

INTER-RECORD-GAP MEASUREMENT

REPRODUCTION

A. PURPOSE OF TEST

TO WRITE PAIRS OF RECORDS ON THE 729 MODEL II OR IV IN HIGH DENSITY AND MEASURE THE INTER-RECORD GAP BETWEEN THE TWO RECORDS IN MILLISECONDS. THE TEST IS EXECUTED IN TWO PARTS AND MUST BE RUN CONSECUTIVELY:

PART I - IRG MEASUREMENT - WRITE WRITES THE RECORDS ON TAPE DRIVE #4 AND FORMS GAPS UNDER SEVEN CONDITIONS OF WRITING:

GROUP	PAIRS OF RE-CORDS IN GROUP	DOWN TIME OF GO LINE BETWEEN WRITES		PRINTOUT COMMENT
		MODEL IV	MODEL II	
1	100	0.83 MS	1.20 MS	MINIMUM DLY
2	100	0.95 - 2.09 MS	1.33 - 2.47 MS	1-2 MS DLY
3	100	1.98 - 4.26 MS	2.35 - 4.64 MS	2-4 MS DLY
4	100	3.89 - 11.86 MS	4.26 - 12.23 MS	4-12 MS DLY
5	100	11.86 MS	12.23 MS	12 MS DLY
6	10	5 SECONDS	5 SECONDS	5 SEC DLY
7	10	0.83 MS	1.20 MS	MIN & CREEP

NOTE: DOWN TIMES OF GO LINE SHOWN IN ABOVE TABLE ARE ROUNDED TO THE NEAREST 0.01 MS. IN GROUP 7, THE SECOND RECORD OF EACH PAIR IS BACKSPACED AND RE-WRITTEN ONCE, BUT MAY BE CHANGED AS DESCRIBED LATER.

PART II - IRG MEASUREMENT - READ READS THE RECORDS, MEASURES THE GAPS IN MILLISECONDS, AND PRINTS THE RESULTS FOR EACH OF THE SEVEN CONDITIONS. (SEE PRINTOUT EXAMPLE ON PAGE 5.)

B. LOADING PROCEDURES

1. WHEN RUNNING TEST FROM CARDS:
  - A. SET WORKING TAPE DRIVE TO 4 AND HIGH DENSITY.
  - B. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.
2. WHEN RUNNING TEST FROM TAPE:
  - A. SET WORKING TAPE DRIVE TO 4 AND HIGH DENSITY.
  - B. ENTER A 1 IN 1269.

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DIAGNOSTIC FUNCTION TEST

REPRODUCTION

C. PROGRAM CONTROL

- B ON - VARIES THE NUMBER OF CHARACTERS IN THE FIRST RECORD OF EACH PAIR FROM 150 TO APPROXIMATELY 1150 CHARACTERS.  
 OFF - WRITES A FIXED 10-CHARACTER RECORD AS THE FIRST RECORD OF EACH PAIR.
- C ON - FOR TESTING 729 MODEL IV  
 OFF - FOR TESTING 729 MODEL III
- G ON - FOR MACHINES WITH ADVANCED PROGRAM FEATURE.  
 OFF - FOR MACHINES WITHOUT ADVANCED PROGRAM FEATURE.

D. TEST PROCEDURE

THE FIRST INSTRUCTION IS A STOP CODE IN LOCATION 399. THIS STOP ALLOWS THE OPERATOR TO SET TAPE DRIVE ON 4, SET SENSE SWITCHES B, C, AND G AS DESIRED, AND MANUALLY MAKE TWO CHANGES IN THE PROGRAM AS FOLLOWS:

1. TO CHANGE THE 5 SECONDS DELAY IN GROUP 6 TO ANY DESIRED DELAY FROM 1 TO 39 SECONDS, CHANGE THE 5 (NO WM) IN LOCATION 098 TO APPROPRIATE CHARACTER.  
 EXAMPLES:

2 FOR 2 SECONDS DELAY  
 + FOR 10 SECONDS DELAY  
 V FOR 15 SECONDS DELAY

2. TO CHANGE THE NUMBER OF BKSP-REWRITES IN GROUP 7 TO ANY NUMBER FROM 1 TO 39 TIMES, CHANGE THE 1 (NO WM) IN LOCATION 122 TO APPROPRIATE CHARACTER.  
 EXAMPLES:

3 FOR 3 BKSP-REWRITES  
 S FOR 12 BKSP-REWRITES  
 O FOR 20 BKSP-REWRITES

THE INSTRUCTIONS ARE SET UP TO WRITE 100 PAIRS OF RECORDS WITH MINIMUM DELAY FOR GROUP 1. DEPENDING UPON THE SETTING OF SENSE SWITCH B, THE FIRST RECORD OF EACH PAIR MAY BE A FIXED 10-CHARACTER RECORD ALWAYS WRITTEN FROM LOCATIONS 540-549 (1240-1249) OR MAY BE

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# DIAGNOSTIC FUNCTION TEST

VARIED TO START THE FIRST PAIR WITH A 10-CHARACTER RECORD AND INCREASE THE FIRST RECORD OF EACH SUCCEEDING PAIR BY 10. THIS IS DONE BY DECREASING THE B ADDRESS OF THE TAPE WRITE INSTRUCTION FROM S40 TO S30 TO S20 TO S10, ETC. THE FIRST RECORD OF THE LAST PAIR (100) IS A 1000-CHARACTER RECORD WRITTEN FROM LOCATIONS 240-1249.

THE SECOND RECORD OF EACH PAIR IS ALWAYS THE SAME. IT STARTS WITH A TAPE MARK STORED BY THE PROGRAM IN LOCATION /19 (1119) AND CONTINUES TO LOCATION 1249. AFTER ALL THE RECORDS FOR GROUP 1 ARE WRITTEN ON TAPE A COMMAND IS THEN GIVEN TO WRITE A SPACER RECORD TO SIGNAL THE END OF THE GROUP. THIS RECORD IS THE SAME AS THE SECOND RECORD OF EACH PAIR EXCEPT THAT IT STARTS WITH THE LETTERS "IRG" STORED IN LOCATIONS 1116-1118.

THE PROGRAM THEN BRANCHES TO A SET OF INSTRUCTIONS TO VARY THE DELAY FOR GROUP 2 AND PROCEED TO WRITE 100 PAIRS OF RECORDS IN THE SAME MANNER AS FOR GROUP 1. THE PROCEDURE IS REPEATED FOR GROUPS 3, 4, AND 5 AFTER MODIFYING THE DELAY INSTRUCTIONS FOR EACH GROUP AS REQUIRED.

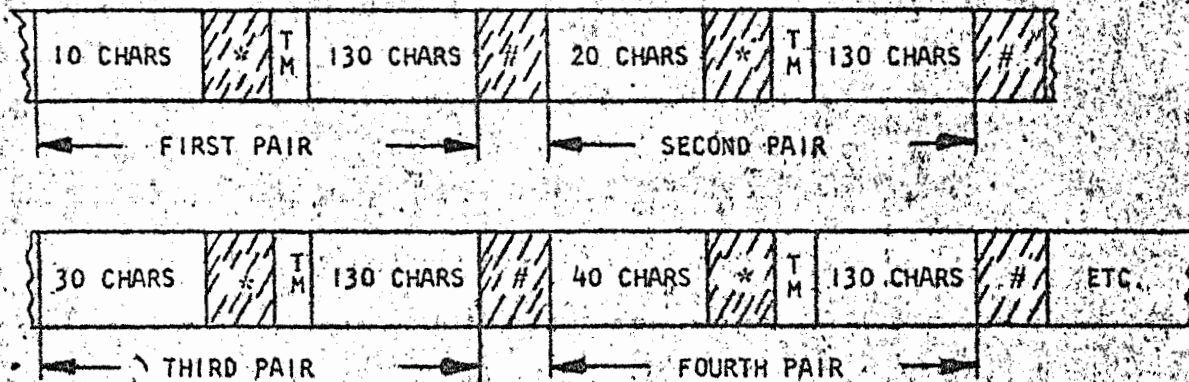
FOR GROUP 6 THE TAPE WRITE INSTRUCTIONS ARE MODIFIED TO WRITE 10 PAIRS OF RECORDS WITH A 5 SECONDS DELAY. THE PROCEDURE FOR GROUP 6 IS THE SAME AS FOR GROUPS 1, 2, 3, 4, AND 5 EXCEPT THAT WITH SENSE SWITCH B ON THE FIRST RECORD OF EACH PAIR IS VARIED IN LENGTH IN THE FOLLOWING MANNER:

- 1ST PAIR - 10 CHARACTERS
- 2ND PAIR - 110 CHARACTERS
- 3RD PAIR - 210 CHARACTERS
- ETC.
- 10TH PAIR - 910 CHARACTERS

FOR GROUP 7 THE PROCEDURE IS THE SAME AS FOR GROUP 6 EXCEPT THAT THE SECOND RECORD OF EACH PAIR IS BACKSPACED AND REWRITTEN ONCE TO TEST FOR CREEP (MAY BE MANUALLY CHANGED); ALSO THE TAPE WRITE INSTRUCTIONS ARE EXECUTED WITH MINIMUM DELAY THE SAME AS FOR GROUP 1.

THE LAST SET OF INSTRUCTIONS EXECUTED IN THE WRITE PROGRAM WRITES A TAPE MARK, REWINDS TAPE DRIVE 4, AND LOADS THE IRG MEASUREMENT - READ PROGRAM IMMEDIATELY FOLLOWING.

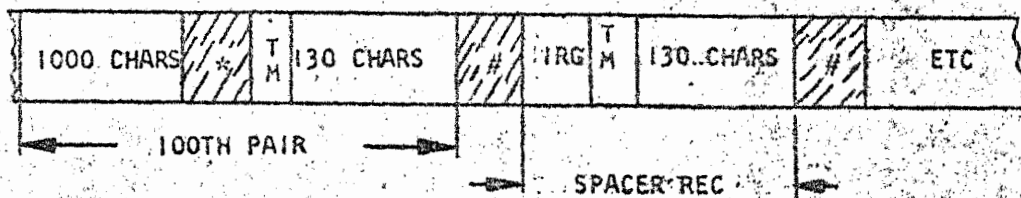
SCHEMATIC OF TAPE WRITTEN FOR GROUPS 1-5 WITH SENSE SWITCH B ON



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# DIAGNOSTIC FUNCTION TEST

PART NO. 451217  
 SHEET 4 OF 22  
 BLOCK NO. 55000



NOTE: \* INDICATES INTER-RECORD GAPS MEASURED.  
 # INDICATES INTER-RECORD GAPS NOT MEASURED.

THE IRG MEASUREMENT - READ PROGRAM IS EXECUTED IN THE FOLLOWING MANNER:

AFTER CLEARING THE PRINT AREA, TESTING FOR A "I" IN S52 TO PRINT OR BY-PASS THE TITLE, AND AGAIN REWINDING TAPE DRIVE #4, THE PROGRAM BRANCHES TO A SERIES OF INSTRUCTIONS TO SET UP THE ROUTINE FOR MEASURING THE GAPS.

THE FOLLOWING AREAS ARE SET UP IN STORAGE TO CONTROL THE OPERATION FOR EACH GROUP:

1. A GROUP COUNTER TO COUNT EACH GROUP AND CONTROL THE SETTING UP OF INSTRUCTIONS FOR EACH OF THE SEVEN GROUPS IN THE TEST.
2. A GAP COUNTER TO COUNT THE NUMBER OF GAPS IN A GROUP (100 FOR GROUPS 1-5; 10 FOR GROUPS 6-7).
3. AN AREA FOR MINIMUM GAP USED TO STORE THE SHORTEST GAP IN MILLISECONDS WITHIN A GROUP.
4. AN AREA FOR MAXIMUM GAP USED TO STORE THE LONGEST GAP IN MILLISECONDS WITHIN A GROUP.
5. A COUNTER TO ACCUMULATE THE TOTAL TIME IN MILLISECONDS FOR ALL GAPS MEASURED WITHIN A GROUP. THIS INCLUDES CORRECTION FACTOR TO ALLOW FOR RDD 144 RESTART TIME (144 USEC FOR MODEL IV, SENSE SWITCH C ON; 216 USEC FOR MODEL II, SENSE SWITCH C OFF).
6. A DELAY LOOP COUNTER TO KEEP TRACK OF THE NUMBER OF TIMES THE LOOP IS EXECUTED BEFORE A TAPE MARK IS SENSED.
7. SET UP TIME FACTOR TO BE USED FOR EACH DELAY LOOP. THIS IS UNDER CONTROL OF SENSE SWITCH G. FOR A SYSTEM WITHOUT INDEXING (SWITCH OFF), THE TIME FACTOR IS 529 USEC; WITH INDEXING (SWITCH ON), THE TIME FACTOR IS 541 USEC. THE TIME FACTOR USED IS ADDED INTO THE ACCUMULATING COUNTER (ITEM 5) EACH TIME THE LOOP IS EXECUTED. AT THE END OF THE GROUP THIS COUNTER WILL CONTAIN THE TOTAL TIME IN MILLISECONDS FOR ALL GAPS MEASURED WITHIN THE GROUP.

THE FIRST RECORD OF EACH PAIR IS READ IN THE NORMAL MANNER. IMMEDIATELY FOLLOWING THIS INSTRUCTION, A DIAGNOSTIC READ INSTRUCTION (J004A) IS EXECUTED. THIS INSTRUCTION ALLOWS EXECUTION OF THE DELAY LOOP INSTRUCTIONS REPEATEDLY WHILE THE GAP IS PASSING THE READ HEAD UNTIL THE TAPE MARK (FIRST CHARACTER OF THE SECOND RECORD OF EACH PAIR) IS SENSED. TWO ERROR CONDITIONS, IF ANY, ARE DETECTED DURING DIAGNOSTIC READ:

1. IF THE EOR (TAPE MARK) INDICATOR REMAINED ON IMMEDIATELY AFTER THE DIAGNOSTIC READ (LOOP COUNTER 00). THE CONDITION IS FLAGGED BY THE SYMBOL \*ERROR IN THE PRINTOUT LINE FOR THE GROUP.

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- IF THE EOR INDICATOR NEVER CAME ON AFTER THE DIAGNOSTIC READ AND THE LOOP COUNTER REACHES 100 (APPROXIMATELY 50 MS). THE CONDITION IS FLAGGED BY THE SYMBOL ERROR \* IN THE PRINTOUT LINE FOR THE GROUP.

GAP TIME FOR EITHER OF THE ABOVE CONDITIONS IS NOT INCLUDED IN THE ACCUMULATING COUNTER. EACH GAP MEASURED WITHIN THE GROUP IS TESTED FOR MAXIMUM AND MINIMUM AS WELL AS ADDED INTO THE ACCUMULATING COUNTER. WHEN THE LAST GAP OF A GROUP HAS BEEN MEASURED, AN INSTRUCTION IS THEN EXECUTED TO READ THE SPACER RECORD WHICH TRAILS THE GROUP, LOAD IRG (FIRST THREE CHARACTERS) AND COMPARE THEM WITH IRG IN STORAGE. AN EQUAL COMPARISON INDICATES THAT THE TAPE AND THE PROGRAM ARE IN STEP IN WHICH CASE THE PROGRAM PROCEEDS TO LOAD AND PRINT THE RESULTS FOR THE GROUP AND CONTINUE WITH THE NEXT GROUP.

A TAPE READ ERROR BACKSPACES THE TAPE AND RE-READS THE SPACER RECORD FOR ANOTHER TRY. A COMPARE ERROR STOPS THE MACHINE AT LOCATION 755 AND INDICATES THAT THE TAPE AND THE PROGRAM ARE OUT OF STEP, POSSIBLY CAUSED BY READING A NOISE RECORD. IN THIS CASE, IT IS ADVISABLE TO RE-RUN THE WRITE PORTION OF THE TEST.

THE TEST IS COMPLETED AT THE END OF GROUP 7 AT WHICH TIME DRIVE #4 IS RE-WOUND AND THE PROGRAM FOR THE NEXT TEST IS LOADED.

E. STOPS

STORAGE ADDRESS REGISTER

- 400 HALT - SET UP DRIVE 4
- 756 ERROR IN READING SPACER RECORD
- 930 ERROR - CHECK RESULTS IF NO PRINTER OR NO 1 IN 1252

F. PRINTOUTS

SAMPLE PRINTOUT WITH MODEL II TAPE DRIVE UNIT

IRG MEASUREMENT - WRITE 5500

IRG MEASUREMENT - READ 5500

WRITE CONDITION	MAX	MIN	AVG	RANGE OF GAPS IN MS	
MINIMUM DLY	12.8	11.0	11.7	1.8	
1-2 MS DLY	12.8	10.8	11.8	1.9	
2-4 MS DLY	12.8	11.0	11.9	1.8	
4-12 MS DLY	12.8	9.8	10.7	3.0	
12 MS DLY	10.8	9.8	10.2	1.1	*ERROR (1)
5 SEC DLY	10.1	9.1	9.5	1.1	ERROR* (2)
MIN & CREEP	14.9	13.6	14.1	1.3	(3)

(RESULTS ROUNDED TO NEAREST 0.1 MS)

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# REPRODUCTION DIAGNOSTIC FUNCTION TEST

PART NO. 451217  
SHEET 6 OF 24  
BLOCK NO. 5500D

**F. (CONTINUED)**

- (1) AT LEAST ONCE DURING THIS GROUP, EOR (TAPE MARK) INDICATOR WAS ON IMMEDIATELY AFTER DIAGNOSTIC READ.
- (2) AT LEAST ONCE DURING THIS GROUP, EOR INDICATOR NEVER CAME ON AFTER DIAGNOSTIC READ.  
IN BOTH CASES, MAX, MIN, AND RANGE FIGURES ARE CORRECT, BUT THE AVG IS IN ERROR ON THE LOW SIDE BECAUSE THE TOTAL TIME ACCUMULATED FOR THE GROUP IS ALWAYS DIVIDED BY 100 (GROUPS 1-5) OR 10 (GROUPS 6-7), EVEN THOUGH TIME FOR ONE OR MORE GAPS WITH ERROR INDICATION WAS NOT INCLUDED IN THE TOTAL TIME FOR THE GROUP. IN SUCH CASES, THE TEST SHOULD BE RE-RUN.
- (3) IN THIS CASE, THE SECOND RECORD OF EACH PAIR IS BACKSPACED AND RE-WRITTEN ONCE. THE AVERAGE CREEP, THEREFORE, IS 2.4 MS (DIFFERENCE BETWEEN MINIMUM DELAY AVG 11.7 MS, GROUP 1, AND MIN & CREEP AVG 14.1 MS, GROUP 7).

NOTE: FIGURES SHOWN IN ABOVE EXAMPLE APPLY TO MODEL II - HIGH DENSITY. IF TAPE IS WRITTEN IN LOW DENSITY, FIGURES WILL BE LARGER SINCE RDD 144 CORRECTION FACTOR IS GREATER FOR LOW DENSITY THAN IT IS FOR HIGH DENSITY.

**G. COMMENTS**

FOR THE 729 MAGNETIC TAPE UNIT THE IDEAL GAP LENGTH IS 0.75 INCHES. CONVERTED TO MILLISECONDS THE TIME IS AS FOLLOWS:

<u>GAP LENGTH</u>	<u>MODEL II</u>	<u>MODEL IV</u>
0.75 INCHES	10.0 MS	6.7 MS

ACCEPTABLE INDIVIDUAL GAPS MAY VARY APPROXIMATELY AS FOLLOWS:

<u>GAP LENGTH</u>	<u>MODEL II</u>	<u>MODEL IV</u>
0.69 IN. TO 0.91 IN.	9.2 MS TO 12.1 MS	6.1 MS TO 8.1 MS

ACCEPTABLE CREEP

+0.05 IN. TO +0.2 IN.	+0.7 MS TO +2.7 MS	+0.4 MS TO +1.8 MS
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NOTE: MACHINES WITHOUT PRINTERS MAY OBTAIN A PUNCH OUT OF THE IRG MEASUREMENTS BY ALTERING THE FOLLOWING INSTRUCTIONS:

<u>INST</u>	<u>IS NOW</u>	<u>CHANGE TO</u>
926	. 931	N 931
930	$\frac{2}{1}$	$\frac{4}{1}$

THE VALUES WILL APPEAR IN PUNCHED CARDS AS FOLLOWS: (ALL OTHER INFORMATION IS INSIGNIFICANT.)

<u>WR COND GRP</u>	<u>AVG</u>	<u>MAX</u>	<u>MIN</u>	<u>RANGE</u>
COL 6	12-14	19-21	24-26	32-34

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CONVERSION TABLE  
 (MILLISECONDS TO INCHES)

MS	INCHES		MS	INCHES		MS	INCHES	
	MOD II	MOD IV		MOD II	MOD IV		MOD II	MOD IV
.1	.0075	.0113	5.1	.3825	.5738	10.1	.7575	1.1363
.2	.0150	.0225	5.2	.3900	.5850	10.2	.7650	1.1475
.3	.0225	.0338	5.3	.3975	.5963	10.3	.7725	1.1588
.4	.0300	.0450	5.4	.4050	.6075	10.4	.7800	1.1700
.5	.0375	.0563	5.5	.4125	.6188	10.5	.7875	1.1813
.6	.0450	.0675	5.6	.4200	.6300	10.6	.7950	1.1925
.7	.0525	.0788	5.7	.4275	.6413	10.7	.8025	1.2038
.8	.0600	.0900	5.8	.4350	.6525	10.8	.8100	1.2150
.9	.0675	.1013	5.9	.4425	.6638	10.9	.8175	1.2263
1.0	.0750	.1125	6.0	.4500	.6750	11.0	.8250	1.2375
1.1	.0825	.1238	6.1	.4575	.6863	11.1	.8325	1.2488
1.2	.0900	.1350	6.2	.4650	.6975	11.2	.8400	1.2600
1.3	.0975	.1463	6.3	.4725	.7088	11.3	.8475	1.2713
1.4	.1050	.1575	6.4	.4800	.7200	11.4	.8550	1.2825
1.5	.1125	.1688	6.5	.4875	.7313	11.5	.8625	1.2938
1.6	.1200	.1800	6.6	.4950	.7425	11.6	.8700	1.3050
1.7	.1275	.1913	6.7	.5025	.7538	11.7	.8775	1.3163
1.8	.1350	.2025	6.8	.5100	.7650	11.8	.8850	1.3275
1.9	.1425	.2138	6.9	.5175	.7763	11.9	.8925	1.3388
2.0	.1500	.2250	7.0	.5250	.7875	12.0	.9000	1.3500
2.1	.1575	.2363	7.1	.5325	.7988	12.1	.9075	1.3613
2.2	.1650	.2475	7.2	.5400	.8100	12.2	.9150	1.3725
2.3	.1725	.2588	7.3	.5475	.8213	12.3	.9225	1.3838
2.4	.1800	.2700	7.4	.5550	.8325	12.4	.9300	1.3950
2.5	.1875	.2813	7.5	.5625	.8438	12.5	.9375	1.4063
2.6	.1950	.2925	7.6	.5700	.8550	12.6	.9450	1.4175
2.7	.2025	.3038	7.7	.5775	.8663	12.7	.9525	1.4288
2.8	.2100	.3150	7.8	.5850	.8775	12.8	.9600	1.4400
2.9	.2175	.3263	7.9	.5925	.8888	12.9	.9675	1.4513
3.0	.2250	.3375	8.0	.6000	.9000	13.0	.9750	1.4625
3.1	.2325	.3488	8.1	.6075	.9113	13.1	.9825	1.4738
3.2	.2400	.3600	8.2	.6150	.9225	13.2	.9900	1.4850
3.3	.2475	.3713	8.3	.6225	.9338	13.3	.9975	1.4963
3.4	.2550	.3825	8.4	.6300	.9450	13.4	1.0050	1.5075
3.5	.2625	.3938	8.5	.6375	.9563	13.5	1.0125	1.5188
3.6	.2700	.4050	8.6	.6450	.9675	13.6	1.0200	1.5300
3.7	.2775	.4163	8.7	.6525	.9788	13.7	1.0275	1.5413
3.8	.2850	.4285	8.8	.6600	.9900	13.8	1.0350	1.5525
3.9	.2925	.4388	8.9	.6675	1.0013	13.9	1.0425	1.5638
4.0	.3000	.4500	9.0	.6750	1.0125	14.0	1.0500	1.5750
4.1	.3075	.4613	9.1	.6825	1.0238	14.1	1.0575	1.5863
4.2	.3150	.4725	9.2	.6900	1.0350	14.2	1.0650	1.5975
4.3	.3225	.4838	9.3	.6975	1.0463	14.3	1.0725	1.6088
4.4	.3300	.4950	9.4	.7050	1.0575	14.4	1.0800	1.6200
4.5	.3375	.5063	9.5	.7125	1.0688	14.5	1.0875	1.6313
4.6	.3450	.5175	9.6	.7200	1.0800	14.6	1.0950	1.6425

TABLE CONTINUED (BY COLUMN) ON SHEET 8

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REPRODUCTION  
DIAGNOSTIC FUNCTION TEST

CONVERSION TABLE  
(MILLISECONDS TO INCHES)

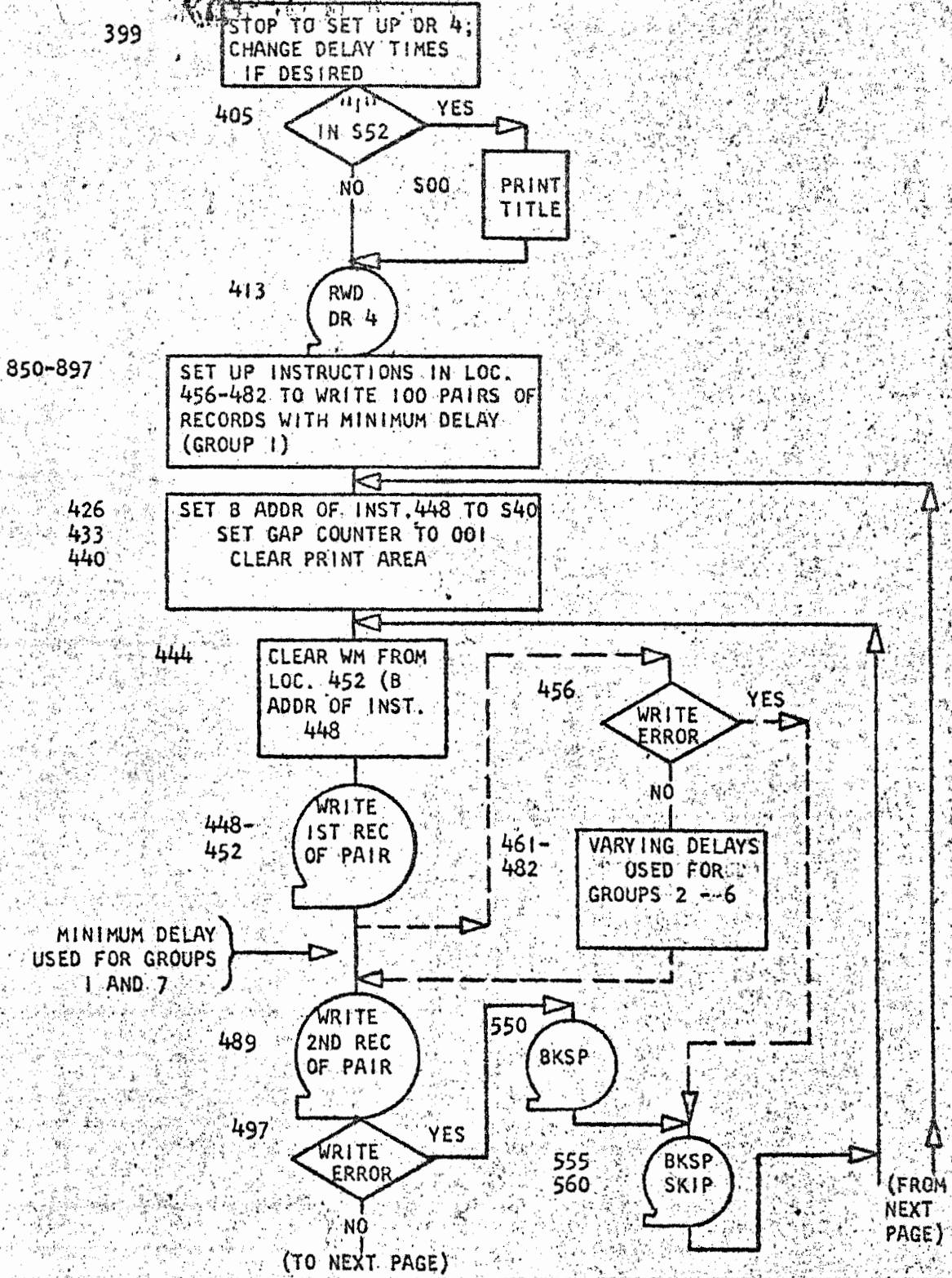
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	MOD II	MOD IV		MOD II	MOD IV		MOD II	MOD IV
4.7	.3525	.5288	9.7	.7275	1.0913	14.7	1.1025	1.6538
4.8	.3600	.5400	9.8	.7350	1.1025	14.8	1.1100	1.6650
4.9	.3675	.5513	9.9	.7425	1.1138	14.9	1.1175	1.6763
5.0	.3750	.5625	10.0	.7500	1.1250	15.0	1.1250	1.6875

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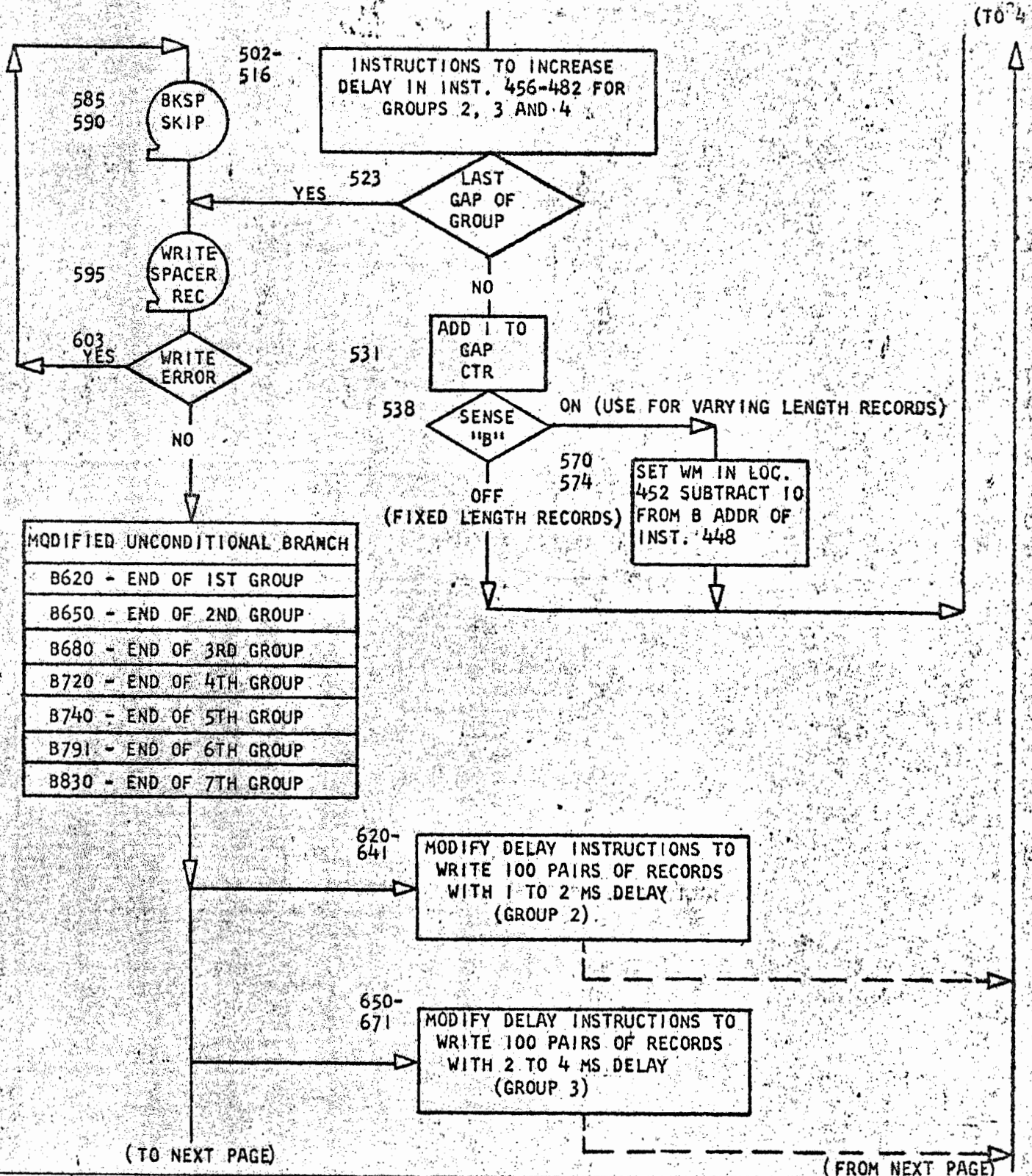
# DIAGNOSTIC FUNCTION TEST

## IRG MEASUREMENT - WRITE FLOW CHART



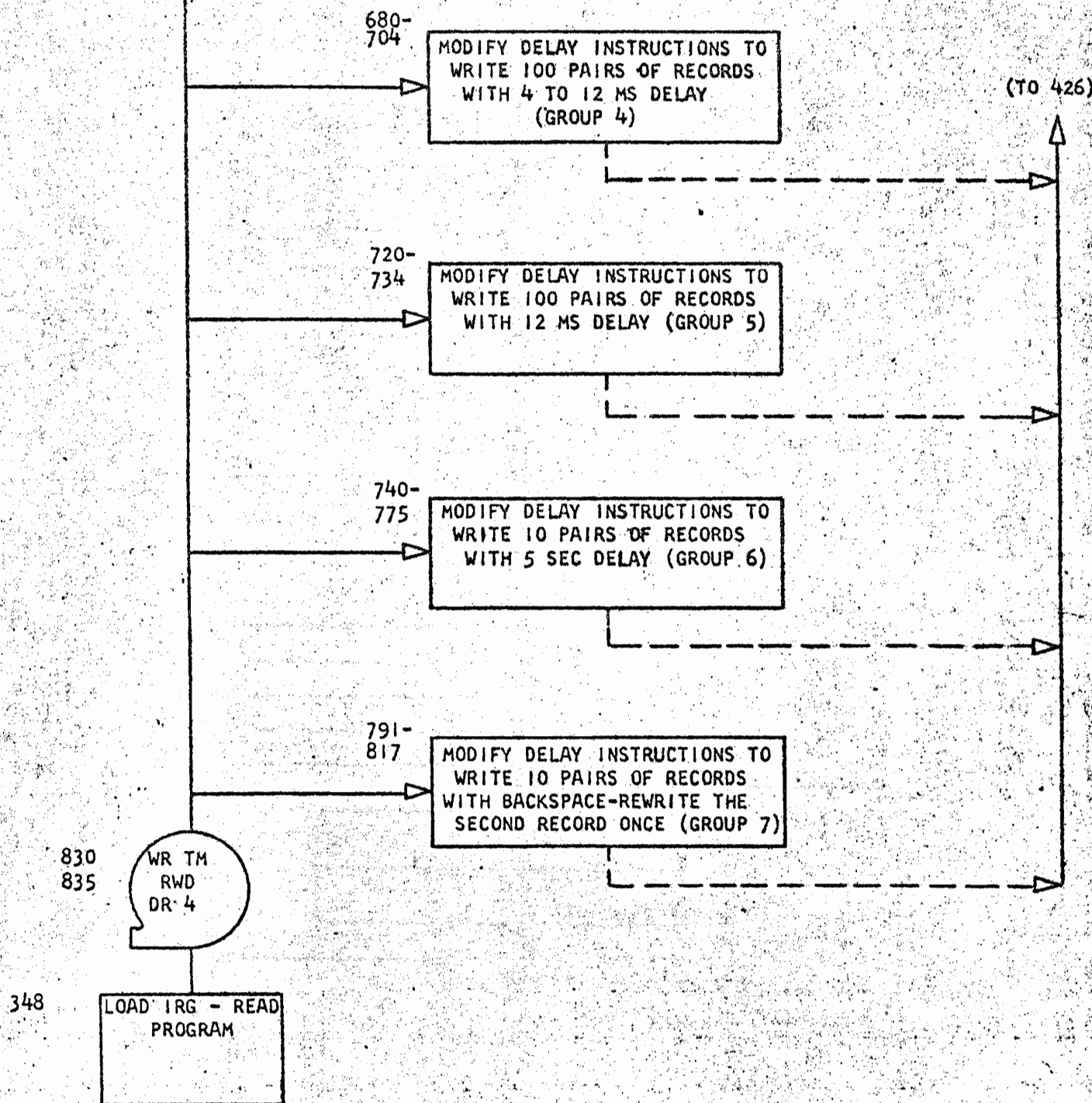
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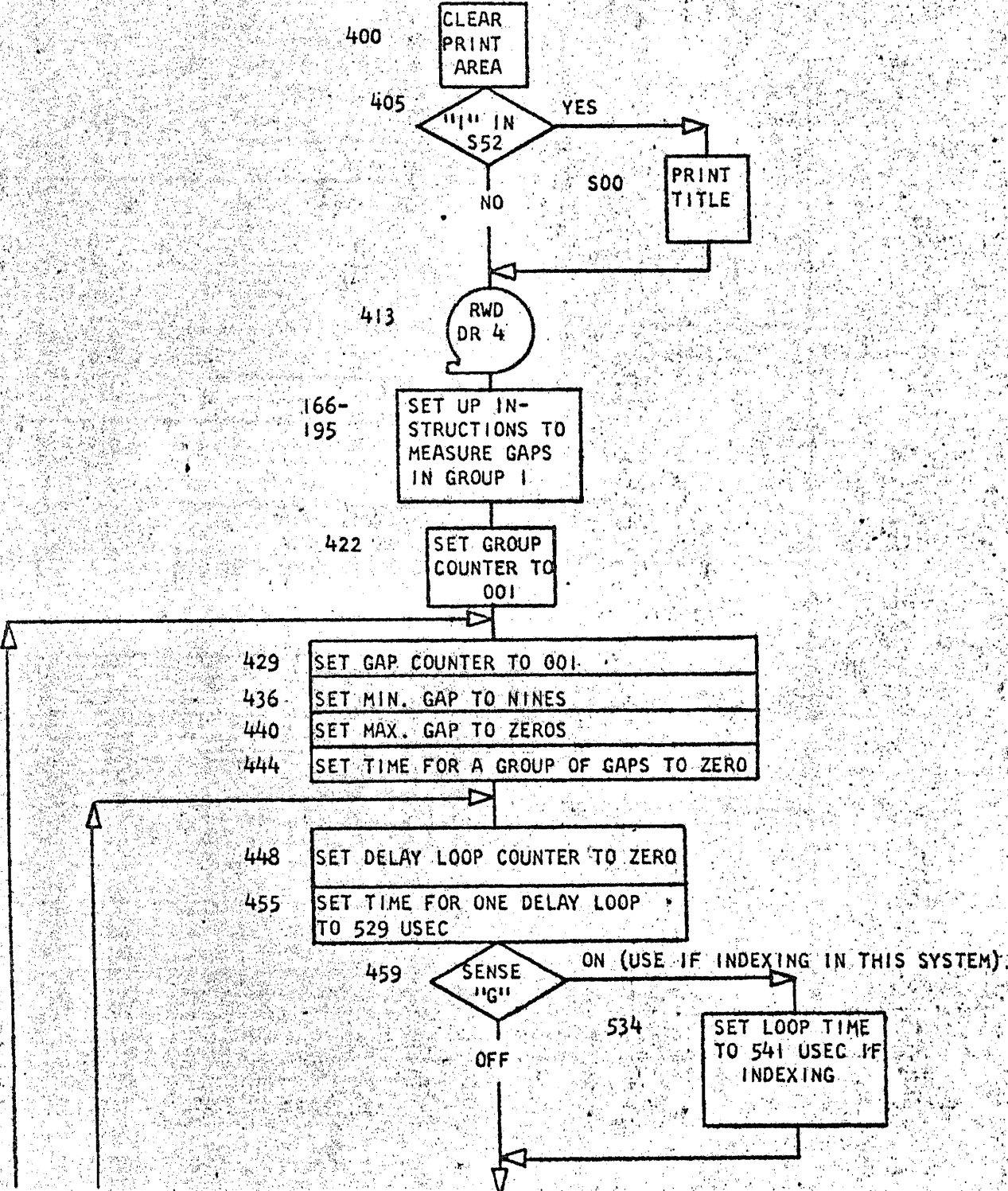
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# REPRODUCTION DIAGNOSTIC FUNCTION TEST

## IRG MEASUREMENT - READ FLOW CHART



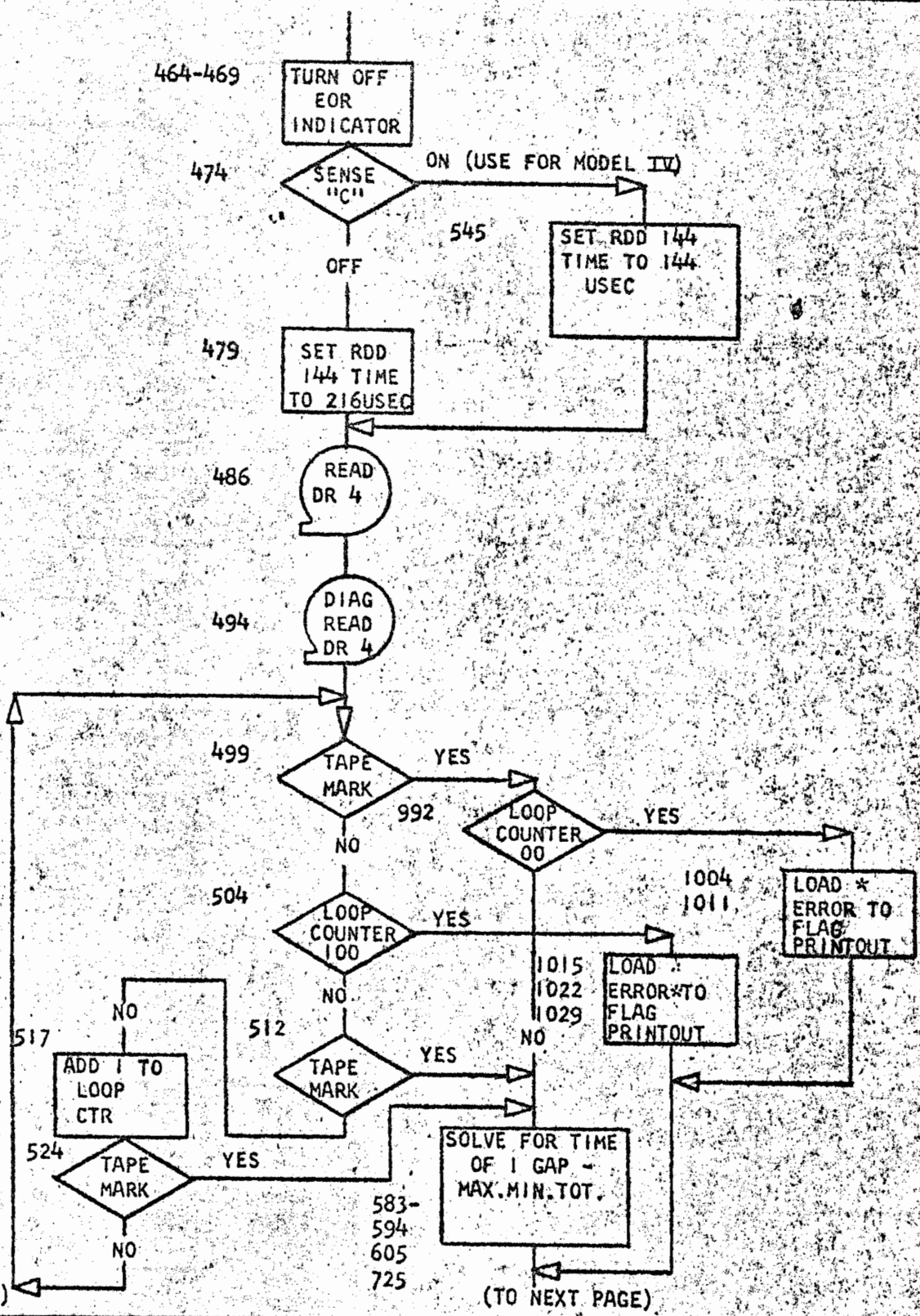
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# DIAGNOSTIC FUNCTION TEST

(TO 429) (TO 448)

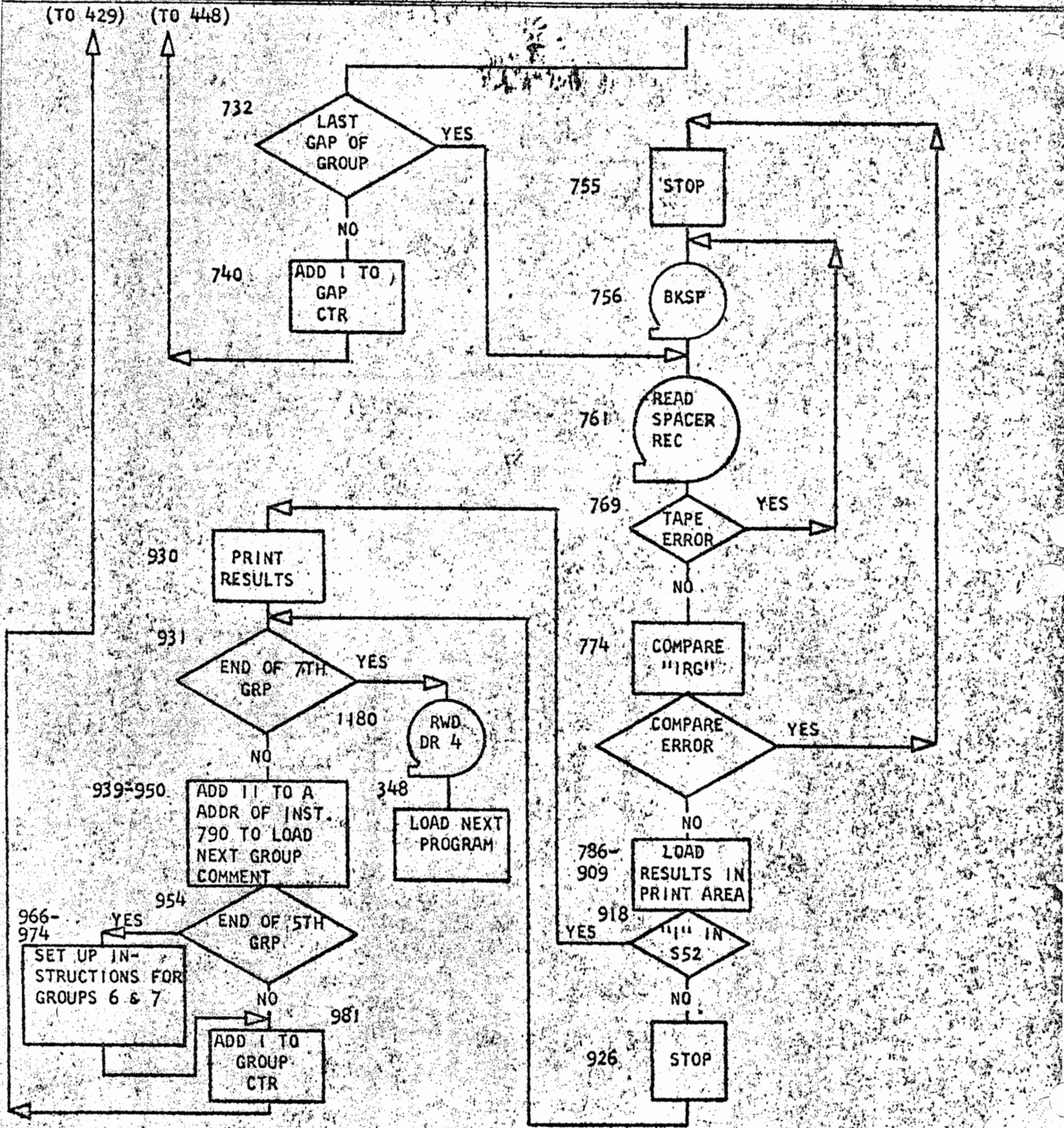


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DIAGNOSTIC FUNCTION TEST

REPRODUCTION

PROGRAM LISTING FOR USE WITH FLOW CHART

IRG MEASUREMENT - WRITE 5500D

INSTRUCTION ADDRESS	OP	A	B	REMARKS
082 082	I	001		CONSTANT
086 086	X	XX		GAP COUNTER
089 089	S	40		CONSTANT - B ADDR OF FIRST TAPE WR INST
092 092	I	90		CONSTANT TO SUBTRACT 10
095 095	I	00		CONSTANT TO SUBTRACT 100
098 098	S	000	005	CONSTANTS
105 105	X	XXX	X	..
110 110	I	-		..
115 115	B	523	1051	CONSTANTS TO MODIFY DELAY INSTR
123 123	U	204	B	..
128 128	B	468		..
133 133	B	489		..
138 138	/	489	200	..
145 145	/	489	279	..
152 152	Z	199	200	..
159 159	N	082	467	..
166 166	N	000	000	..
173 173	N	000	0	..
178 178	M	111	106	..
185 185	A	083	106	..
192 192	B	489		..
377 377	B	399	5691	USE WHEN PROGRAM IS LOADED FROM TAPE
385 385	B	588		..
399 399	.			STOP TO SET UP DR 4 + CHANGE DELAY TIMES
400 400	/	332		START TEST
404 404	/			
405 405	B	500	5521	BR TO TITLE PRINT ROUTINE IF 1 IN 552
413 413	U	204	R	REWIND DRIVE 4
418 418	.	199		SET WM TO LIMIT DELAY INSTR
422 422	B	850		BR TO SET INSTR FOR MINIMUM DELAY
426 426	M	091	454	SET TAPE WRITE B ADDR TO 540
433 433	M	085	088	SET GAP COUNTER TO 001
440 440	/	299		CLEAR PRINT AREA
444 444	□	452		CLEAR WM FROM B ADDR OF TAPE WRITE INST.
448 448	L	204	540W	WRITE FIRST RECORD OF A PAIR
456 456	B	489		VARIABLE DELAY
461 461	/	489	200	..
468 468	/	489	279	..
475 475	Z	199	200	..
482 482	Z	199	200	..
489 489	L	204	19W	WRITE SECOND RECORD OF A PAIR
497 497	B	550	L	BRANCH IF WRITE ERROR
502 502	N	082	467	INSTR USED TO INCREASE DELAY FOR

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GROUPS 2, 3, AND 4

509	509	N	000	000	
516	516	N	000	000	
523	523	B	595	0861	BR TO WR SPACER REC IF LAST GAP OF GROUP
531	531	A	082	088	ADD 1 TO GAP COUNTER
538	538	B	570	B	ON TO VARY LNTH OF FIRST REC OF PAIR SS
543	543	B	444		BRANCH TO WRITE NEXT PAIR OF RECORDS
550	550	U	204	B	BACKSPACE
555	555	U	204	B	BACKSPACE
560	560	U	204	E	SKIP
565	565	B	444		BRANCH TO WRITE NEXT PAIR OF RECORDS
570	570	,	452		SUBTR 10 FROM B ADDR OF TAPE WRITE TO
574	574	A	094	454	INCREASE LENGTH OF FIRST REC OF PAIR
581	581	B	444		BRANCH TO WRITE NEXT PAIR OF RECORDS
585	585	U	204	B	BACKSPACE
590	590	U	204	E	SKIP
595	595	L	204	/16W	WRITE SPACER RECORD
603	603	B	585	L	BRANCH IF WRITE ERROR
608	608	B	620		BRANCH TO LOAD NEXT TYPE OF DELAY INSTR
620	620	L	/24	460	SET UP DELAY INSTR FOR 1 TO 2 MS DLY
627	627	M	531	502	..
634	634	M	491	611	..
641	641	B	426		BRANCH TO WRITE WITH 1 TO 2 MS DLY
650	650	L	/31	467	SET UP DELAY INSTR FOR 2 TO 4 MS DLY
657	657	D	498	505	..
664	664	M	495	611	..
671	671	B	426		BRANCH TO WRITE WITH 2 TO 4 MS DLY
680	680	L	/45	474	SET UP DELAY INSTR FOR 4 TO 12 MS DLY
687	687	L			..
688	688	L	/66	522	..
695	695	L			..
696	696	L			..
697	697	M	499	611	..
704	704	B	426		BRANCH TO WRITE WITH 4 TO 12 MS DLY
720	720	M	/71	506	SET UP DELAY INSTR FOR 12 MS FIXED DLY
727	727	M	/03	611	..
734	734	B	426		BRANCH TO WRITE WITH 12 MS FIXED DLY
740	740	L	479	488	SET UP DELAY INSTR FOR 5 SEC FIXED DLY
747	747	L			..
748	748	L			..
749	749	L			..
750	750	,	484		..
754	754	D	540	529	ALTER INSTR IN 523 TO COUNT 10 GAPS
761	761	D	540	577	ALTER INSTR IN 523 TO SUBTR 100 FROM
768	768	M	/07	611	B ADDR OF TAPE WRITE INSTRUCTION
775	775	B	426		BRANCH TO WRITE WITH 5 SEC FIXED DLY
791	791	L	196	479	SET UP INSTR TO BKSP REWRITE
798	798	L			..
799	799	L			..
800	800	L			..
801	801	L	132	519	..
808	808	L			..
809	809	L			..

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810 810 M /11 611
817 817 B 426
830 830 U 2U4 M
835 835 U 2U4 R
840 840 B 348
850 850 L 158 488
857 857 L 158
861 861 L
862 862 L
863 863 L
864 864 L 172 522
871 871 L 172
875 875 L
876 876 D 507 529
883 883 D 582 577
890 890 M #87 611
897 897 B 426
1052 #52 M 104 109
1059 #59 A 104 109
1066 #66 C 100 107
1073 #73 N 0B4 68/
1084 #84 B 620 B650B680B720
1100 /00 B 740 B791B830
1116 /16 I RG
1120 /20 B 555 L
1125 /25 C 199 199
1132 /32 Z 274 275
1139 /39 / 475 200
1146 /46 A 082 474
1153 /53 A 085 481
1160 /60 A 085 488
1167 /67 B 523
1180 /80
1250 S50
    
```

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''
BR TO BKSP-REWR SECOND RECORD OF PAIR
WRITE TAPE MARK
REWIND
BRANCH TO LOAD READ PROGRAM
SET UP INSTRUCTIONS FOR MINIMUM DELAY
    
```

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''
BRANCH TO BEGIN WRITING WITH MINIMUM DLY
CONSTANTS TO MODIFY DELAY INSTRUCTIONS
    
```

```

''
UNCONDITIONAL BRANCH INSTRUCTIONS
FOR GROUPS 2 TO 7
SPACER RECORD TM IN /19
CONSTANTS TO MODIFY DELAY INSTR
    
```

GROUP MARK IN S50

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1401 DATA PROCESSING SYSTEM  
 DIAGNOSTIC FUNCTION TEST  
**REPRODUCTION**

PROGRAM LISTING FOR USE WITH FLOW CHART

IRG MEASUREMENT - READ 5500D

INSTRUCTION ADDRESS	OP	A	B	REMARKS
082	082	1	000 00001	CONSTANTS
091	091	0	000 00	::
097	097	2	07	::
100	100	4	08	::
103	103	X	XX	RDD144 TIME
106	106	X		GROUP COUNTER
107	107	5	29	TIME FOR 1 DELAY LOOP IN MSEC
110	110	X	X	DELAY LOOP COUNTER
112	112	X	XXX XXX	CTR FOR TOTAL USEC OF GAPS IN A GROUP
119	119	0	000 0	MAX GAP IN A GROUP
124	124	9	999 9	MIN GAP IN A GROUP
129	129	X	XX	GAP COUNTER
132	132	X	XXX X	COUNTER FOR USEC OF 1 GAP
137	137	X	X	COUNTER USED IN MULTIPLE ADDITION
139	139	X	XXX X	COUNTER USED IN SOLVING FOR MAX + MIN
144	144		0.	CONTROL WORD FOR EDIT
148	148	*		CONSTANT
149	149	I	RG	CONSTANT COMPARED TO SPACER RECORD
152	152	9	999 9	CONSTANTS
157	157	5	295 41	::
163	163	I	9	::
166	166	M	332 /98	SET INSTR TO MEASURE GAPS IN GROUP 1
173	173	D	650 665	::
180	180	D	788 738	::
187	187	D		::
188	188	M	+35 793	::
195	195	B	422	BRANCH TO SET CTRS TO INITIAL COND
377	377	B	400 S691	USE WHEN PROGRAM IS LOADED FROM TAPE
385	385	B	S88	::
400	400	/	332	START TEST
404	404	/		
405	405	B	S00 S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52
413	413	U	204 R	REWIND DRIVE 4
418	418	B	166	BRANCH TO SET INSTR FOR GROUP 1
422	422	M	090 106	SET GROUP COUNTER TO 1
429	429	M	090 131	SET GAP COUNTER TO 001
436	436	M	156	SET MIN GAP TO NINES
440	440	M	089	SET MAX GAP TO ZEROS
444	444	M	089	SET TIME FOR A GROUP OF GAPS TO ZEROS
448	448	M	089 111	SET DELAY LOOP COUNTER TO ZEROS
455	455	M	159	SET TIME FOR 1 LOOP TO 529
459	459	B	534 G	G ON IF INDEXING IN THIS SYSTEM SS
464	464	B	469 K	TURN OFF EOR INDICATOR

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469	469	N 000	O	C ON IF MODEL IV	SS
474	474	B 545	C	SET RDD144 TIME FOR MOD II HIGH DENSITY	
479	479	M 096	105	READ FIRST RECORD OF A PAIR	
486	486	L %U4	S47R	DIAGNOSTIC READ	
494	494	U %U4	A	BRANCH IF TAPE MARK IS SENSED	
499	499	B 992	K	BRANCH IF NO TM SENSED AFTER 50 MS	
504	504	V #15	110S	BRANCH IF TAPE MARK IS SENSED	
512	512	B 594	K	ADD 1 TO LOOP COUNTER	
517	517	A 082	111	BRANCH IF TAPE MARK IS SENSED	
524	524	B 605	K	BRANCH TO REPEAT LOOP	
529	529	B 499		SET LOOP TIME TO 541 USEC IF INDEXING	
534	534	M 162	109	..	
541	541	B 464		SET RDD144 TIME FOR MOD 4 HIGH DEN	
545	545	M 093	105	..	
552	552	B 486		SOLVE FOR TIME OF 1 GAP	
583	583	+ 158	136	..	
590	590	B 619		..	
594	594	+ 099	136	..	
601	601	B 619		..	
605	605	+ 102	136	..	
612	612	A 164	111	..	
619	619	A 105	136	..	
626	626	M 089	138	MULTIPLY DELAY LOOP COUNTER BY TIME FOR	
633	633	A 109	136	1 LOOP USING MULTIPLE ADDITION	
640	640	A 082	138	..	
647	647	C 138	111	..	
654	654	B 633	/	..	
659	659	A 136	118	ADD USEC FOR 1 GAP TO USEC FOR A GRP	
666	666	L 123	143	FIND MAX GAP	
673	673	S 136	143	..	
680	680	V 692	143K	..	
688	688	B 699		..	
692	692	L 136	123	..	
699	699	L 128	143	FIND MIN GAP	
706	706	S 136	143	..	
713	713	V 725	143B	..	
721	721	B 732		..	
725	725	L 136	128	..	
732	732	B 761	1291	BRANCH IF LAST GAP OF THIS GROUP	
740	740	A 082	131	ADD 1 TO GAP COUNTER	
747	747	B 448		BRANCH TO READ NEXT GAP	
755	755	.		STOP IF ERROR IN READING SPACER RECORD	
756	756	U %U4	B	BACKSPACE	
761	761	L %U4	S47R	READ SPACER RECORD	
769	769	B 756	L	BRANCH IF READ ERROR	
774	774	C S49	151	COMPARE READ AREA TO CONSTANT -IRG-	
781	781	B 755	/	BRANCH IF UNEQUAL	
786	786	/	299	CLEAR PRINT AREA	
790	790	L #53	212	LOAD GROUP COMMENT IN PRINT AREA	
797	797	L 123	136	SOLVE FOR + LOAD RANGE IN PRINT AREA	
804	804	S 128	136	..	
811	811	A 157	135	..	

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1401 DATA PROCESSING SYSTEM  
DIAGNOSTIC FUNCTION TEST

REPRODUCTION

818	818	L	147	242	
825	825	E	134	242	
832	832	A	157	122	SOLVE FOR + LOAD MAX IN PRINT AREA
839	839	L	147	224	..
846	846	E	121	224	..
853	853	A	157	127	SOLVE FOR + LOAD MIN IN PRINT AREA
860	860	L	147	230	..
867	867	E	126	230	..
874	874	A	157	115	SOLVE FOR + LOAD AVG IN PRINT AREA
881	881	L	147	236	..
888	888	E	114	236	..
895	895	L	198	254	LOAD WORD ERROR IN PRINT AREA
902	902	M	332	198	IF ANY ERRORS IN SENSING TAPE MARK
909	909	B	918		BRANCH TO PRINT RESULTS
918	918	B	930	5521	PRINT RESULTS IF 1 IN S52
926	926	.	931		STOP TO CHECK RESULTS IF NO PRINTER
930	930	2			PRINT
931	931	B	180	1067	BRANCH TO REWIND IF END OF TEST
939	939	.	791		ADD 11 TO A FIELD OF INSTR IN 790
943	943	A	875	793	TO LOAD NEXT GROUP COMMENT
950	950	#	791		..
954	954	B	966	1065	BRANCH IF END OF 5TH GROUP
962	962	B	981		BRANCH TO ADD 1 TO GROUP COUNTER
966	966	D	873	738	SET UP INSTR FOR A 10 GAP GROUP
973	973	D			..
974	974	D	951	665	..
981	981	A	082	106	ADD 1 TO GROUP COUNTER
988	988	B	429		BRANCH TO MEAS NEXT GROUP OF GAPS
992	992	C	089	111	TEST FOR ZEROS IN LOOP COUNTER
999	999	B	583	/	BR TO SOLVE FOR GAP TIME IF NO ZEROS
1004	#04	M	148	190	FLAG PRINTOUT WITH * ERROR IF TM
1011	#11	B	#22		WAS SENSED BEFORE ANY DELAY LOOPING
1015	#15	M	148	198	FLAG PRINTOUT WITH ERROR * IF NO TM
1022	#22	M	#40	196	WAS SENSED AFTER 50 MS DELAY LOOPING
1029	#29	B	732		..
1033	#33	#	53		CONSTANTS
1036	#36	E	RRO	R	..
1043	#43	M	INI	MUM DLY	COMMENT FOR GROUP 1
1054	#54		1-2	MS DLY	COMMENT FOR GROUP 2
1065	#65		2-4	MS DLY	COMMENT FOR GROUP 3
1076	#76	4	-12	MS DLY	COMMENT FOR GROUP 4
1087	#87		12	MS DLY	COMMENT FOR GROUP 5
1098	#98		5	SEC DLY	COMMENT FOR GROUP 6
1109	/09	M	IN	+ CREEP	COMMENT FOR GROUP 7
1120	/20	W	RIT	E CONDITION	CONSTANTS FOR HEADINGS
1140	/40	M	AX	MIN AVG RA	..
1160	/60	N	GE	OF GAPS IN MS	..
1180	/80	U	%U4	R	REWIND
1185	/85	B	348		BRANCH TO LOAD NEXT PROGRAM
1190	/90				BLANKS
1247	S47	X	XX		TAPE READ-IN AREA
1250	S50				GROUP MARK IN S50

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REPRODUCTION

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

,008015,022029,033033N	1001	IRG MEASUREMENT - WRITE	5500 0A
,008015,022029,033033N	1001	SET WORDMARK CARD	5500 02
L060109,086089,092095,09810510011001XXXS401901005000005XXXXX			5500 03
L067144,115123,128133,13813810011-	85231051U4B8468 8489 /489200		5500 04
L072184,152159,166173,1781781001/489279Z199200N082467N000000N0000M111106			5500 05
L044196,192192,192192,1921921001A083106B489			5500 06
L067367,340344,348349,3573611001,008012,00110011B361080AB348/340080			5500 07
L069404,377385,399400,4044051001 1 OF 2 5B399S691B588	. /332/		5500 08
L071443,413418,422426,4334401001BS005521U4R,1998850M091454M085088/299			5500 09
L070481,448456,461468,4754821001452L4S40WB489 /489200/489279Z199200			5500 10
L066515,489497,502509,51651610012199200L4/19WB550LN082467N000000			5500 11
L071554,523531,538543,5505551001N000000B5950861A082088B5708B444 U4B			5500 12
L067589,560565,570574,5815851001U4BU4EB444 ,452A094454B444U4B			5500 13
L069626,595603,608620,6276271001U4EL4/16WB585LB620	L/24460		5500 14
L069663,634641,650657,6646641001M531502M+91611B426	L/314670498505		5500 15
L065696,671680,687688,6956961001M+95611B426	L/45474LL/66522LL		5500 16
L069733,704720,727734,7347341001M+99611B426	M/71506M/03611		5500 17
L059760,740747,748749,7507541001B426 L+79488LLL,484D540529			5500 18
L072800,768775,791798,7998001001D540577M/07611B426	L196479LLL		5500 19
L071839,808809,810817,8308351001L132519LLM/11611B426	U4MU4R		5500 20
L063870,850857,861862,8638641001B348	L158488L158LLL172522		5500 21
L072910,875876,883890,8978971001L172LD507529D582577M+87611B426			5500 22
L067*65*31*31,*52*59,*66*661001	M104109A104109		5500 23
L066*99,*73*84,/00/00,/00/001001C100107N0B468/	8620B650B680B720		5500 24
L071/38,/16/20,/25/32,/39/391001B740B7918830	IRGTB555LC199199Z274275		5500 25
	M		
L072/78,/46/53,/60/67,/67/671001/475200A082474A085481A085488B523			5500 26
L065S114/79/79,/80S00,S01S051001	2,049L077277		5500 27
L071550,S13S17,S21S50,S50S5010012/2772413		G	5500 28
		M	
/333080N		CLEAR WORDMARK CARD	5500 29
,019027,031,038042B031T98GB399L046352BW04BS88		IRG MEASUREMENT - WRITE	5500 30

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1401 DATA PROCESSING SYSTEM  
DIAGNOSTIC FUNCTION TEST

PART NO. 451217  
SHEET 22 OF 22  
BLOCK NO. 55000

REPRODUCTION

TABLE OF UNPRINTABLE CHAR

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

.008015,022029,033033N 1001 IRG MEASUREMENT - READ 5500D20A  
 .008015,022029,033033N 1001 SET WORDMARK CARD 5500D202  
 L060109,091097,100103,1061071001100000001000000207408XXXX529 5500D203  
 L061138,112119,124129,1321371001XXXXXXX0000099999XXXXXXXXXX 5500D204  
 L059165,144148,149152,1571631001XXXXX 0. \*IRG9999952954119 5500D205  
 L066199,173180,187188,1951951001M332/98D650665D788738DM+35793B422 5500D206  
 L067367,340344,348349,3573611001,008012,001100118361080A8400/340080 5500D207  
 L069404,377385,400404,4054051001 B400S6918S88 /332/ 5500D208  
 L071443,413418,422429,4364401001BS00S521UZU4RB166M090106M090131M156M089 5500D209  
 L067478,448455,459464,4694741001M089M08911M1598534GB469KN00008545C 5500D210  
 L070516,486494,499504,5125171001M096105LXU4S47RUZU4AB992KV+15110SB594K 5500D211  
 L067551,524529,534541,5455521001A082111B605KB499 M162109B464M093105 5500D212  
 L070589,583590,590590,5905901001B486 P158136 5500D213  
 Z  
 L068625,594601,605612,6196261001B619P099136B619P102136A164111A105136 5500D214  
 Z  
 L072665,633640,647654,6596661001M089138A109136A082138C138111B633/A1361185500D215  
 L072705,673680,688692,6997061001L123143S136143V692143K8699L136123L1281435500D21  
 L066739,713721,725732,7407401001S136143V725143BB732L136128B7611291 5500D217  
 L066773,747755,756761,7697741001A082131B448 .UZU4BLXU4S47RB756L 5500D218  
 L069810,781786,790797,8048111001CS491518755//299L+53212L123136S128136 5500D219  
 L067845,818825,832839,8468461001A157135L147242E134242A157122L147224 5500D220  
 L067880,853860,867874,8818811001E121224A157127L147230E126230A157115 5500D221  
 L069917,888895,902909,9189181001L147236E114236L/98254M332/98B918 5500D222  
 L068953,926930,931939,9439501001B930S521.9312B/801067,791A875793#791 5500D223  
 L070991,962966,973974,9819881001B96610658981D8737380D951665A082106B429 5500D224  
 L069#28,999#04,#11#15,#22#291001C089111B583/M148/90B#22M148/98M#40/96 5500D225  
 L068#64,#33#36,#43#54,#65#651001B732#53ERROR MINIMUM DLY 1-2 MS DLY 5500D226  
 L065#97,#76#87,#98#98,#98#981001 2-4 MS DLY4-12 MS DLY 12 MS DLY 5500D227  
 L072/37,/09/20,/20/20,/20/201001 5 SEC DLYMIN + CREEPWRITE CONDITION 5500D228  
 L072/77#/38/38,/40/60,/60/601001 MAX MIN AVG RANGE OF GAPS IN MS 5500D229  
 L055S00#/78/78,/80/85,/90S001001 UXU4RB348 2 5500D230  
 L060S28,S05S12,S13S17,S18S251001,049L0772772/2772#/40/60N/80 5500D231  
 L054S50,S36S37,S41S45,S47S501001L/792602/2702413 XXXG 5500D232  
 M  
 /333080N CLEAR WORDMARK CARD 5500D233  
 ,019027,031,038042B031T98GB400L046352BW04BS88 IRG MEASUREMENT - READ 5500D234  
 M

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