H      4774
05229 DIV W      4859
05234 RND E      0002
05239 SPR 5      7427        AVERAGE
05244 WR  R      7412
```

```
05249 RCV U      7412
05254 TMT 9 15   7298 7BI8   CALCULATE 10 MSEC DELAY
05259 TMT 9 15   7374 7CG4   AND PREPARE TYPEOUTS
05264 RAD H      4728
05269 RND E      0002
05274 SPR 5      7417        LOW
05279 RAD H      4720
05284 SUB P      4728
05289 RND E      0002
05294 SPR 5      7422        RNG
05299 RAD H      4784
05304 DIV W      4859
05309 RND E      0002
05314 SPR 5      7427        AVERAGE
05319 WR  R      7412
```

```
05324 RCV U      7412
05329 TMT 9 15   7298 7BI8   CALCULATE READ AFTER BSP
05334 TMT 9 15   7393 7CI3   AND PREPARE TYPEOUT
05339 RAD H      4744
05344 RND E      0002
05349 SPR 5      7417        LOW
05354 RAD H      4736
05359 SUB P      4744
05364 RND E      0002
05369 SPR 5      7422
05374 RAD H      4794
05379 RND E      0004
05384 SPR 5      7427        AVERAGE
05389 WR  R      7412
05394 SEL 2      0912
05399 TRS O      5409--------  BYPASS 400 MS DLY
05404 TR  1      5414--------  TO 400 MS DLY
05409 TR  1      7459--------  TO CREEP TEST
```



NEXT PAGE

DELAY 400 MS WR
HOUSEKEEPING

SET UP DLY IN MS
UNL DLY TO T/O
5 MSEC DLY FOR NTR LOOP

UNL TO DLY
051 NUMBER OF RECORDS

SET UP REF RECORD

TURN TI OFF
400 X,S

@@@@@

001 FROM REC CTR

TOTAL LOOP GIVES A
DLY 10000 TIMES
THE SET INSTRUCTION

DLY 00400 MS WR

WR NEXT REC

OVER T M
TURN T I OFF 030
BLANK LAST ~~255~~ POS OF RD FLD
~~255~~ POSITIONS
030

```
05654 RCV U      6919        SET RCV FOR TZB TBL
05659 RAD H      3091        0
05664 LOD 8 06   5669 5W09
05669 NOP A      5704
05674 UNL 7 06   2394 2TR4
05679 UNL 7 03   2390 2310   1
05684 RAD H 10   6505 6N-5   51
05689 WR  R 02   0510 05J0   0060  0080  SET REC CTR FOR 51 (06) REC
05694 RD  Y      6520
05699 TR  1     20004 -004   TO TZB TBL

05704 SUB P 10   6502 6N-2   01 RETURN FROM TABLE EXIT
05709 TRZ N 10   5719 5PJ9
05714 TR  1     20004 -004

05719 LOD 8 06   5724 5XK4   HOUSEKEEPING
05724 NOP A      6924
05729 UNL 7 06   5779 5XP9
05734 RAD H      3073
05739 UNL 7      7214        RESET HI
05744 RAD H      3080
05749 UNL 7      7221        RESET LOW
05754 SET B      0010
05759 LOD 8      7249
05764 UNL 7      7231        RESET CTR
05769 NOP A      7174  6949
05774 LOD 8 06   5769 5X09

05779 LDA #
05784 CMP 4 06   5779 5XP9
05789 TRE L      5879--------AD20  TO COMPUTE AND T/O
05794 SUB P      3012        39974
05799 SHR C      0001        DIV BY 10
05804 MPY V      3018        05 TZB TIME
05809 ADD G      6509        035 DLY BEFORE ENTERING TBL
05814 SUB P      4081
05819 SUB P      4073        CHK CHAR DLY

05824 CMP 4      7214        HI
05829 TRH K      5854
05834 CMP 4      7221        LOW
05839 TRH K      5864
05844 UNL 7      7221        LOW
05849 TR  1      5864
05854 UNL 7      7214        HI
05859 TR  1      5834
05864 ADM 6      7231        ADD TO CTR
05869 ADM 6 05   5779 5XX9   STEP LDA &5
05874 TR  1      5779
```

```
AD19.....05879  SGN  T       5929
         05884  ADM  6       7214
         05889  ADM  6       7221
         05894  RCV  U       6018
         05899  SET  B  15   0019  O&A9
         05904  TMT  9  15   5980  5IHO
         05909  TMT  9  15   5999  5II9
         05914  RAD  H       7221
         05919  RND  E       0002
         05924  SPR  5       6023
         05929  RAD  H       7214
         05934  SUB  P       7221
         05939  RND  E       0002
         05944  SPR  5       6028
         05949  RAD  H       7231
         05954  DIV  W       6514
         05959  RND  E       0002
         05964  SPR  5       6033
         05969  SEL  2       0500
         05974  WR   R       6018
                      I
                      V
         05979  TR   1       7459------------AE22
```

COMPUTE AND TYPEOUT

LOW

RANGE
0050
AVERAGE

TO CREEP TEST

```
                                                    CONSTANTS
2 019 05998                                          00.0 00.0 00.0 MSC
2 019 06017                                          DELAY  0400 MS,WR
2 019 06036                                         T/O
2 019 06055                                               AREA
2 001 06056                                          □
2 003 06059                                         & 05 MSEC DLY FOR NTR LOOP
2 001 06060                                          □
2 001 06061                                         &1
2 004 06065                                         & 101
2 003 06068                                         & 05 TZB INSTRUCTION TIME
2 005 06073                                          00400 DLY IN MILLI SEC
2 005 06079 00                                       XXXXX
2 050 06129 00
2 050 06179
2 050 06229
2 050 06279
2 050 06329
2 050 06379
2 050 06429
2 045 06474
2 005 06479                                          XXXXX
2 001 06480                                          □
2 004 06484                                         &~~051~~ 006
2 004 06488                                         & 001
2 005 06494 00
2 005 06499                                          @@@@@
2 001 06500                                          □
2 002 06502                                         &01
2 003 06505                                         &~~51~~ 06
2 004 06509                                         & 035 DLY BEFORE ENTERING TBL
2 005 06514                                         &~~0050~~ 0005
2 001 06515                                          □
5 400 06919 00                                         READ
2 050 06969
2 050 07019                                               AREA
2 050 07069                                                     650 POSITIONS
2 050 07119
2 050 07169
2 001 07170                                          □
2 002 07172                                          00
2 010 07182                                          0000000000
2 001 07183                                          □
2 008 07191                                            000000 HI 400 MS DLY
2 008 07199                                            999999 LOW 400 MS DLY
2 008 07207                                          A0000000 FIX DLY 400 MS
2 007 07214                                         & 000000  HI
2 007 07221                                         & 999999  LOW
2 010 07231                                         &A000000000  CTR
2 008 07239                                         &A0000000
2 010 07249                                         &A000000000

                                                                CONSTANTS
2 027 07276                                          ~~0200~~ 729 II,   224 GROUPS
2 001 07277                                          □
2 018 07295                                           LOW  RNG AVERAGE
2 001 07296                                          □
2 001 07297                                          A
2 019 07316                                           00.0 00.0 00.0 MSC
2 019 07335                                           NO DELAY WHILE WR
2 019 07354                                           MIN DELAY WHILE WR
2 019 07373                                           VARIABLE DELAY, WR
2 019 07392                                           DELAY 10 MSEC, WR
2 019 07411                                           RD AFTER BACKSPACE
2 019 07430                                         TYPE
2 019 07449                                               OUT
2 001 07450                                          □          AREA
2 001 07451                                             SPACE
2 001 07452                                          □
```

```
AE17
AE20
AE24
AE25.....07459 RAD H 15  8627 8FB7    HOUSEKEEPING
         07464 RAD H     8621         RESET MEMORY COUNTER
         07469 ST  F     8838
                  I
                  V
AF24.....07474 LOD 8 06  7479 7UP9    MODIFY RETURN TRANSFER
         07479 NOP A     7649
         07484 UNL 7 06  2394 2TR4
         07489 UNL 7 03  2390 23I0
                  I
                  V
         07494 UNL 7 01  7499 74Z9    WRITE TAPE MARKS
         07499 SEL 2
         07504 WTM 3     0001
         07509 WTM 3     0001
         07514 IOF 3     0000
                  I
                  V
         07519 PTW 3     0029         SKIP AND WRITE A
         07524 WR  R     8595
         07529 TRS O 03  7534 75C4
         07534 TRS O 02  8104 81-4-----AJ24  CHL CHK
         07539 TRS O     8139------8------AK24  UNEXPECTED E.O.F.
                  I
                  V
         07544 PTW 3     0029         SKIP AND WRITE B
         07549 WR  R     8605
         07554 TRS O 03  7559 75E9
         07559 TRS O 02  8104 81-4----AJ24
         07564 TRS O     8139------8------AK24  UNEXPECTED E.O.F.
                  I
                  V
         07569 PTW 3     0029         SKIP AND WRITE C
         07574 WR  R     8610
         07579 TRS O 03  7584 75H4
         07584 TRS O 02  8104 81-4----AJ24
         07589 TRS O     8139------8------AK24  UNEXPECTED E.O.F.
                  I
                  V
         07594 WR  R 02  0030 00L0    BACKSPACE THREE RECORDS
         07599 BSP 3     0004
         07604 RCV U     8844
         07609 BLM $     0008
         07614 RAD H     8627
                  I
                  V
AG24
AG25.....07619 SET B 10  0001 0--1    READ FIRST RECORD AND
         07624 LOD 8 10  8603 80-3    TIME SECOND RECORD
         07629 WR  R 02  0020 00K0    SET RECORD COUNTER
         07634 RCV U     8849
         07639 RD  Y     8840
         07644 TR  1    20004 -004

         07649 CMP 4 10  8840 8QM0    CHECK RECORD READ
         07654 LOD 8 06  7659 7WN9
         07659 NOP A     7684
         07664 UNL 7 06  2394 2TR4
         07669 RAD H     8622
         07674 TRE L    20004 -004    TO TABLE
         07679 TR  1     8169------8------AL24  OUT OF STEP
```

```
          07684 ST   F       8889
          07689 RCV  U       8654
          07694 SND  /       8854
          07699 LDA  #       8654
          07704 SUB  P       8633
          07709 SHR  C       0001
          07714 MPY  V       8636
          07719 ST   F       8904
          07724 RAD  H       8889
          07729 MPY  V       8641
          07734 ADD  G       8904
          07739 ST   F       8665
          07744 LOD  8 06    7749 7XM9
          07749 NOP  A       7979
          07754 UNL  7 06    2394 2TR4
          07759 SET  B 10    0001 0--1
          07764 LOD  8 10    8603 80-3
```

COMPUTE TIME OF BASIC SKIP

39974
DIVIDE BY TEN
05 TZB TIME
TABLE TIME
TIMES THRU TABLE
19977

```
          07769 BSP  3       0004
          07774 SET  B       0000
          07779 WR   R       8605
          07784 BSP  3       0004
          07789 SET  B       0000
          07794 WR   R       8605
          07799 BSP  3       0004
          07804 SET  B       0000
          07809 WR   R       8605
          07814 BSP  3       0004
          07819 SET  B       0000
          07824 WR   R       8605
          07829 BSP  3       0004
          07834 SET  B       0000
          07839 WR   R       8605
          07844 BSP  3       0004
          07849 SET  B       0000
          07854 WR   R       8605
          07859 BSP  3       0004
          07864 SET  B       0000
          07869 WR   R       8605
          07874 BSP  3       0004
          07879 SET  B       0000
          07884 WR   R       8605
          07889 BSP  3       0004
          07894 SET  B       0000
          07899 WR   R       8605
          07904 BSP  3       0004
          07909 SET  B       0000
          07914 WR   R       8605
```

BACKSPACE WRITE TEN TIMES

```
          07919 TRA  I 03    7929 79B9
          07924 TR   1       7934
          07929 HLT  J      33333 C333
```

OPTIONAL STOP AFTER
WRITE BACKSPACE TEST

```
          07934 WR   R 02    0020 00K0
          07939 BSP  3       0004
AH25      07944 RCV  U       8844
          07949 BLM  $       0008
          07954 RAD  H       8622
```

BACKSPACE TO TIME CREEP

```
          07959 WR   R 02    0020 00K0
          07964 RCV  U       8849
          07969 RD   Y       8840
          07974 TR   1      20004 -004
```

MEASURE CREEP

```
                                                    CHECK FOR CORRECT GAP
 07979 CMP 4 10   8840 8QM0
 07984 LOD 8 06   7989 7ZQ9
 07989 NOP A      8014
 07994 UNL 7 06   2394 2TR4
 07999 RAD H      8622
 08004 TRE L     20004 -004                         TO TABLE
 08009 TR  1      8339------------------AP25        OUT OF STEP

 08014 ST  F      8894                               COMPUTE TIME-SKIP PLUS CREEP
 08019 RCV U      8884
 08024 SND /      8854
 08029 LDA #      8884
 08034 SUB P      8633                               39974
 08039 SHR C      0001                               DIVIDE BY TEN
 08044 MPY V      8636                               05 TZB TIME
 08049 ST  F      8904                               TABLE TIME
 08054 RAD H      8894                               TIMES THRU TABLE
 08059 MPY V      8641                               19977
 08064 ADD G      8904
 08069 SUB P      8665                               BASIC SKIP
 08074 SET B      0005
 08079 ADM 6      8838                               TO COUNTER
 08084 ADD G 15   8623 8FB3
 08089 CMP 4 15   8655 8FE5
 08094 TRE L      8494------------------AQ25
 08099 TR  1      7474------------------AF22

AJ22.. 08104 SEL 2      0500                         CHL CHECK ON WRITE-START
       08109 UNL 7 01   8760 87W0                    TO RESTART CREEP TEST
       08114 WR  R      8724
       08119 UNL 7 01   8124 81S4
       08124 SEL 2
       08129 HLT J      0005
       08134 TR  1      7459------------------AE22  TO RESTART CREEP TEST

AK22.. 08139 IOF 3      0000                         UNEXPECTED END OF FILE-
       08144 RWD 3      0002                         RESTARTING CREEP TEST
       08149 SEL 2      0500
       08154 UNL 7 01   8805 88 5
       08159 WR  R      8762
       08164 TR  1      7459------------------AE22

AL22.. 08169 TRS 0 03   8174 81G4-----+-+            PROGRAM OUT OF STEP
       08174 CMP 4 10   8850 8QN0....+.I
       08179 TRE L      8204------------+-+
       08184 LOD 8 10   8612 8QJ2       I I
       08189 CMP 4 10   8850 8QN0       I I
       08194 TRE L      8254------------+-+-----AM25
       08199 TR  1      8304------------+-+-----AN25
                                         I
                                         I
                                         I
       08204 SEL 2      0500.....+.+.I              TAPE STEPPED BACKWARD-START
       08209 UNL 7 01   8827 88S7                   TO PLACE BACK IN STEP
       08214 WR  R      8807                        AND PROCEED WITH TEST
       08219 UNL 7 01   8224 82S4
       08224 SEL 2
       08229 HLT J      0006
       08234 BSP 3      0004
       08239 BSP 3      0004
       08244 IOF 3      0000
       08249 TR  1      7619------------------AG22
```

```
AM24 08254 SEL 2      0500
     08259 UNL 7 01   8827 88S7
     08264 WR  R      8807
     08269 UNL 7 01   8274 82X4
     08274 SEL 2
     08279 HLT J      0007
     08284 BSP 3      0004
     08289 BSP 3      0004
     08294 BSP 3      0004
     08299 TR  1      7619------AG22
```

TAPE STEPPED FORWARD-START TO PLACE BACK IN STEP AND PROCEED WITH TEST

```
AN24 08304 SEL 2      0500
     08309 UNL 7 01   8698 86Z8
     08314 WR  R      8666
     08319 UNL 7 01   8304 83 4
     08324 SEL 2
     08329 HLT J      0008
     08334 TR  1      7459------AE22
```

UNDETERMINED ERROR AFTER BACKSPACE-START WILL RESTART THE CREEP TEST ON THE PRESENT DRIVE

```
AP24 08339 TRS 0 03   8344 83D4
     08344 CMP 4 10   8850 8QNO
     08349 TRE L      8374------
     08354 LOD 8 10   8612 8QJ2
     08359 CMP 4 10   8850 8QNO
     08364 TRE L      8434------
     08369 TR  1      8304
```

PROGRAM OUT OF STEP

```
     08374 SEL 2      0500
     08379 UNL 7 01   8827 88S7
     08384 WR  R      8806
     08389 UNL 7 01   8394 83Z4
     08394 SEL 2
     08399 HLT J      0009
     08404 BSP 3      0004
     08409 SET B 10   0001 0--1
     08414 LOD 8 10   8603 80-3
     08419 BSP 3      0004
     08424 IOF 3      0000
     08429 TR  1      7944------AH23
```

TAPE STEPPED BACKWARD-START TO PROCEED WITH TEST

```
     08434 SEL 2      0500
     08439 UNL 7 01   8827 88S7
     08444 WR  R      8806
     08449 UNL 7 01   8454 84V4
     08454 SEL 2
     08459 HLT J      0010
     08464 SET B 10   0001 0--1
     08469 LOD 8 10   8603 80-3
     08474 BSP 3      0004
     08479 BSP 3      0004
     08484 BSP 3      0004
     08489 TR  1      7944------AH23
```

TAPE STEPPED FORWARD-START TO PROCEED WITH TEST

```
AQ24 08494 ST  F 15   8908 8I&8
     08499 RAD H      8908
     08504 MPY V      8625
     08509 ST  F      8904
     08514 RAD H      8838
     08519 DIV W      8904
```

COMPILE AND COMPUTE NUMBER OF TIMES 10

MEMORY COUNTER

NEXT PAGE

```
08524 NOP A      8539------+-+      SW FOR 729 IV
08529 MPY V      8645      | I      TAPE SPEED
08534 TR  1      8544------+-+-+
08539 MPY V      8649......+.+I     TAPE SPEED
                           I  I
                           I  I
08544 RND E      0005......+..I     TYPE CREEP
08549 SET B      0004       |
08554 SPR 5      8718       |
08559 SEL 2      0500       |
08564 WR  R      8700<-     |
08569 UNL 7 01   8574 85X4  |
08574 SEL 2                 |
08579 RWD 3      0002       |
08584 TR  1      1089------+-------H05
```

CONSTANTS AND WORK AREA

```
2 005 08589                & 0000
2 003 08592                & 00
2 009 08603 00              AAAAAAAAA
2 001 08604                 |
2 003 08607 00              BBB
2 001 08608                 |
2 003 08612 00              CCC
2 001 08613                 |
2 008 08621                & 0000000
2 001 08622                &0
2 001 08623                &1
2 002 08625                &10 NUMBER OF WR BSP PER PASS
2 002 08627                & 0
2 006 08633                & 39974
2 003 08636                & 05
2 005 08641                &19977
2 004 08645                &0750 TAPE SPEED 729 II
2 004 08649                &1125 TAPE SPEED 729 IV
2 005 08654 00              00000 BASIC UNL
2 001 08655                 3 TIMES THROUGH CREEP SECTION
2 010 08665                 A000000000 BASIC IN MICRO SEC
2 033 08698                 UNDETERMINED ERROR AFTER BSP
2 001 08699                 |
2 023 08722                 BSP WR CREEP 00.00 IN.
2 001 08723                 |
2 037 08760                 CHL  CHK ON WR,DURING CREEP
2 001 08761                 |
2 044 08805                 UNEXPECTED E.O.F., RESTARTING CREEP TEST
2 001 08806                 |
2 021 08827                 TAPE OUT OF STEP
2 001 08828                 |
5 010 08838                 MEMORY COUNTER
5 010 08849 00              READ R1
5 005 08854 00              READ R2
5 005 08859 00              READ R3
5 020 08879                 DUMMY READ AREA
5 005 08884 00              WORK AREA
5 005 08889 00              TIMES THRU TABLE 1ST
5 005 08894 00              TIMES THRU TABLE 2ND
5 010 08904                 WORK AREA
5 004 08908                 WORK AREA
```

MOTION TEST-916 ON
WILL BYPASS THIS TEST

```
                                                                    TAPE DRIVE MUST BE READY
AR07.....08914 UNL 7 01  8919 89/9
        08919 SEL 2
        08924 TRS 0 03  8929 89B9-----
                                                                    PLACE G.M.
        08929 SET B 15  0001 0&&1.....                              G.M.
        08934 LOD 8 15  9169 9AF9
        08939 UNL 7 15 39999 III9                                   REMOVE GM FROM 8TR06
        08944 LOD 8 15 18570 YEG0
        08949 LOD 8 15 18587 YEH7
        08954 LOD 8 15 18629 YFB9
        08959 UNL 7 02 18570 Y5P0
        08964 UNL 7 02 18587 Y5Q7
        08969 UNL 7 02 18629 Y6K9
        08974 SET B 14  0001 0&-1
        08979 LOD 8 14 18638 YFL8
        08984 UNL 7 02 18638 Y6L8                                   REMOVE G.M. FROM 8LD01
        08989 NOP A     9039------                                  SW 729 IV
                                                                    HOUSEKEEP 729 II
        08994 LOD 8 06  8999 8ZR9                                   LOWER LIMIT MOD II
        08999 NOP A    13360 T360
        09004 UNL 7 06  9084 9 Q4                                   555
        09009 RAD H 10  9153 9JN3
        09014 ST  F 10  9162 9JO2                                   UPPER LIMIT MOD II
        09019 LDA #     9024
        09024 NOP A    25570 N570
        09029 UNL 7     9168
        09034 TR  1     9084------
                                                                    HOUSEKEEPING FOR 729 IV
        09039 LOD 8 06  9044 9 M4.....
        09044 NOP A    13360 T360                                   555
        09049 UNL 7 06  9084 9 Q4
        09054 RAD H 10  9157 9JN7                                   UPPER LIMIT 729 IV
        09059 ST  F 10  9162 9JO2
        09064 LDA #     9069
        09069 NOP A    26125 0125
        09074 UNL 7     9168
        09079 TR  1     9084------
                                                                    WRITE LONG RECORD
        09084 WR  R     0000.....
        09089 LDA #     9084
        09094 CMP 4     9168
        09099 TRH K     9129------
                                                                    REWIND
        09104 RWD 3     0002
        09109 LDA # 09  9084 9-Y4
        09114 ADD G 09  9162 9JW2
        09119 ULA * 09  9084 9-Y4
        09124 TR  1     9084
                                                                    REPLACE GM
        09129 UNL 7 15 18570 YEG0.....
        09134 UNL 7 15 18587 YEH7
        09139 UNL 7 15 18629 YFB9
        09144 UNL 7 14 18638 YFL8
        09149 TR  1     1089------------H05
```

CONSTANTS

```
2 004 09153                & 555 BITS PER IN, MOD II HI DEN
2 004 09157                & 555 BITS PER IN, MOD IV HI DEN
2 005 09162                 00000 DECREMENT
2 006 09168                 000000
2 001 09169                 ¤

2 004 09157                & 555 BITS PER IN, MOD IV HI DEN
2 005 09162                 00000 DECREMENT
2 006 09168                 000000
2 001 09169                 ¤
```