NO. 2128301
SHEET 0
OF 64

DIAGNOSTIC TEST

TITLE 1620 (BASIC MACHINE AND AUTOMATIC DIVISION) DIAGNOSTIC TEST - CU01

MACH.TYPE 1620 BY J. H. M. APPR. G. I. A. DATE 4-11-62

49 14004

ENGINEERING CHANGE HISTORY

E/C NO.	DATE	SHEETS AFFECTED
404530	8-15-60	1-64
404568	12-15-60	4, 12, 14, 25, 30, 60, 62, 64
404618	5-15-61	1, 1A, 6A, 12, 13, 36, 38, 55, 55A, 56, 63, 63A, 64
404675	4-11-62	1, 1A, 2, 3, 4, 6A, 11, 11A, 12, 15, 17, 24, 26, 27, 28, 29, 30, 31, 32, 33, 41, 42, 43, 46, 55, 55A, 56, 62, 62A, 63, 63A, 64

E/C NO.	404530	404568	404618	404675			
DATE	8-15-60	12-15-60	5-15-61	4-11-62			

1620 DIAGNOSTICS

Test CU01

A. SCOPE:

This test is essentially a fault detection test designed to check for proper functioning of all standard operation codes, the optional feature DIVIDE operation codes, and the circuitry associated with these codes. Failure of an operation to function properly will cause the associated routine number to be typed out (provided Switch #1 is OFF). However, since the operation code and E time triggers are known for each routine, a failure of one routine will indicate the circuits or components that may be the source of the trouble. Failure of several routines may establish a pattern that will further isolate the failing component(s).

B. SET UP:

Seven switches must be set for the desired operation. These are the three check switches, Data Check Switch, Overflow Check Switch, I/O Check Switch. If set in the PROGRAM position, a check error will not cause a machine stop; only the light will be turned on and the indicator can be interrogated and turned off by the running program. If set in the STOP position, the program will halt at the end of the memory cycle which causes the indicator to turn on. The suggested settings for these switches when running CU01 are Data Check - Stop; I/O - Stop; Overflow - Program. On suffix A machines, there is no I/O Check Switch; there is a MAR Check Switch which should be set to stop.

The four console Sense switches have the following functions in this test and should be set as desired: (SUGGESTED SETTING, ALL SWITCHES OFF)

SWITCH #1	ON	-	Bypass error type out
	OFF	-	Type out routine number on error
SWITCH #2	ON	-	Loop in routine
	OFF	-	Continue to next routine
SWITCH #3	ON	-	Stop on error
	OFF	-	Do not stop on error, continue
SWITCH #4	ON	-	Repeat Test CU01

NORMAL LOAD FROM TAPE READER:

To run the entire test, the paper tape containing the memory load for CU01 must be loaded in the paper tape reader and the reader put in a REEL mode and a READY condition. Also, put the tape punch in the READY condition. The following instruction must be manually inserted in memory locations 00000-00018: 3600024003004900828 Then RELEASE and START.

NORMAL LOAD FROM CARD I/O

Place card deck for CU01 in read hopper. Load and run in blank cards in punch hopper. Reset 1620. Depress Load key; which will cause the core storage to be loaded for CU01.

Routines with instructions addressing the paper tape reader and paper tape punch are the only routines that are different for card I/O. These differences are minor; i. e., a change to select card reader or card punch instead of paper tape reader or paper tape punch, and a change of P addresses to account for the 80 character positions of the card.

The first eight cards contain loading instructions and the math tables. The first two cards contain 8 instructions. The second through sixth instructions load the math tables at 60 characters per card. The seventh instruction loads core storage positions 00000 to 00060 with the loading instructions and the eighth instruction branches to 00000.

The loading instructions are:

```
11 00030 00060
14 00030 19944
36 00384 00500
47 00000 01200
49 00828 00000
```

The compare instruction in the above routine detects when core storage has been loaded for CU01. An equal comparison indicates that the core storage load is complete, and the program then branches to the routine that types out the setting of the sense switches.

The interlock circuits of the card reader are such that when the read hopper is empty the machine will stop on the next command for a card read. Two cards remain in the read feed. To transport these cards past the read brushes and transmit the data to the 1620 core storage, the 1622 start key must be depressed or two blank cards placed behind the deck when the deck is placed in the hopper. One of these two methods MUST be used to complete the core storage load for CU01 and to commence with the execution of the routines.

The first program executed by CU01 is a check of the console sense switches. The setting of these switches are typed out along with the instruction to set these as desired; then press the START key; HOWEVER, to check DIVIDE if installed, the following operations must be performed BEFORE depressing START:

1. INSERT
2. KEY IN 4914004
3. RELEASE
4. START

These operations will cause the instruction, branch to first division routine, to be written in memory positions 13992 - 13998, and then branch to 00552.

Division is an optional feature; although the routines to check out division are included in the program. If division is not installed, the load dividend and the divide OP codes are not valid and would cause the machine to "hang-up" when entered in the OP register and an execution attempted. Thus, a branch operation to skip the division routines is included in the program. This instruction must be altered to check division.

ENTER SINGLE ROUTINE FROM KEYBOARD

A single routine can be entered from the keyboard in the following manner:

1. Manually insert the instructions 36xxxxx0010049yyyyy from the keyboard. (xxxxx is the first memory location of the routine. In most cases it is the first position of the constant or working area. yyyyy is the first instruction of the sub-routine.)
2. Then release and start. The machine will "hang-up" waiting for information from the keyboard.
3. Key in the constants and instructions of the routine. Then release and start.
4. With Switch #2 on, the machine will loop in this routine. NOTE: If the instruction involves arithmetics, the arithmetic tables must be loaded in memory locations 100-399.

PRODUCE NEW PAPER TAPE:

To regenerate or produce another tape for input, read in the MASTER tape. When the machine halts after typing out the status of the program sense switches, Reset, Insert, key in the instructions 35000240020048, Release, Start.

C. TEST METHOD:

This test is made up of a number of sub-routines. Each sub-routine checks an operation code for specific condition and can be run as an individual test. Each sub-routine has associated with it constants and a working area, the test routine, and an error routine; and these take a block of memory. No other routine will use this block of memory. The only exception is arithmetics, where the add and multiply tables and the product area are involved.

The test was designed to first check out the more simple decision elements to determine their proper operation. As a decision element was proved to be working correctly, it was used to check the next more complicated routine.

The test starts with Checking out Branch No Record Mark, then proceeds to checkout Branch No Flag, Branch on Digit, Branch Indicate, Branch No Indicate, Transmit Digit, Transmit Digit (Immediate), Transmit Field, Transmit Field (Immediate), Transmit Record, Branch and Transmit, Branch Back, Branch and Transmit (Immediate), Set Flag, Clear Flag, Add, Add (Immediate), Subtract, Subtract (Immediate), Compare, Compare (Immediate), Multiply, Multiply (Immediate), Control, Write Numerically, Write Alphanumerically, Dump Numerically. Load Dividend, Load Dividend (Immediate), Divide, Divide (Immediate) are checked just prior to the control check if the instructions are followed.

Routines in CU01, other than those that check Input-Output operations, are performed 1000 times. This is done to give a good exercise to the logic and to have the program run for an interval of time that can be visually noted. The 1000 repeat takes in the order of 150 seconds (without division).

Upon completion of the 1000th loop, the program enters the routines (077-079) for checking the Input-Output functions.

Routine 077 checks carriage return, tab, space, write numeric, and write alphanumeric operations.

Routine 078 checks dump numeric, and routine 079 checks write alpha on cards or paper tape. After these routines are completed, the machine enters the "completed test" routine. The machine will halt if Switch #4 is OFF.

The typeout of routines 077 - 079 should appear as follows:

```
    12345 67890
    12345 67890 12345
    12345 67890
NUM INFO ABOVE OFFSET TO RIGHT TWO SPACES BETWEEN
5 AND 6 THREE LINES OF DATA.
1997601234567891̄2̄199989
```

The characters that appear on the left margin and the length of the lines will depend upon the setup of the typewriter. The first tab stop should be at least ten characters from the left-hand margin.

To check the paper tape output, load paper tape in reader after system has come to a HALT after performing CU01. Select the STRIP mode. START. The output tape will then be read into memory and typed out. The dump numeric information should be identical to that which was dumped to the typewriter except that the record work is omitted. Three identical groups of write alpha data will be typed out.

```
    1997601234567891̄2̄199989
.)+$*-/,(=@ ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
.)+$*-/,(=@ ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
.)+$*-/,(=@ ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
```

Routine 097 checks for proper operation of the arithmetic indicators and BI and BNI on these indicators.

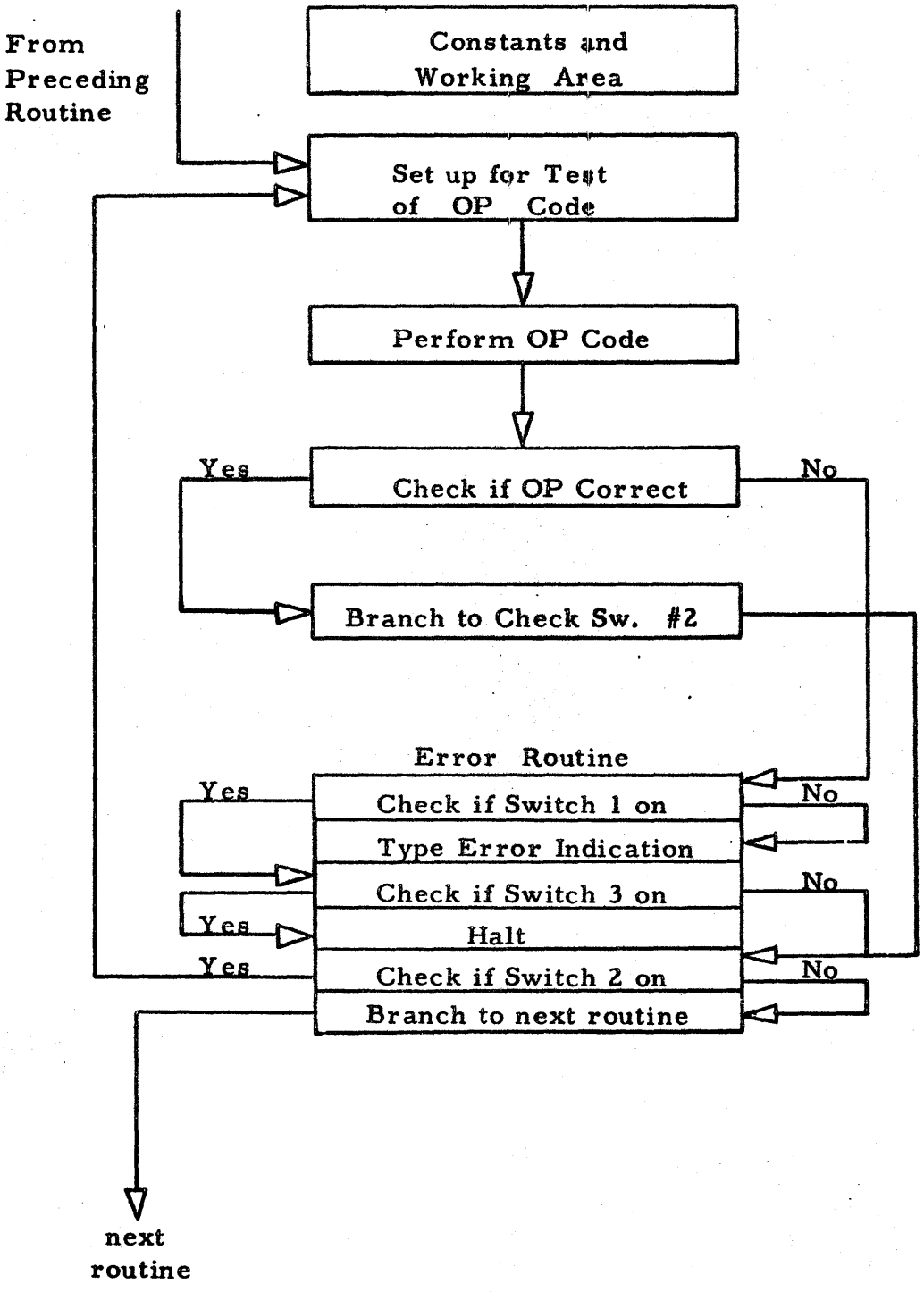
Typical error typeouts are H followed by the routine number. If the first digit following the H is a 5, this indicates that it is a sub-routine associated with the routine designated by the last two digits; i.e., (H529 or H016). H529 is a subroutine of routine 29.

The complete normal typeout information will be as follows: (Note: The numbers after "THEN START" are present only if DIVIDE is installed and checked.)

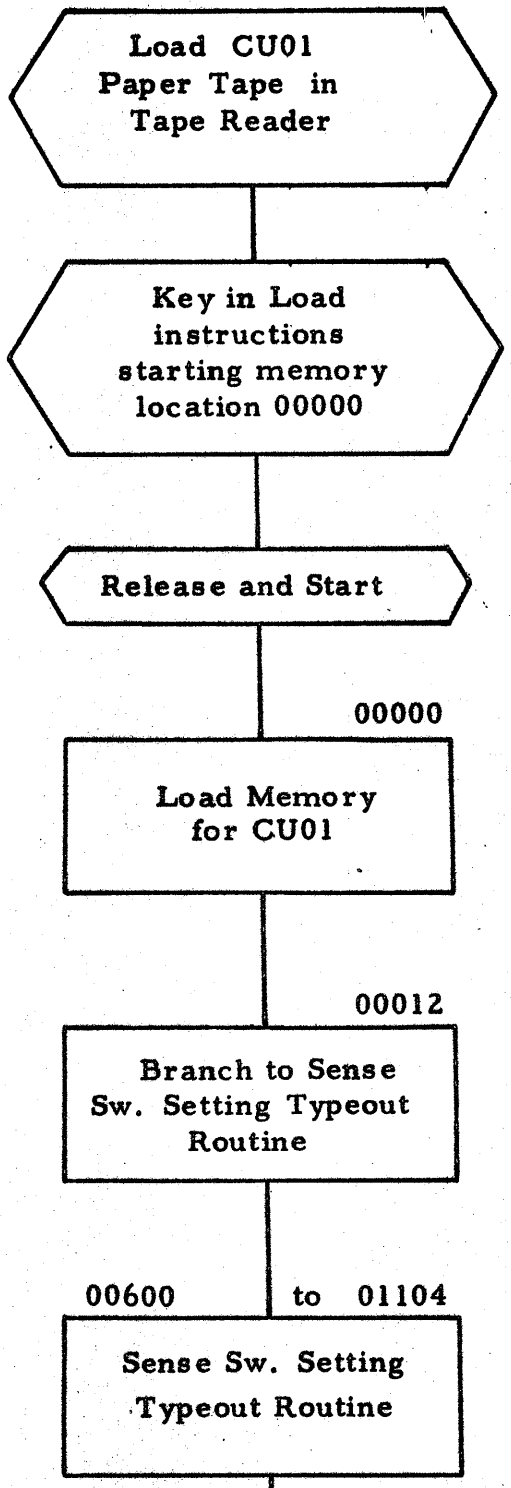
```
SW 1 OFF SW 2 OFF SW 3 OFF SW 4 OFF SET SWS FOR CU01.
  THEN START. 4914004
START ROUTINES. ETOS FOLLOW.
                    12345 67890
                    12345 67890 12345
                    12345 67890
NUM INFO ABOVE OFFSET TO RIGHT TWO SPACES BETWEEN 5 AND
 6 THREE LINES OF DATA

1997601234567891̄2̄199989
TEST ROUTINES COMPLETED.  IF SW1 OFF AND NO ROUTINE NOS
TYPED OUT, MACHINE PERFORMED TESTS PROPERLY.
1997601234567891̄2̄199989
.)+$*-/,(=@ ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
.)+$*-/,(=@ ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
.)+$&-/,(=@ ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
```

CU01

Typical Flow Chart of a Test Routine



CU01 FLOW CHART



Load Instructions are
360002400300
4900828

This instruction will load all of memory starting at 00024. A ≠ will be loaded in 00000.

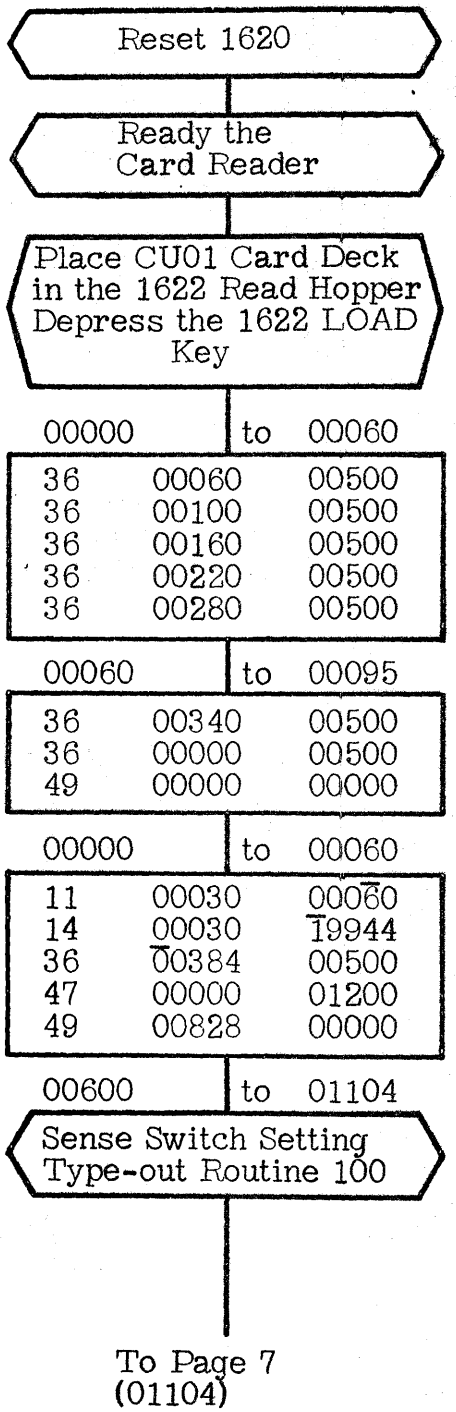
E Cycle Trigs
18
19

This routine will indicate if BI and/or BNI codes are working. Machine wi(HALT with 01091 in MAR. START must be depressed to resume.

If DIVIDE installed, modify BRANCH instruction at 13992 to check. DIVIDE. Key in 36139920010049005 52. Release and start. Key in 4914052, Release and Start.

To Page 7
(01104)

CU01 FLOW CHART
FOR 1622 I/O



Card #1

Card #2

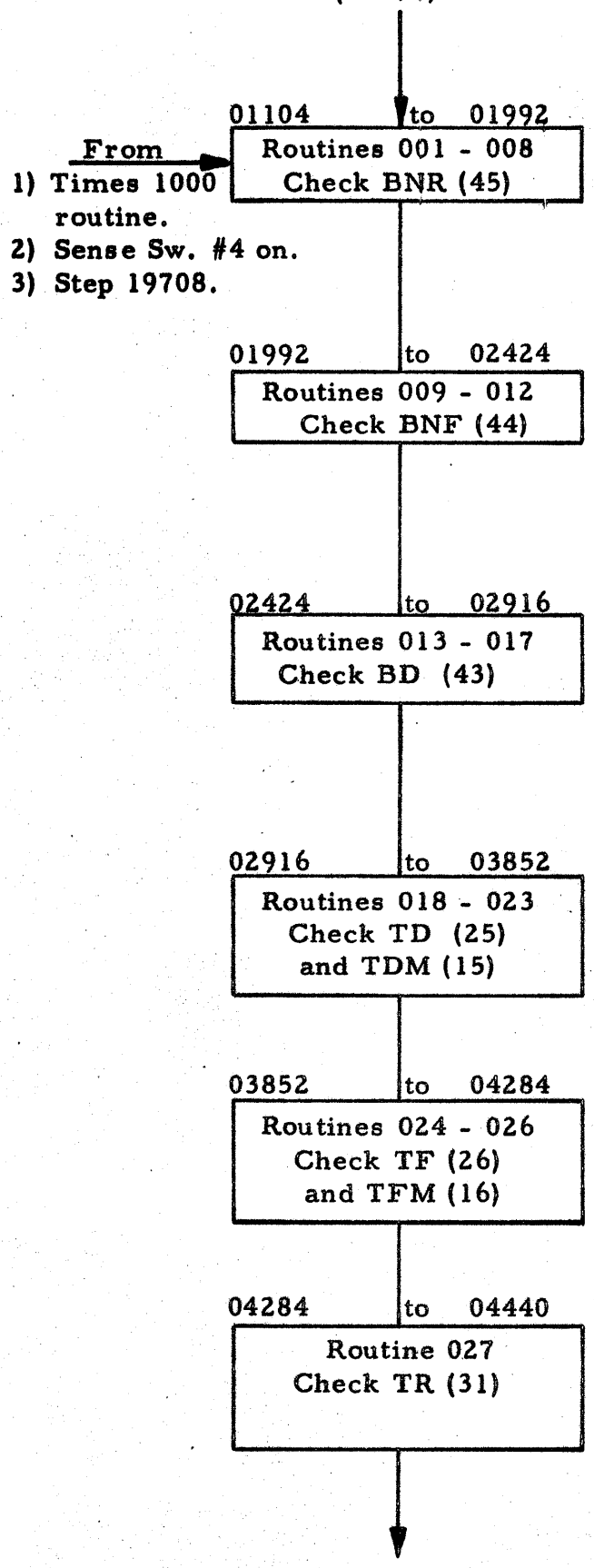
First and Second Load Cards load the math tables and the Program Load Card (Card #8). (Cards #3 through #7 contain the math tables.)

Card #8

Load Card #8 contains instructions for loading the CU01 routines.

This routine will indicate whether BI and/or BNI are working. The 1620 will Halt with 01091 in MAR. To check DIVIDE, if installed, see Page 2. If DIVIDE is not installed, press Start.

From Page 6
(01091)



E Cycle Trigs.		Aux. Trigs.
28	Check for RM	RM
29		
18	Branch	
19		

E Cycle Trigs.		Aux Trigs.
28	Check for FLAG	FM #1
29		
18	Branch	
19		

E Cycle Trigs.		Aux. Trigs
28	Check for digit	Digit
29		
18	Branch	
19		

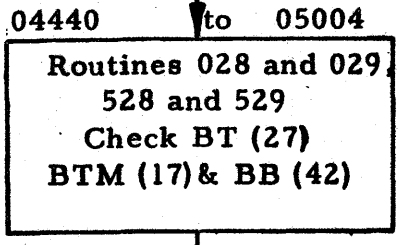
E Cycle Trigs.		Aux. Trigs.
26	Read Mem.	None
27	Write Mem.	

E Cycle Trigs.		Aux. Trigs.
26	Read Mem.	First Cycle
27	Write Mem.	Decr. FM#

E Cycle Trigs.		Aux. Trigs.
26	Read Mem.	Incr.
27	Write Mem.	RM

To Page 8
(04440)

From Page 7
(04284)



04440 to 05004

Routines 028 and 029
528 and 529
Check BT (27)
BTM (17) & BB (42)

E Cycle Trigs.	Aux. Trigs.
BT & BTM	BT & BTM
15 Set up IR-2	Decr.
16 Set up IR-1	First Cycle
26, 27 Transmit Field	FM #1
BB	BB
20	Save control
19	status

05004 to 05604

Routines 030 - 033
Check Set Flag (32)

E Cycle Trigs.	Aux. Trigs.
28	None
29	

05604 to 06228

Routines 034 - 037
Check Clear Flag (33)

E Cycle Trigs.	Aux. Trigs.
28	None
29	

06228 to 07248

Routines 038 - 042
Check H/P, E/Z
Trigs.; ADD (21)

E Cycle Trigs.	Aux. Trigs.
11	H/P, Carry In
12	E/Z, Carry Out
13	T/C, Recomp.,
14	#22; Incr./Decr
23	First Cycle
	FM #1
	FM #2

07248 to 09024

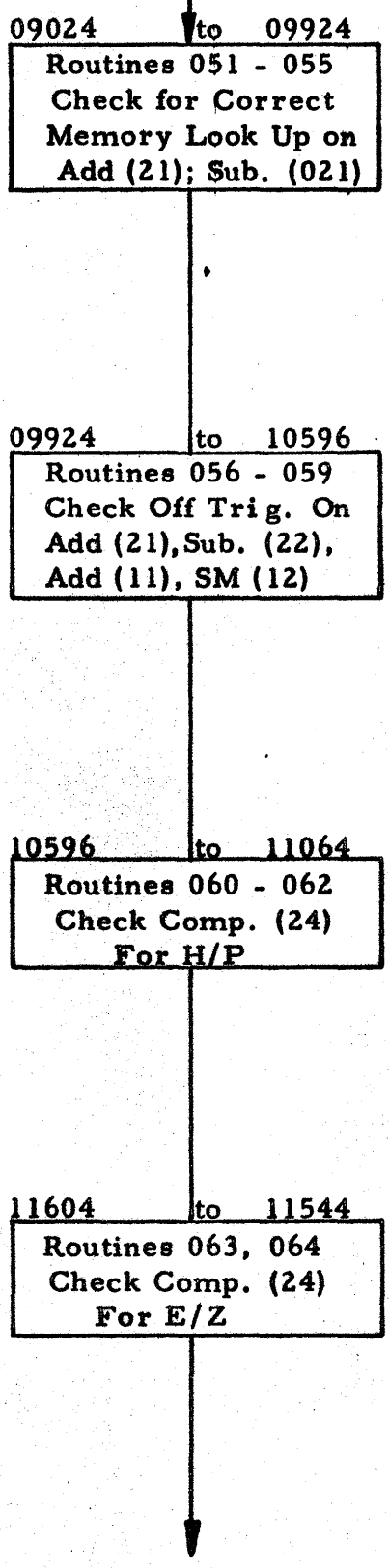
Routines 043 - 050
Check H/P, E/Z
Trigs.; Subt. (22)

E Cycle Trigs.	Aux. Trigs.
11	H/P
12	E/Z
13	T/C
14	Incr./Decr.
23	First Cycle
	FM #1
	FM #2
	Carry Out
	Carry In
	Recomp., #22

To Page 9
(09024)

PN 2128301
EC 404530

From Page 8
(09024)



E Cycle Trigs.	Aux. Trigs.
11	H/P
12	E/Z
13	T/C
14	FM #1
23	FM #2
	Carry Out
	Carry In
	Incr./Decr.
	First Cycle
	Recomp., #22

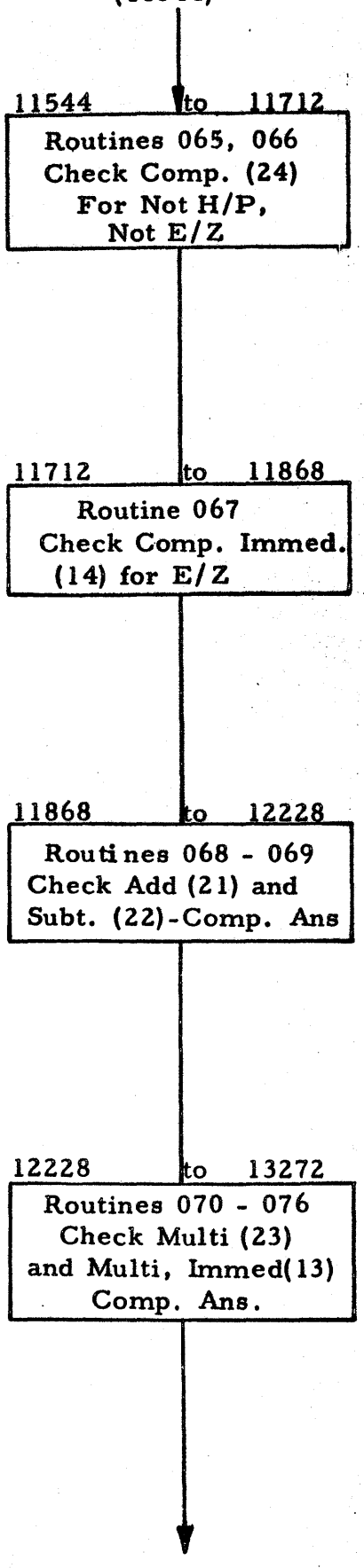
E Cycle Trigs.	Aux. Trigs.
	H/P #22
11	E/Z O'Flow
12	T/C
13	FM #1
14	Carry Out
23	Carry In
	Incr./Decr.
	Recomp.

E Cycle Trigs.	Aux. Trigs.
Depends upon length	T/C, H/P, E/Z,
and sign of fields.	Incr./Decr.
If all trigs. used:	First Cycle
11	FM #1
12	FM #2
13	Carry Out
14	Carry In
21	

E Cycle Trigs.	Aux. Trigs.
Depends upon length	T/C, H/P, E/Z,
and sign of fields.	First Cycle,
If all trigs. used,	FM #1
they are:	FM #2
11	Carry Out
12	Carry In
13	Incr./Decr.
14	
21	

To Page 10
(11544)

From Page 9
(11544)



11544 to 11712

Routines 065, 066
Check Comp. (24)
For Not H/P,
Not E/Z

E Cycle Trigs.	Aux. Trigs.
Depends upon length and sign of fields. If all used:	T/C, H/P, E/Z, First Cycle
11	FM #1
12	FM #2
13	Incr./Decr.
14	Carry Out
21	Carry In

11712 to 11868

Routine 067
Check Comp. Immed.
(14) for E/Z

E Cycle Trigs.	Aux. Trigs.
11	T/C, H/P, E/Z
12	First Cycle
13	FM #1
14	FM #2
	Incr./Decr.
	Carry Out
	Carry In

11868 to 12228

Routines 068 - 069
Check Add (21) and
Subt. (22)-Comp. Ans

E Cycle Trigs.	Aux. Trigs.
11	E/Z, H/P, T/C
12	First Cycle
13	FM #1
14	FM #2
21	Incr./Decr.
	Carry Out
	Carry In

12228 to 13272

Routines 070 - 076
Check Multi (23)
and Multi, Immed(13)
Comp. Ans.

E Cycle Trigs.	Aux. Trigs.
32	E/Z, H/P
33	T/C
34	First Cycle
35	Carry Out
36	Carry In
37	FM #1
38	FM #2
39	Incr./Decr.
40	Cycle Control
41	00080
19	

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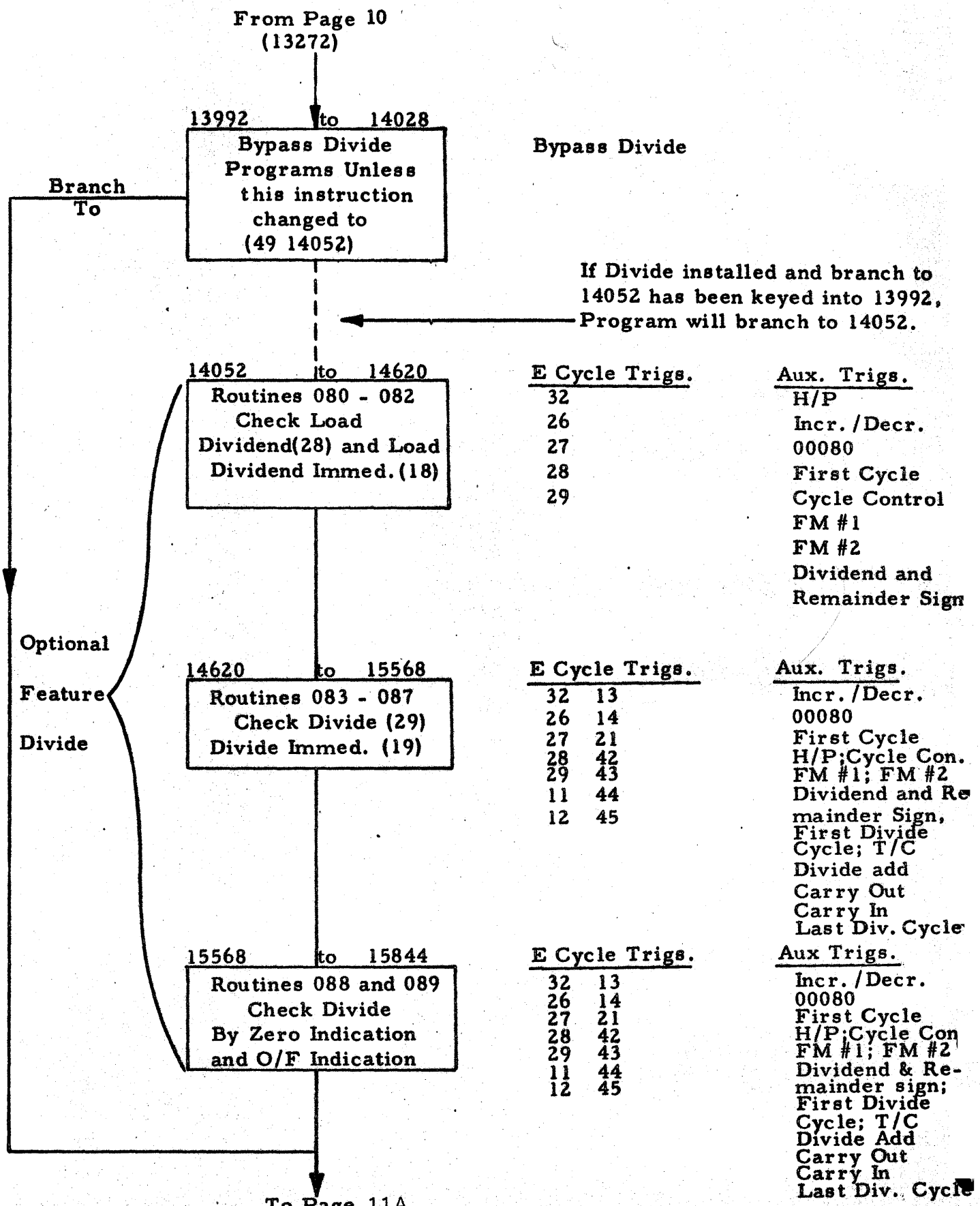
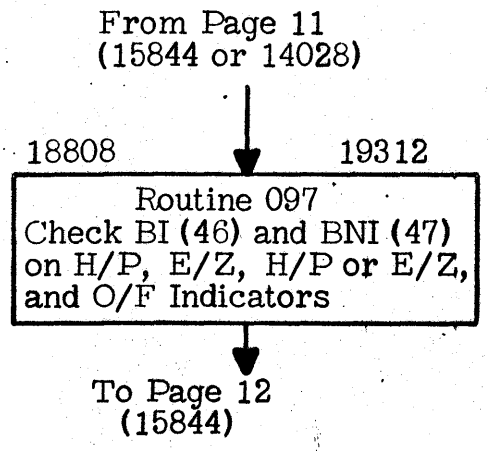
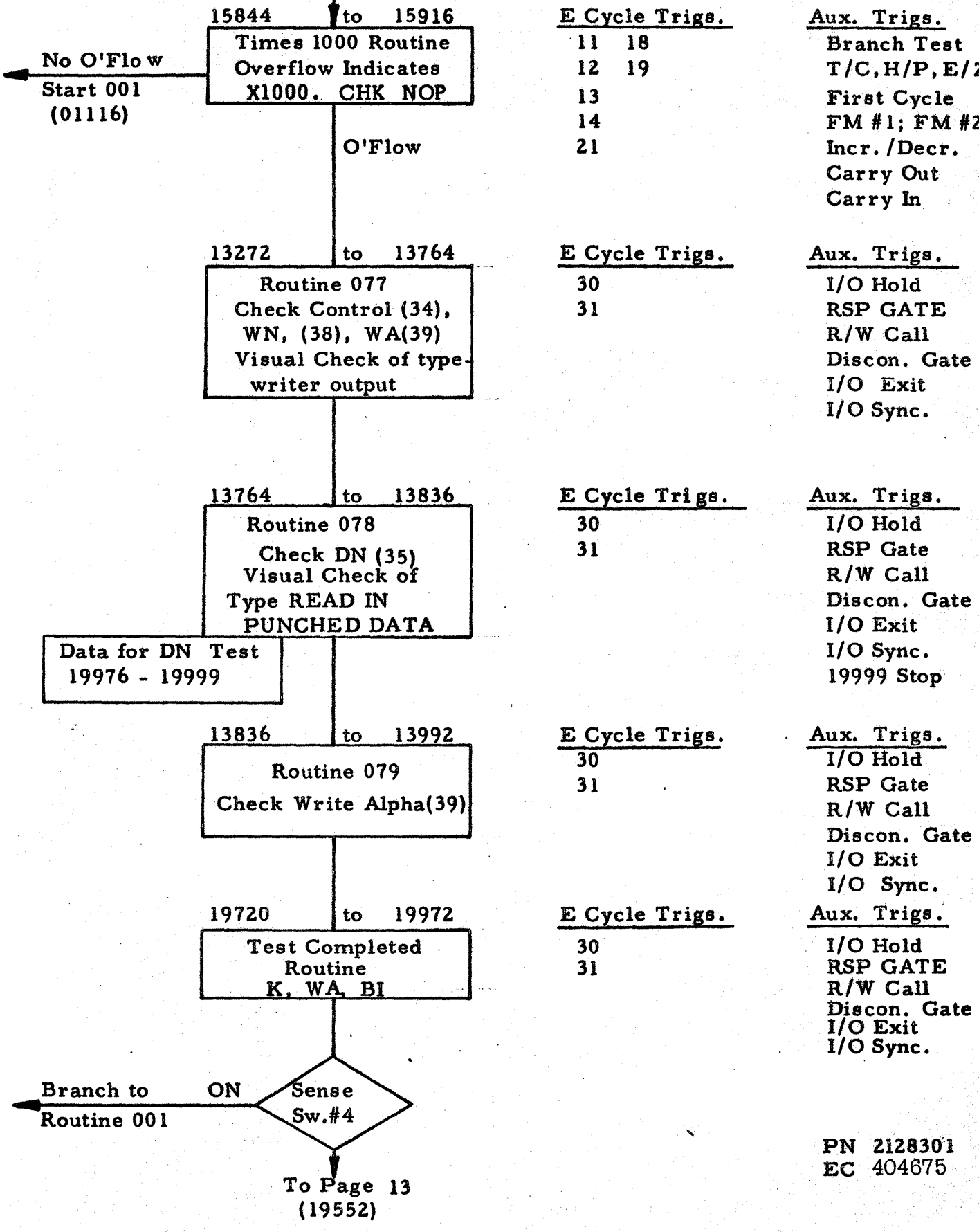
(13992)



PN 2128301
EC 404675


From Page 11
(15844 or 14028)
18808
19312
Routine 097
Check BI (46) and BNI (47)
on H/P, E/Z, H/P or E/Z,
and O/F Indicators
To Page 12
(15844)

From Page 11A
(19312)



E Cycle Trigs.	Aux. Trigs.
11 18	Branch Test
12 19	T/C, H/P, E/Z
13	First Cycle
14	FM #1; FM #2
21	Incr./Decr.
	Carry Out
	Carry In

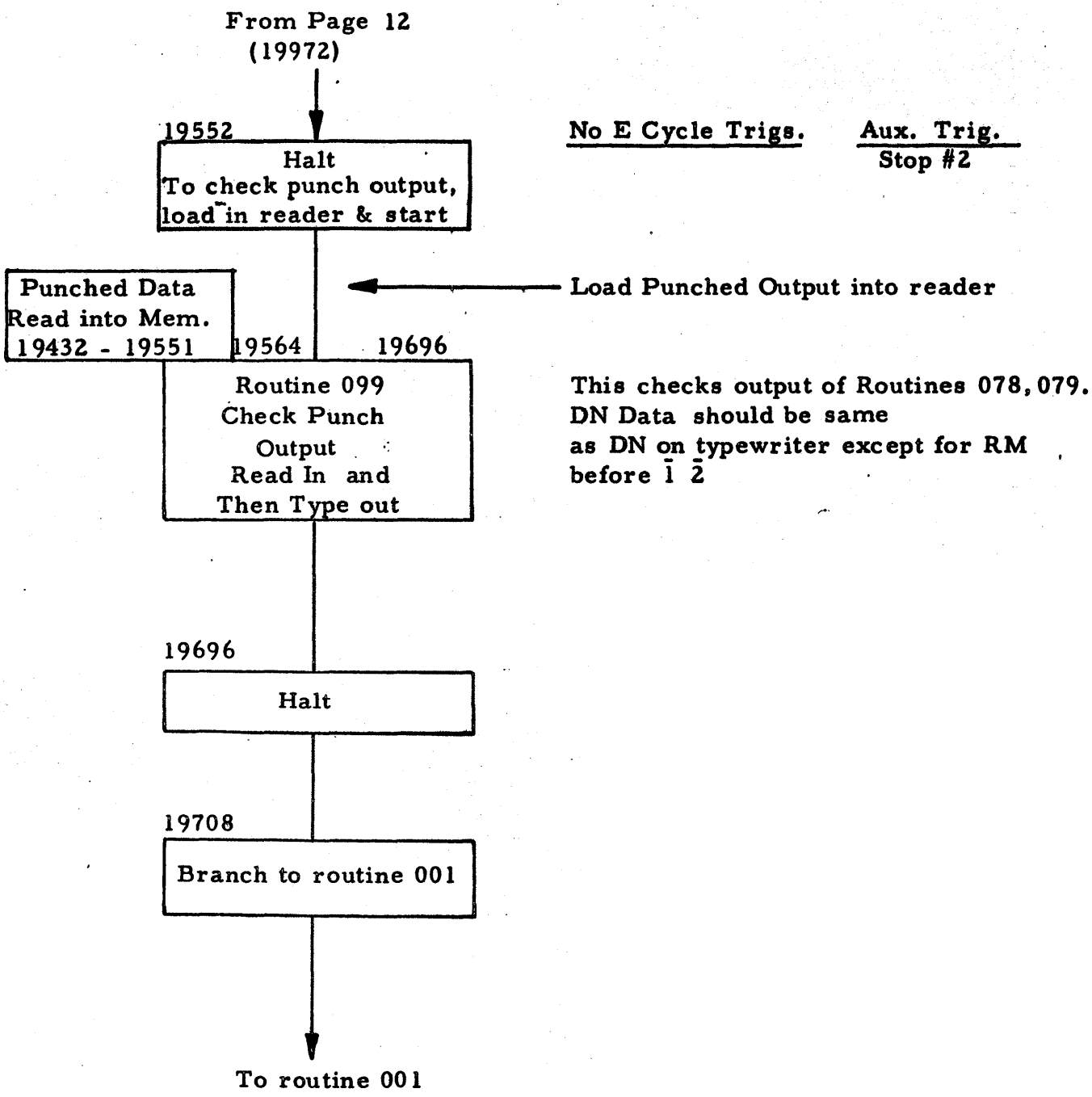
E Cycle Trigs.	Aux. Trigs.
30	I/O Hold
31	RSP GATE
	R/W Call
	Discon. Gate
	I/O Exit
	I/O Sync.

E Cycle Trigs.	Aux. Trigs.
30	I/O Hold
31	RSP Gate
	R/W Call
	Discon. Gate
	I/O Exit
	I/O Sync.
	19999 Stop

E Cycle Trigs.	Aux. Trigs.
30	I/O Hold
31	RSP Gate
	R/W Call
	Discon. Gate
	I/O Exit
	I/O Sync.

E Cycle Trigs.	Aux. Trigs.
30	I/O Hold
31	RSP GATE
	R/W Call
	Discon. Gate
	I/O Exit
	I/O Sync.

PN 2128301
EC 404675


From Page 12
(19972)
19552
Halt
To check punch output, load in reader & start
No E Cycle Trigs.
Aux. Trig.
Stop #2
Punched Data
Read into Mem.
19432 - 19551
Load Punched Output into reader
19564
19696
Routine 099
Check Punch
Output
Read In and
Then Type out
This checks output of Routines 078, 079.
DN Data should be same
as DN on typewriter except for RM
before 1 2
19696
Halt
19708
Branch to routine 001
To routine 001

1620 DIAGNOSTIC PROGRAM

CUO1

MEM LOC	00PPPPPQQQQQ 01 23456 78 9 0 1	OP TYP	
24		X	
36		X	
48		X	
60		X	
72		X	
84		X	
96	000 00000	MT	MULTIPLY TABLE
108	00 00102 03040	MT	MULTIPLY TABLE
120	00 20406 08000	MT	MULTIPLY TABLE
132	30 60902 10040	MT	MULTIPLY TABLE
144	80 21610 05001	MT	MULTIPLY TABLE
156	51 02006 02181	MT	MULTIPLY TABLE
168	42 00704 11282	MT	MULTIPLY TABLE
180	00 80614 22300	MT	MULTIPLY TABLE
192	90 81726 30000	MT	MULTIPLY TABLE
204	00 00005 06070	MT	MULTIPLY TABLE
216	80 90012 14161	MT	MULTIPLY TABLE
228	81 51811 24272	MT	MULTIPLY TABLE
240	02 42822 36352	MT	MULTIPLY TABLE
252	03 53045 40363	MT	MULTIPLY TABLE
264	24 84455 32494	MT	MULTIPLY TABLE
276	65 36048 46546	MT	MULTIPLY TABLE
288	27 54453 62718	MT	MULTIPLY TABLE
300	01 23456 78912	AT	ADD TABLES
312	34 56789 02345	AT	ADD TABLES
324	67 8901 3 45678	AT	ADD TABLES
336	90 12456 7890 1	AT	ADD TABLES
348	23 56789 0123 4	AT	ADD TABLES
360	67 8901 2 3457 8	AT	ADD TABLES
372	90 1234 5 6890 1	AT	ADD TABLES
384	23 4567 9 0123 4	AT	ADD TABLES
396	56 78	AT	ADD TABLES
408		X	
420		X	
432		X	
444		X	
456		X	
468		X	
480		X	
492	62 63415 963	X	START
504	59 56646 34955	X	ROUTIN
516	45 6203 4563	X	ES. ET
528	56 62 4 65653	X	OS FOL

```
540     53 56660 3  0≠      X       LOW.
552     34       00102      K       CARRIAGE RETURN
564     39 00493 00100      WA      START ROUTINES. ETOS FOLLOW
576     49 01116            B

588                         X
```

ROUTINE 100
TYPES SENSE SW SETTINGS

```
600     62 66  7 1  56      X       SWITCH SETUP DATA
612     55   0≠6 266        X       SWITCH SETUP DATA
624     71   564 646        X       SWITCH SETUP DATA
636     0≠ 6266  72         X       SWITCH SETUP DATA
648     56 55  0 ≠6266      X       SWITCH SETUP DATA
660        72  5 64646      X       SWITCH SETUP DATA
672        0≠626 6  73      X       SWITCH SETUP DATA
684        5655   0≠62      X       SWITCH SETUP DATA
696     66   73   5646      X       SWITCH SETUP DATA
708     46   0≠6 266        X       SWITCH SETUP DATA
720     74   565 5  0≠      X       SWITCH SETUP DATA
732     62 66  7 4  56      X       SWITCH SETUP DATA
744     46 46  0 ≠6245      X       SWITCH SETUP DATA
756     63   626 662        X       SWITCH SETUP DATA
768     46 5659      43     X       SWITCH SETUP DATA
780     64 70710 3          X       SWITCH SETUP DATA
792        63484 555        X       SWITCH SETUP DATA
804     62 63415 96303      X       SWITCH SETUP DATA
816     00 0≠               X
828     46 00852 00100      BI      CHECK FOR SW 1 ON
840     47 00876 00100      BNI     CHECK FOR SW 1 OFF
852     39 00601 00100      WA      SW 1 ON
864     49 00888            B
876     39 00619 00100      WA      SW 1 OFF
888     46 00912 00200      BI      CHECK FOR SW 2 ON
900     47 00936 00200      BNI     CHECK FOR SW 2 OFF
912     39 00639 00100      WA      SW 2 ON
924     49 00948            B
936     39 00657 00100      WA      SW 2 OFF
948     46 00972 00300      BI      CHECK FOR SW 3 ON
960     47 00996 00300      BNI     CHECK FOR SW 3 OFF
972     39 00677 00100      WA      SW 3 ON
```

```
 984    49 01008          B
 996    39 00695 00100    WA     SW 3 OFF
1008    46 01032 00400    BI     CHECK FOR SW 4 ON
1020    47 01056 00400    BNI    CHECK FOR SW 4 OFF
1032    39 00715 00100    WA     SW 4 ON
1044    49 01068          B
1056    39 00733 00100    WA     SW 4 OFF
1068    39 00753 00100    WA     SET SWS FOR CUO1 THEN START
1080    48                H
1092    49 00552          B
```

ROUTINE 001
BRANCH NO RECORD MARK ON RM EVEN MEMORY PO

```
1104                 ≠    X      CONSTANTS
1116    45 01152 01114    BNR    CHECK FOR RM
1128    49 01200          B
1140    41                NOP
                           ERROR ROUTINE
1152    46 01176 00100    BI     CHECK SW 1 IF ON BY ETO
1164    39 01189 00100    WA
1176    47 01200 00300    BNI    CHECK SW 3 IF ON STOP ERROR
1188    48 70707 1  0≠    H
1200    46 01116 00200    BI     CHECK SW 2 IF ON LOOP ROUTINE
1212    49 01236          B
```

ROUTINE 002
BRANCH NO RECORD MARK ON RM ODD MEMORY POS

```
1224                 ≠    X      CONSTANTS
1236    45 01272 01235    BNR    CHECK FOR RM
1248    49 01320          B
1260    41                NOP
                           ERROR ROUTINE
1272    46 01296 00100    BI
```

```
1284    39 01309 00100    WA
1296    47 01320 00300    BNI
1308    48 70707 2  0≠    H
1320    46 01236 00200    BI
1332    49 01356          B
```

ROUTINE 003
BRANCH NO RECORD MARK ON 8 IN EVEN MEMORY POSITIO

```
1344                8     X       CONSTANTS
1356    45 01428 01354    BNR     CHECK FOR NO RM
1368    49 01380          B
                          ERROR ROUTINE
1380    46 01404 00100    BI
1392    39 01417 00100    WA
1404    47 01428 00300    BNI
1416    48 70707 3  0≠    H
1428    46 01356 00200    BI
1440    49 01464          B
```

ROUTINE 004
BRANCH NO RECORD MARK ON 8 IN ODD MEMORY POSITION

```
1452                8     X       CONSTANTS
1464    45 01536 01463    BNR     CHECK FOR NO RM
1476    49 01488          B
                          ERROR ROUTINE
1488    46 01512 00100    BI
1500    39 01525 00100    WA
1512    47 01536 00300    BNI
1524    48 70707 4  0≠    H
1536    46 01464 00200    BI
1548    49 01572          B
```

ROUTINE 005
BRANCH NO RECORD MARK ON 2 IN EVEN MEMORY POSITIO

```
1560                2     X      CONSTANTS
1572   45 01644 01570     BNR    CHECK FOR NO RM
1584   49 01596           B
                                     ERROR ROUTINE
1596   46 01620 00100     BI
1608   39 01633 00100     WA
1620   47 01644 00300     BNI
1632   48 70707 5  0≠     H
1644   46 01572 00200     BI
1656   49 01680           B
```

ROUTINE 006
BRANCH NO RECORD MARK ON 2 IN ODD MEMORY POS

```
1668                2     X      CONSTANTS
1680   45 01752 01679     BNR    CHECK FOR NO RM
1692   49 01704           B
                                     ERROR ROUTINE
1704   46 01728 00100     BI
1716   39 01741 00100     WA
1728   47 01752 00300     BNI
1740   48 70707 6  0≠     H
1752   46 01680 00200     BI
1764   49 01788           B
```

ROUTINE 007
BRANCH NO RECORD MARK ON ZERO IN EVEN MEMORY POS

```
1776                0     X      CONSTANTS
1788   45 01860 01786     BNR    CHECK FOR NO RM
1800   49 01812           B
```

ERROR ROUTINE

```
1812   46 01836 00100    BI
1824   39 01849 00100    WA
1836   47 01860 00300    BNI
1848   48 70707 7  0≠    H
1860   46 01788 00200    BI
1872   49 01896          B
```

ROUTINE 008
BRANCH NO RECORD MARK ON ZERO IN ODD MEMORY POS

```
1884                0    X      CONSTANTS
1896   45 01968 01895    BNR    CHECK FOR NO RM
1908   49 01920          B
                                 ERROR ROUTINE
1920   46 01944 00100    BI
1932   39 01957 00100    WA
1944   47 01968 00300    BNI
1956   48 70707 8  0≠    H
1968   46 01896 00200    BI
1980   49 02004          B
```

ROUTINE 009
BRANCH NO FLAG ON FLAG EVEN MEMORY POS

```
1992                Ī    X      CONSTANTS
2004   44 02028 02002    BNF    CHECK FOR FLAG
2016   49 02076          B
                                 ERROR ROUTINE
2028   46 02052 00100    BI
2040   39 02065 00100    WA
2052   47 02076 00300    BNI
2064   48 70707 9  0≠    H
2076   46 02004 00200    BI
2088   49 02112          B
```

ROUTINE 010
BRANCH NO FLAG ON FLAG ODD MEMORY POS

```
2100                  1    X      CONSTANTS
2112   44 02136 02111      BNF    CHECK FOR FLAG
2124   49 02184             B
                            ERROR ROUTINE
2136   46 02160 00100       BI
2148   39 02173 00100       WA
2160   47 02184 00300       BNI
2172   48 70717 0  0≠       H
2184   46 02112 00200       BI
2196   49 02220             B
```

ROUTINE 011
BRANCH NO FLAG ON NO FLAG EVEN MEMORY POS

```
2208                  0    X      CONSTANTS
2220   44 02292 02218      BNF
2232   49 02244             B
                            ERROR ROUTINE
2244   46 02268 00100       BI
2256   39 02281 00100       WA
2268   47 02292 00300       BNI
2280   48 70717 1  0≠       H
2292   46 02220 00200       BI
2304   49 02328             B
```

ROUTINE 012
BRANCH NO FLAG ON NO FLAG ODD MEMORY POS

```
2316                  0    X      CONSTANTS
2328   44 02400 02325      BNF
2340   49 02352             B
```

ERROR ROUTINE

```
2352   46 02376 00100    BI
2364   39 02389 00100    WA
2376   47 02400 00300    BNI
2388   48 70717 2  0≠    H
2400   46 02328 00200    BI
2412   49 02436          B
```

ROUTINE 013
BRANCH ON DIGIT 1

```
2424                1    X      CONSTANTS
2436   43 02496 02434    BD     CHECK FOR A 1
                                 ERROR ROUTINE
2448   46 02472 00100    BI
2460   39 02485 00100    WA
2472   47 02496 00300    BNI
2484   48 70717 3  0≠    H
2496   46 02436 00200    BI
2508   49 02532          B
```

ROUTINE 014
BRANCH ON DIGIT 2

```
2520                2    X      CONSTANTS
2532   43 02592 02531    BD     CHECK FOR A 2
                                 ERROR ROUTINE
2544   46 02568 00100    BI
2556   39 02581 00100    WA
2568   47 02592 00300    BNI
2580   48 70717 4  0≠    H
2592   46 02532 00200    BI
2604   49 02628          B
```

ROUTINE 015
BRANCH ON DIGIT 4

```
2616                    4       X       CONSTANTS
2628    43 02688 02626          BD      CHECK FOR A 4
                                        ERROR ROUTINE
2640    46 02664 00100          BI
2652    39 02677 00100          WA
2664    47 02688 00300          BNI
2676    48 70717 5  0≠          H
2688    46 02628 00200          BI
2700    49 02724                B
```

ROUTINE 016
BRANCH ON DIGIT 8

```
2712                    8       X       CONSTANTS
2724    43 02784 02723          BD      CHECK FOR AN 8
                                        ERROR ROUTINE
2736    46 02760 00100          BI
2748    39 02773 00100          WA
2760    47 02784 00300          BNI
2772    48 70717 6  0≠          H
2784    46 02724 00200          BI
2796    49 02820                B
```

ROUTINE 017
BRANCH ON DIGIT 0

```
2808                    0       X       CONSTANTS
2820    43 02844 02818          BD      CHECK FOR ZERO
2832    49 02892                B
```

```
                                        ERROR ROUTINE
2844    46 02868 00100      BI
2856    39 02881 00100      WA
2868    47 02892 00300      BNI
2880    48 70717 7  0≠      H
2892    46 02820 00200      BI
2904    49 02928            B
```

```
                                        ROUTINE 018
                                    TRANS DIGIT FROM EVEN TO EVEN MEMORY POS
2916                0 ≠     X      CONSTANTS AND WORKING AREA
2928    25 02922 02926      TD     TRANS RM
2940    45 03000 02922      BNR    CHECK FOR RM
2952    25 02922 02924      TD     TRANS ZERO
2964    43 03000 02922      BD     CHECK FOR NO DIGIT
2976    49 03048            B
2988    41                  NOP
                                    ERROR ROUTINE
3000    46 03024 00100      BI
3012    39 03037 00100      WA
3024    47 03048 00300      BNI
3036    48 70717 8  0≠      H
3048    46 02928 00200      BI
3060    49 03084            B
```

```
                                        ROUTINE 019
                                    TRANS DIGIT FROM ODD TO ODD MEMORY POS
3072                0 ≠     X      CONSTANTS AND WORKING AREA
3084    25 03077 03083      TD     TRANS RM
3096    45 03156 03077      BNR    CHECK FOR RM
3108    25 03077 03081      TD     TRANS ZERO
```

```
3120   43 03156 03077    BD     CHECK FOR NO DIGIT
3132   49 03204          B
3144   41                NOP
                                 ERROR ROUTINE
3156   46 03180 00100    BI
3168   39 03193 00100    WA
3180   47 03204 00300    BNI
3192   48 70717 9  0≠    H
3204   46 03084 00200    BI
3216   49 03240          B
```

ROUTINE 020
TRANS DIGIT FROM EVEN TO ODD MEMORY POSITION

```
3228              0 ≠    X      CONSTANTS AND WORKING AREA
3240   25 03233 03238    TD     TRANS RM
3252   45 03312 03233    BNR    CHECK FOR RM
3264   25 03233 03236    TD     TRANS ZERO
3276   43 03312 03233    BD     CHECK FOR NO DIGIT
3288   49 03360          B
3300   41                NOP
                                 ERROR ROUTINE
3312   46 03336 00100    BI
3324   39 03349 00100    WA
3336   47 03360 00300    BNI
3348   48 70727 0  0≠    H
3360   46 03240 00200    BI
3372   49 03396          B
```

ROUTINE 021
TRANS DIGIT FROM ODD TO EVEN MEMORY POS

```
3384              0 ≠    X      CONSTANTS AND WORKING AREA
3396   25 03390 03395    TD     TRANS RM
3408   45 03468 03390    BNR    CHECK FOR RM
```

```
3420   25 03390 03393    TD     TRANS ZERO
3432   43 03468 03390    BD     CHECK FOR NO DIGIT
3444   49 03516          B
3456   41                NOP
                                 ERROR ROUTINE
3468   46 03492 00100    BI
3480   39 03505 00100    WA
3492   47 03516 00300    BNI
3504   48 70727 1  0≠    H
3516   46 03396 00200    BI
3528   49 03552          B
```

ROUTINE 022
TRANS IMMED RECORD MARK TO EVEN MEMORY POS

```
3540                     X      WORKING AREA
3552   15 03546 0000≠    TDM    TRANS IMMED RM
3564   45 03624 03546    BNR    CHECK FOR RM
3576   15 03546 00000    TDM    TRANS IMMED ZERO
3588   43 03624 03546    BD     CHECK FOR NO DIGIT
3600   49 03672          B
3612   41                NOP
                                 ERROR ROUTINE
3624   46 03648 00100    BI
3636   39 03661 00100    WA
3648   47 03672 00300    BNI
3660   48 70727 2  0≠    H
3672   46 03552 00200    BI
3684   49 03708          B
```

ROUTINE 023
TRANS IMMED RECORD MARK TO ODD MEMORY POS

```
3696                          X       WORKING AREA
3708    15 03701 0000≠        TDM     TRANS IMMED RM
3720    45 03780 03701        BNR     CHECK FOR RM
3732    15 03701 00000        TDM     TRANS IMMED ZERO
3744    43 03780 03701        BD      CHECK FOR NO DIGIT
3756    49 03828              B
3768    41                    NOP
                              ERROR ROUTINE
3780    46 03804 00100        BI
3792    39 03817 00100        WA
3804    47 03828 00300        BNI
3816    48 70727 3  0≠        H
3828    46 03708 00200        BI
3840    49 03864              B
```

ROUTINE 024
TRANS FIELD-2 CHAR ($\overline{1}\neq$) TO ODD MEMORY POS

```
3852                  1≠      X       CONSTANTS AND WORKING AREA
3864    26 03857 03863        TF      TRANS 1≠
3876    45 03924 03857        BNR     CHECK FOR RM
3888    44 03924 03856        BNF     CHECK FOR FLAG
3900    49 03972              B
3912    41                    NOP
                              ERROR ROUTINE
3924    46 03948 00100        BI
3936    39 03961 00100        WA
3948    47 03972 00300        BNI
3960    48 70727 4  0≠        H
3972    46 03864 00200        BI
3984    49 04008              B
```

ROUTINE 025
TRANS FIELD - 2 CHAR (Ī≠) TO EVEN MEMORY POS

```
3996                Ī≠      X       CONSTANTS AND WORKING AREA
4008   26 04002 04006       TF      TRANS Ī≠
4020   45 04068 04002       BNR     CHECK FOR RM
4032   44 04068 04001       BNF     CHECK FOR FLAG
4044   49 04116             B
4056   41                   NOP
                            ERROR ROUTINE
4068   46 04092 00100       BI
4080   39 04105 00100       WA
4092   47 04116 00300       BNI
4104   48 70727 5  0≠       H
4116   46 04008 00200       BI
4128   49 04152             B
```

ROUTINE 026
TRANS FIELD IMMED - 3 CHAR (Ī7≠)

```
4140                        X       WORKING AREA
4152   16 04145 00Ī7≠       TFM     TRANS Ī7≠
4164   45 04212 04145       BNR     CHECK FOR RM
4176   44 04212 04143       BNF     CHECK FOR FLAG
4188   49 04260             B
4200   41                   NOP
                            ERROR ROUTINE
4212   46 04236 00100       BI
4224   39 04249 00100       WA
4236   47 04260 00300       BNI
4248   48 70727 6  0≠       H
4260   46 04152 00200       BI
4272   49 04308             B
```

ROUTINE 027
TRANS RECORD-6 CHAR (Ī2480≠) TO ODD MEMORY POS

```
4284          Ī 2480≠   X      CONSTANT$
4296                    X      WORKING AREA
4308   31 04301 04290   TR     TRAN$ RECORD - Ī2480≠
4320   44 04368 04301   BNF    CHEC$K FOR FIRST CHARACTER
4332   45 04368 04306   BNR    CHEC$K FOR LAST CHARACTER
4344   49 04416         B
4356   41               NOP
                               ERRO$R ROUTINE
4368   46 04392 00100   BI
4380   39 04405 00100   WA
4392   47 04416 00300   BNI
4404   48 70727 7  0≠   H
4416   46 04308 00200   BI
4428   49 04452         B
```

ROUTINE 028
BRANCH AND TRANS 6 CHAR (Ī2480≠)

```
4440          Ī 2480≠   X      CONSTANTS
4452   27 04596 04451   BT     BRANCH TO 04596 AND TRANS FIELD
4464   44 04656 04594   BNF    CHECK 04594 FOR FLAG
4476   49 04704         B
4488   41               NOP
4500   41               NOP
                               ERROR ROUTINE
4512   46 04536 00100   BI
4524   39 04549 00100   WA
4536   47 04560 00300   BNI
4548   48 70727 8  0≠   H
4560   46 04452 00200   BI
4572   49 04620         B
```

SUB-ROUTINE 528
THIS IS ROUTINE BRANCHED TO IN 028. CHKS TRANS
CORRECT. CHANGES 0 TO Ī and BB to MAIN ROUTINE

```
4584                    X      WORKING AREA
4596   45 04512 04595   BNR    CHECK LOW ORDER FOR RM
4608   44 04512 04590   BNF    CHECK HIGH ORDER FOR FLAG
4620   15 04594 0000Ī   TDM    TRANS Ī TO 04594
```

```
4632   16 04593 0̄0000    TFM   CLEAR TRANSMITTED FIELD
4644   42 04692          BB    BRANCH BACK TO 04464
                                 ERROR ROUTINE
4656   46 04680 00100    BI
4668   39 04693 00100    WA
4680   47 04704 00300    BNI
4692   48 75727 8  0≠     H
4704   46 04452 00200    BI
4716   49 04728          B
```

ROUTINE 029
BRANCH AND TRANS IMMED TRANS 3 CHAR FIELD (1̄7≠)

```
4728   17 04872 001̄7≠    BTM   BRANCH TO 04872 AND TRANS FIELD
4740   44 04932 04868    BNF   CHECK 04868 FOR FLAG
4752   49 04980          B
4764   41                NOP
4776   41                NOP
                                 ERROR ROUTINE
4788   46 04812 00100    BI
4800   39 04825 00100    WA
4812   47 04836 00300    BNI
4824   48 70727 9  0≠     H
4836   46 04728 00200    BI
4848   49 04896          B
```

SUB-ROUTINE 529
THIS IS ROUTINE BRANCHED TO IN 029. CHKS TRANS CORRECT. CHANGES 7 TO 1̄ AND BB TO MAIN ROUTINE

```
4860                     X     WORKING AREA
4872   45 04788 04871    BNR   CHECK LOW ORDER FOR RM
4884   44 04788 04869    BNF   CHECK HIGH ORDER FOR FLAG
4896   16 04870 000̄0̄1̄   TFM   TRANS FIELD 1̄0̄1̄ IMMED
4908   42 04968          BB    BRANCH BACK TO 04740
4920   41                NOP
```

ERROR ROUTINE

```
4932   46 04956 00100    BI
4944   39 04969 00100    WA
4956   47 04980 00300    BNI
4968   48 75727 9  0/    H
4980   46 04728 00200    BI
4992   49 05016          B
```

ROUTINE 030

SET FLAG ON CHAR WITH FLAG AND C BIT ($\bar{8}$)

```
5004                8̄    X       WORKING AREA
5016   46 05028 01600    BI      TURN OFF MBR E CHECK
5028   32 05014          SF      SET FLAG ON 8̄
5040   44 05076 05014    BNF     CHECK FLAG NOT REMOVED
5052   46 05076 01600    BI      CHECK C BIT NOT REMOVED
5064   49 05124          B
```

ERROR ROUTINE

```
5076   46 05100 00100    BI
5088   39 05113 00100    WA
5100   47 05124 00300    BNI
5112   48 70737 0  0/    H
5124   46 05016 00200    BI
5136   49 05160          B
```

ROUTINE 031

SET FLAG ON CHAR WITH FLAG AND NO C BIT $\bar{6}$

```
5148                6̄    X       WORKING AREA
5160   46 05172 01700    BI      TURN OFF MBR O CHECK
5172   32 05157          SF      SET FLAG ON 6̄
5184   44 05220 05157    BNF     CHECK FLAG NOT REMOVED
5196   46 05220 01700    BI      CHECK C BIT NOT REMOVED
5208   49 05268          B
```

```
                                        ERROR ROUTINE
5220   46 05244 00100    BI
5232   39 05257 00100    WA
5244   47 05268 00300    BNI
5256   48 70737 1  0≠    H
5268   46 05160 00200    BI
5280   49 05304          B
```

ROUTINE 032
SET FLAG ON CHAR WITH C BIT AND NO FLAG(5)

```
5292                5    X       WORKING AREA
5304   32 05302          SF      SET FLAG ON 5
5316   44 05376 05302    BNF     CHECK FOR FLAG
5328   46 05376 01600    BI      CHECK C BIT REMOVED
5340   15 05302 00005    TDM     RESTORE TO 5
5352   49 05424          B
5364   41                NOP
                                  ERROR ROUTINE
5376   46 05400 00100    BI
5388   39 05413 00100    WA
5400   47 05424 00300    BNI
5412   48 70737 2  0≠    H
5424   46 05304 00200    BI
5436   49 05460          B
```

ROUTINE 033
SET FLAG BIT ON CHAR WITH NO C BIT OR FLAG(4)

```
5448                4    X       WORKING AREA
5460   32 05459          SF      SET FLAG ON 4
5472   44 05532 05459    BNF     CHECK FOR FLAG
5484   46 05532 01700    BI      CHECK C BIT
```

```
5496   15 05459 00004    TDM   RESTORE TO 4
5508   49 05580          B
5520   41                NOP
                                ERROR ROUTINE
5532   46 05556 00100    BI
5544   39 05569 00100    WA
5556   47 05580 00300    BNI
5568   48 70737 3  0≠    H
5580   46 05460 00200    BI
5592   49 05616          B
```

ROUTINE 034
CLEAR FLAG ON CHAR WITH NO FLAG OR C BIT(1)

```
5604                1    X     WORKING AREA
5616   33 05614          CF    CLEAR FLAG ON 1
5628   44 05652 05614    BNF   CHECK FLAG NOT ADDED
5640   49 05688          B     ENTER ERROR IF FLAG
5652   46 05688 01600    BI    CHECK C BIT NOT INSERTED
5664   49 05736          B
5676   41                NOP
                                ERROR ROUTINE
5688   46 05712 00100    BI
5700   39 05725 00100    WA
5712   47 05736 00300    BNI
5724   48 70737 4  0≠    H
5736   46 05616 00200    BI
5748   49 05772          B
```

ROUTINE 035
CLEAR FLAG ON CHAR WITH NO FLAG BUT WITH C BIT(3)

```
5760                3    X     WORKING AREA
5772   33 05769          CF    CLEAR FLAG
5784   44 05808 05769    BNF   CHECK FLAG NOT INSERTED
```

```
5796    49 05844          B      ENTER ERROR IF FLAG
5808    46 05844 01700    BI     CHECK C BIT NOT REMOVED
5820    49 05892          B
5832    41                NOP
                                 ERROR ROUTINE
5844    46 05868 00100    BI
5856    39 05881 00100    WA
5868    47 05892 00300    BNI
5880    48 70737 5  0≠    H
5892    46 05772 00200    BI
5904    49 05928          B
```

ROUTINE 036
CLEAR FLAG ON CHAR WITH FLAG BUT NO C BIT ($\bar{5}$)

```
5916              5̄     X      WORKING AREA
5928    33 05926          CF     CLEAR FLAG ON 5̄
5940    44 05964 05926    BNF    CHECK FLAG REMOVED
5952    49 06000          B      ENTER ERROR IF FLAG
5964    46 06000 01600    BI     CHECK IF C BIT INSERTED
5976    32 05926          SF     RESTORE FLAG
5988    49 06048          B
                                 ERROR ROUTINE
6000    46 06024 00100    BI
6012    39 06037 00100    WA
6024    47 06048 00300    BNI
6036    48 70737 6  0≠    H
6048    46 05928 00200    BI
6060    49 06084          B
```

ROUTINE 037
CLEAR FLAG ON CHAR WITH FLAG AND C BIT ($\bar{7}$)

```
6072              7̄     X      WORKING AREA
6084    33 06081          CF     CLEAR FLAG ON 7̄
6096    44 06120 06081    BNF    CHECK FOR NO FLAG
```

```
6108   49 06156          B      ENTER ERROR IF FLAG
6120   46 06156 01700    BI     CHECK C BIT REMOVED
6132   32 06081          SF     RESTORE FLAG
6144   49 06204          B
                                 ERROR ROUTINE
6156   46 06180 00100    BI
6168   39 06193 00100    WA
6180   47 06204 00300    BNI
6192   48 70737 7  0#     H
6204   46 06084 00200    BI
6216   49 06240          B
```

ROUTINE 038
CHECK HI-POS AND EQ-ZERO TRIGS FOR H/P NOT E/Z

```
6228              11     X      CONSTANTS AND WORKING AREA
6240   26 06233 06239    TF     SET ONES IN P FIELD
6252   21 06233 06239    A      ADD 11 TO 11. RESULTS H/P
6264   47 06324 01100    BNI    CHECK H/P TRIG FOR H/P
6276   46 06360 01200    BI     CHECK E/Z TRIG FOR NOT E/Z
6288   49 06408          B
6300   41                NOP
6312   41                NOP
                                 ERROR ROUTINE
6324   46 06276 00100    BI
6336   38 06355 00100    WN
6348   49 06276 038#     B
6360   46 06384 00100    BI
6372   39 06397 00100    WA
6384   47 06408 00300    BNI
6396   48 75737 8  0#     H
6408   46 06240 00200    BI
6420   49 06444          B
```

ROUTINE 039
CHK HI-POS AND EQ-ZERO TRIGS FOR NOT H/P NOT E/Z

```
6432                  2̄2̄     X     CONSTANTS AND WORKING AREA
6444   26 06437 06442       TF    SET MINUS 22 IN P FIELD
6456   21 06437 06442       A     ADD -22 TO-22
6468   46 06528 01100       BI    CHECK H/P TRIG FOR NOT H/P
6480   46 06564 01200       BI    CHECK E/Z TRIG FOR NOT E/Z
6492   49 06612             B
6504   41                   NOP
6516   41                   NOP
                            ERROR ROUTINE
6528   46 06480 00100       BI
6540   38 06559 00100       WN
6552   49 06480 039≠        B
6564   46 06588 00100       BI
6576   39 06601 00100       WA
6588   47 06612 00300       BNI
6600   48 75737 9  0≠       H
6612   46 06444 00200       BI
6624   49 06648             B
```

ROUTINE 040
CHK HI-POS AND EQ-ZERO TRIGS FOR NOT H/P NOT E/Z

```
6636                  8̄8̄1̄1   X     CONSTANTS AND WORKING AREA
6648   26 06641 06647       TF    SET 11 IN P FIELD
6660   21 06641 06645       A     ADD MINUS 88 TO 11
6672   46 06732 01100       BI    CHECK H/P FOR NOT H/P
6684   46 06768 01200       BI    CHECK E/Z FOR NOT E/Z
6696   49 06816             B
6708   41                   NOP
6720   41                   NOP
                            ERROR ROUTINE
6732   46 06684 00100       BI
6744   38 06763 00100       WN
6756   49 06684 040≠        B
6768   46 06792 00100       BI
6780   39 06805 00100       WA
6792   47 06816 00300       BNI
6804   48 75747 0  0≠       H
6816   46 06648 00200       BI
6828   49 06852             B
```

ROUTINE 041
CHK HI-POS AND EQ-ZERO TRIGS FOR H/P NOT E/Z

```
6840                8̄8̄4̄4̄    X      CONSTANTS AND WORKING AREA
6852   26 06845 06850       TF     SET MINUS 44 IN P FIELD
6864   21 06845 06848       A      ADD 88 TO -44
6876   47 06936 01100       BNI    CHECK H/P FOR H/P
6888   46 06972 01200       BI     CHECK E/Z FOR NOT E/Z
6900   49 07020             B
6912   41                   NOP
6924   41                   NOP
                            ERROR ROUTINE
6936   46 06888 00100       BI
6948   38 06967 00100       WN
6960   49 06888 041≠        B
6972   46 06996 00100       BI
6984   39 07009 00100       WA
6996   47 07020 00300       BNI
7008   48 75747 1  0≠       H
7020   46 06852 00200       BI
7032   49 07056             B
```

ROUTINE 042
CHK HI-POS AND EQ-ZERO TRIGS FOR E/Z NOT H/P

```
7044                4̄4̄4̄4    X      CONSTANTS AND WORKING AREA
7056   26 07049 07055       TF     SET 44 IN P FIELD
7068   21 07049 07053       A      ADD MINUS 44 TO 44
7080   46 07140 01100       BI     CHECK H/P TRIG FOR NOT H/P
7092   47 07176 01200       BNI    CHECK E/Z TRIG FOR E/Z
7104   49 07224             B
7116   41                   NOP
7128   41                   NOP
                            ERROR ROUTINE
7140   46 07092 00100       BI
7152   38 07171 00100       WN
7164   49 07092 042≠        B
7176   46 07200 00100       BI
7188   39 07213 00100       WA
7200   47 07224 00300       BNI
7212   48 75747 2  0≠       H
7224   46 07056 00200       BI
7236   49 07260             B
```

ROUTINE 043
CHK HI-POS AND EQ-ZERO TRIGS FOR H/P NOT E/Z

```
7248                 Ī1ī88    X       CONSTANTS AND WORKING AREA
7260   26 07253 07259         TF      SET 88 IN P FIELD
7272   22 07253 07257         S       SUBT 11 FROM 88
7284   47 07344 01100         BNI     CHECK H/P TRIG FOR H/P
7296   46 07380 01200         BI      CHECK E/Z TRIG FOR NOT E/Z
7308   49 07428               B
7320   41                     NOP
7332   41                     NOP
                              ERROR ROUTINE
7344   46 07296 00100         BI
7356   38 07375 00100         WN
7368   49 07296 043≠          B
7380   46 07404 00100         BI
7392   39 07417 00100         WA
7404   47 07428 00300         BNI
7416   48 75747 3  0≠         H
7428   46 07260 00200         BI
7440   49 07464               B
```

ROUTINE 044
CHK HI-POS AND EQ-ZERO TRIGS FOR NOT H/P NOT E/Z

```
7452                 Ī1ī88    X       CONSTANTS AND WORKING AREA
7464   26 07457 07461         TF      SET 11 IN P FIELD
7476   22 07457 07463         S       SUBT 88 FROM 11
7488   46 07548 01100         BI      CHECK H/P TRIG FOR NOT H/P
7500   46 07584 01200         BI      CHECK E/Z TRIG FOR NOT E/Z
7512   49 07632               B
7524   41                     NOP
7536   41                     NOP
                              ERROR ROUTINE
7548   46 07500 00100         BI
7560   38 07579 00100         WN
7572   49 07500 044≠          B
7584   46 07608 00100         BI
7596   39 07621 00100         WA
7608   47 07632 00300         BNI
7620   48 75747 4  0≠         H
7632   46 07464 00200         BI
7644   49 07668               B
```

ROUTINE 045
CHECK HI-POS AND EQ-ZERO TRIGS FOR E/Z, NOT H/P

```
7656                  88    X      CONSTANTS AND WORKING AREA
7668   26 07661 07667       TF     SET 88 IN P FIELD
7680   22 07661 07667       S      SUBT 88 FROM 88
7692   46 07752 01100       BI     CHECK H/P TRIG FOR  NOT H/P
7704   47 07812 01200       BNI    CHECK E/Z TRIG FOR E/Z
7716   49 07860             B
7728   41                   NOP
7740   41                   NOP
                            ERROR ROUTINE
7752   46 07776 00100       BI
7764   39 07789 00100       WA
7776   47 07800 00300       BNI
7788   48 70747 5  0≠       H
7800   49 07704             B
7812   46 07836 00100       BI
7824   39 07849 00100       WA
7836   47 07860 00300       BNI
7848   48 75747 5  0≠       H
7860   46 07668 00200       BI
7872   49 07896             B
```

ROUTINE 046
CHECK HI-POS AND EQ-ZERO TRIGS FOR H/P NOT E/Z

```
7884                  4422  X      CONSTANTS AND WORKING AREA
7896   26 07889 07895       TF     SET 22 IN P FIELD
7908   22 07889 07893       S      SUBT-44 FROM 22
7920   47 07980 01100       BNI    CHECK H/P TRIG FOR H/P
7932   46 08040 01200       BI     CHECK E/Z TRIG FOR NOT E/Z
7944   49 08088             B
7956   41                   NOP
7968   41                   NOP
                            ERROR ROUTINE
7980   46 08004 00100       BI
7992   39 08017 00100       WA
8004   47 08028 00300       BNI
8016   48 70747 6  0≠       H
8028   49 07932             B
```

```
8040   46 08064 00100    BI
8052   39 08077 00100    WA
8064   47 08088 00300    BNI
8076   48 75747 6  0⁄    H
8088   46 07896 00200    BI
8100   49 08124          B
```

ROUTINE 047
CHK HI-POS AND EQ-ZERO TRIGS FOR NOT H/P NOT E/Z

```
8112              44ZZ    X      CONSTANTS  AND WORKING AREA
8124   26 08117 08122     TF     SET MINUS 22 IN P FIELD
8136   22 08117 08120     S      SUBT 44 FROM - 22
8148   46 08208 01100     BI     CHECK H/P TRIG FOR NOT H/P
8160   46 08268 01200     BI     CHECK E/Z TRIG FOR NOT E/Z
8172   49 08316           B
8184   41                 NOP
8196   41                 NOP
                                 ERROR ROUTINE
8208   46 08292 00100     BI
8220   39 08245 00100     WA
8232   47 08256 00300     BNI
8244   48 70747 7  0⁄     H
8256   49 08160           B
8268   46 08292 00100     BI
8280   39 08305 00100     WA
8292   47 08316 00300     BNI
8304   48 75747 7  0⁄     H
8316   46 08124 00200     BI
8328   49 08352
```

ROUTINE 048
CHK HI-POS AND EQ-ZERO TRIGS FOR H/P NOT E/Z

```
8340              88ZZ    X      CONSTANTS AND WORKING AREA
8352   26 08345 08351     TF     SET -22 IN P FIELD
8364   22 08345 08349     S      SUBT -88 FROM -22
8376   47 08436 01100     BNI    CHECK H/P TRIG FOR H/P
```

```
8388   46 08496 01200    BI      CHECK E/Z TRIG FOR NOT E/Z
8400   49 08544          B
8412   41                NOP
8424   41                NOP
                         ERROR ROUTINE
8436   46 08460 00100    BI
8448   39 08473 00100    WA
8460   47 08484 00300    BNI
8472   48 70747 8  0≠    H
8484   49 08388          B
8496   46 08520 00100    BI
8508   39 08533 00100    WA
8520   47 08544 00300    BNI
8532   48 75747 8  0≠    H
8544   46 08352 00200    BI
8556   49 08580          B
```

```
                         RQUTINE 049
                   CHK HI-POS AND EQ-ZERO TRIGS FOR NOT H/P NOT E/Z

8568            1144     X       CONSTANTS AND WORKING AREA
8580   26 08573 08578    TF      SET   -44 IN P FIELD
8592   22 08573 08576    S       SUBT -11 FROM -44
8604   46 08664 01100    BI      CHECK H/P TRIG FOR NOT H/P
8616   46 08724 01200    BI      CHECK E/Z TRIG FOR NOT E/Z
8628   49 08772          B
8640   41                NOP
8652   41                NOP
                         ERROR ROUTINE
8664   46 08688 00100    BI
8676   39 08701 00100    WA
8688   47 08712 00300    BNI
8700   48 70747 9  0≠    H
8712   49 08616          B
8724   46 08748 00100    BI
8736   39 08761 00100    WA
8748   47 08772 00300    BNI
8760   48 75747 9  0≠    H
8772   46 08580 00200    BI
8784   49 08808          B
```

ROUTINE 050
CHK HI-POS AND EQ-ZERO TRIGS FOR E/Z NOT H/P

```
8796                 33      X     CONSTANTS AND WORKING AREA
8808   26 08801 08806        TF    SET -33 IN P FIELD
8820   22 08801 08806        S     SUBT -33 FROM -33
8832   46 08892 01100        BI    CHECK H/P TRIG FOR NOT H/P
8844   47 08952 01200        BNI   CHECK E/Z TRIG FOR E/Z
8856   49 09000              B
8868   41                    NOP
8880   41                    NOP
                                   ERROR ROUTINE
8892   46 08916 00100        BI
8904   39 08929 00100        WA
8916   47 08940 00300        BNI
8928   48 70757 0  0≠        H
8940   49 08844              B
8952   46 08976 00100        BI
8964   39 08989 00100        WA
8976   47 09000 00300        BNI
8988   48 75757 0  0≠        H
9000   46 08808 00200        BI
9012   49 09036              B
```

ROUTINE 051
CHECK FOR CORRECT MEMORY LOOKUP ON ADD

```
9024                 9966    X     CONSTANTS AND WORKING AREA
9036   15 00369       ≠      TDM   SET RM IN MEMORY POS 369
9048   26 09029 09035        TF    SET 66 IN P FIELD
9060   21 09029 09033        A     ADD 99 TO 66
9072   45 09120 09029        BNR   CHECK RESULT FOR RM
9084   49 09168              B
9096   41                    NOP
9108   41                    NOP
                                   ERROR ROUTINE
9120   46 09144 00100        BI
9132   39 09157 00100        WA
9144   47 09168 00300        BNI
9156   48 70757 1  0≠        H
9168   15 00369       5      TDM   RESTORE ADD TABLE POS. 369
9180   46 09036 00200        BI
9192   49 09216              B
```

ROUTINE 052
CHECK FOR CORRECT MEMORY LOOK UP ON ADD

```
9204                 9966      X      CONSTANTS AND WORKING AREA
9216   15 00396        ≠       TDM    SET RM IN MEMORY POS. 396
9228   26 09209 09213          TF     SET 99 IN P FIELD
9240   21 09209 09215          A      ADD 66 TO 99
9252   45 09300 09209          BNR    CHECK RESULT FOR RM
9264   49 09348                B
9276   41                      NOP
9288   41                      NOP
                                      ERROR ROUTINE
9300   46 09324 00100          BI
9312   39 09337 00100          WA
9324   47 09348 00300          BNI
9336   48 70757 2  0≠          H
9348   15 00396        5       TDM    RESTORE ADD TABLE POS. 396
9360   46 09216 00200          BI
9372   49 09396                B
```

ROUTINE 053
CHECK FOR CORRECT MEMORY LOOK UP ON SUBT

```
9384                 9966      X      CONSTANTS AND WORKING AREA
9396   15 00303        ≠       TDM    SET RM IN MEMORY POSITION 303
9408   26 09389 09395          TF     SET -66 IN P FIELD
9420   22 09389 09393          S      SUBT -99 FROM -66
0432   45 09480 09389          BNR    CHECK RESULT FOR RM
9444   49 09528                B
9456   41                      NOP
9468   41                      NOP
                                      ERROR ROUTINE
9480   46 09504 00100          BI
9492   39 09517 00100          WA
9504   47 09528 00300          BNI
9516   48 70757 3  0≠          H
9528   15 00303        3       TDM    RESTORE ADD TABLE POS. 303
9540   46 09396 00200          BI
9552   49 09576                B
```

ROUTINE 054
CHECK FOR CORRECT MEMORY LOOK UP ON SUBT

```
9564          1 11666     X      CONSTANTS AND WORKING AREA
9576   15 00305     ≠     TDM    SET RM IN MEMORY POS. 305
9588   26 09569 09572     TF     SET 111 IN P FIELD
9600   22 09569 09575     S      SUBT 666 FROM 111
9612   45 09660 09568     BNR    CHECK RESULT FOR RECORD MARK
9624   49 09708           B
9636   41                 NOP
9648   41                 NOP
                                     ERROR ROUTINE
9660   46 09684 00100     BI
9672   39 09697 00100     WA
9684   47 09708 00300     BNI
9696   48 70757 4  0≠     H
9708   15 00305     5     TDM    RESTORE ADD TABLE POS. 305
9720   46 09576 00200     BI
9732   49 09756           B
```

ROUTINE 055
CHECK FOR CORRECT MEMORY LOOK UP ON SUBT

```
9744          9 99888     X      CONSTANTS AND WORKING AREA
9756   15 00301     ≠     TDM    SET RM IN MEMORY POS. 301
9768   26 09749 09755     TF     SET 888 IN P FIELD
9780   22 09749 09752     S      SUBT 999 FROM 888
9792   45 09840 09748     BNR    CHECK RESULT FOR RECORD MARK
9804   49 09888           B
9816   41                 NOP
9828   41                 NOP
                                     ERROR ROUTINE
9840   46 09864 00100     BI
9852   39 09877 00100     WA
9864   47 09888 00300     BNI
9876   48 70757 5  0≠     H
9888   15 00301     1     TDM    RESTORE ADD TABLE POS. 301
9900   46 09756 00200     BI
9912   49 09936           B
```

ROUTINE 056
CHECK OVERFLOW TRIG

```
 9924                  1288    X      CONSTANTS AND WORKING AREA
 9936   46 09948 01400         BI     TURN OFF OVERFLOW
 9948   26 09929 09935         TF     SET 88 IN P FIELD
 9960   21 09929 09933         A      ADD 12 TO 88
 9972   47 10020 01400         BNI    CHECK FOR OVERFLOW
 9984   49 10068               B
 9996   41                     NOP
10008   41                     NOP
                               ERROR ROUTINE
10020   46 10044 00100         BI
10032   39 10057 00100         WA
10044   47 10068 00300         BNI
10056   48 70757 6  0≠         H
10068   46 09936 00200         BI
10080   49 10104               B
```

ROUTINE 057
CHECK OVERFLOW TRIG

```
10092                    55    X      CONSTANTS AND WORKING AREA
10104   46 10116 01400         BI     TURN OFF OVERFLOW
10116   26 10097 10103         TF     SET 55 IN P FIELD
10128   11 10097   222         AM     ADD 222 TO 55 IMMED
10140   47 10188 01400         BNI    CHECK FOR OVERFLOW
10152   49 10236               B
10164   41                     NOP
10176   41                     NOP
                               ERROR ROUTINE
10188   46 10212 00100         BI
10200   39 10225 00100         WA
10212   47 10236 00300         BNI
10224   48 70757 7  0≠         H
10236   46 10104 00200         BI
10248   49 10272               B
```

ROUTINE 058
CHECK OVERFLOW TRIG

```
10260                  7̄3̄    X      CONSTANTS AND WORKING AREA
10272   46 10284 01400        BI     TURN OFF OVERFLOW
10284   26 10265 10271        TF     SET -73 IN P FIELD
10296   12 10265   2̄7        SM     SUBT 27 FROM -73 IMMED
10308   47 10356 01400        BNI    CHECK FOR OVERFLOW
10320   49 10404              B
10332   41                    NOP
10344   41                    NOP
                              ERROR ROUTINE
10356   46 10380 00100        BI
10368   39 10393 00100        WA
10390   47 10404 00300        BNI
10392   48 70757 8  0≠        H
10404   46 10272 00200        BI
10416   49 10440              B
```

ROUTINE 059
CHECK OVERFLOW TRIG

```
10428                  9̄9̄    X      CONSTANTS AND WORKING AREA
10440   46 10452 01400        BI     TURN OFF OVERFLOW
10452   26 10433 10439        TF     SET 99 IN P FIELD
10464   12 10433   1̄11       SM     SUBT 111 FROM 99
10476   47 10524 01400        BNI    CHECK FOR OVERFLOW
10488   49 10572              B
10500   41                    NOP
10512   41                    NOP
                              ERROR ROUTINE
10524   46 10548 00100        BI
10536   39 10561 00100        WA
10548   47 10572 00300        BNI
10560   48 70757 9  0≠        H
10572   46 10440 00200        BI
10584   49 10608              B
```

ROUTINE 060
CHECK COMPARE FOR H/P

```
10596                 4488      XX     CONSTANTS AND WORKING AREA
10608  26 10601 10607           TF     SET 88 IN P FIELD
10620  24 10601 10605           C      COMPARE 44 TO 88 RESULT H/P
10632  47 10680 01100           BNI    CHECK H/P TRIG FOR H/P
10644  49 10728                 B
10656  41                       NOP
10668  41                       NOP
                                       ERROR ROUTINE
10680  46 10704 00100           BI
10692  39 10717 00100           WA
10704  47 10728 00300           BNI
10716  48 70767 0  0≠           H
10728  46 10608 00200           BI
10740  49 10764                 B
```

ROUTINE 061
CHECK COMPARE FOR H/P

```
10752                 9911      X      CONSTANTS AND WORKING AREA
10764  26 10757 10763           TF     SET 11 IN P FIELD
10776  24 10757 10761           C      COMPARE -22 TO 11
10788  47 10836 01100           BNI    CHECK H/P TRIG FOR H/P
10800  46 10836 01200           BI     CHECK E/Z TRIG FOR NOT E/Z
10812  46 10836 01400           BI     CHECK O/F TRIG FOR NO O/F
10824  49 10884                 B
                                       ERROR ROUTINE
10836  46 10860 00100           BI
10848  39 10873 00100           WA
10860  47 10884 00300           BNI
10872  48 70767 1  0≠           H
10884  46 10764 00200           BI
10896  49 10920                 B
```

ROUTINE 062
CHECK COMPARE FOR H/P

```
10908                  7958    X       CONSTANTS AND WORKING AREA
10920   26 10913 10919         TF      SET -58 IN P FIELD
10932   24 10913 10917         C       COMPARE -79 TO -58
10944   47 10992 01100         BNI     CHECK H/P TRIG FOR H/P
10956   49 11040               B
10968   41                     NOP
10980   41                     NOP
                               ERROR ROUTING
10992   46 11016 00100         BI
11004   39 11029 00100         WA
11016   47 11040 00300         BNI
11028   48 70767 2  0≠         H
11040   46 10920 00200         BI
11052   49 11076               B
```

ROUTINE 063
CHECK COMPARE FOR E/Z

```
11064                  79      X       CONSTANTS AND WORKING AREA
11076   26 11069 11075         TF      SET 79 IN P FIELD
11088   24 11069 11075         C       COMPARE 79 TO 79
11100   47 11148 01200         BNI     CHECK E/Z TRIG FOR E/Z
11112   49 11196               B
11124   41                     NOP
11136   41                     NOP
                               ERROR ROUTINE
11148   46 11172 00100         BI
11160   39 11185 00100         WA
11172   47 11196 00300         BNI
11184   48 70767 3  0≠         H
11196   46 11076 00200         BI
11208   49 11232               B
```

ROUTINE 064
CHECK COMPARE FOR E/Z

```
11220                  68      X       CONSTANTS AND WORKING AREA
11232   26 11225 11230         TF      SET -68 IN P FIELD
11244   24 11225 11230         C       COMPARE -68 TO -68
11256   47 11304 01200         BNI     CHECK E/Z TRIG FOR E/Z
11268   49 11352               B
11280   41                     NOP
11292   41                     NOP
                               ERROR ROUTINE
11304   46 11328 00100         BI
11316   39 11341 00100         WA
11328   47 11352 00300         BNI
11340   48 70767 4  0#         H
11352   46 11232 00200         BI
11364   49 11388               B
```

ROUTINE 065
CHECK COMPARE FOR NOT H/P NOT E/Z

```
11376                  8768    X       CONSTANTS AND WORKING AREA
11388   26 11381 11387         TF      SET 68 IN P FIELD
11400   24 11381 11385         C       COMPARE 87 TO 68
11412   46 11472 01100         BI      CHECK H/P TRIG FOR NOT H/P
11424   46 11472 01200         BI      CHECK E/Z TRIG FOR NOT E/Z
11436   49 11520               B
11448   41                     NOP
11460   41                     NOP
                               ERROR ROUTINE
11472   46 11496 00100         BI
11484   39 11509 00100         WA
11496   47 11520 00300         BNI
11508   48 70767 5  0#         H
11520   46 11388 00200         BI
11532   49 11556               B
```

ROUTINE 066
CHECK COMPARE FOR NOT H/P NOT E/Z

```
11544                7958    X      CONSTANTS AND WORKING AREA
11556   26 11549 11553       TF     SET -79 IN P FIELD
11568   24 11549 11555       C      COMPARE -58 TO -79
11580   46 11640 01100       BI     CHECK H/P TRIG FOR NOT H/P
11592   46 11640 01200       BI     CHECK E/Z TRIG FOR NOT E/Z
11604   49 11688             B
11616   41                   NOP
11628   41                   NOP
                             ERROR ROUTINE
11640   46 11664 00100       BI
11652   39 11677 00100       WA
11664   47 11688 00300       BNI
11676   48 70767 6  0≠       H
11688   46 11556 00200       BI
11700   49 11724             B
```

ROUTINE 067
CHECK COMPARE IMMED FOR E/Z

```
11712               ī0248    X      CONSTANTS AND WORKING AREA
11724   26 11718 11723       TF     SET 10248 IN P FIELD
11736   14 11718 ī0248       CM     COMPARE IMMED
11748   47 11796 01200       BNI    CHECK E/Z TRIG FOR E/Z
11760   49 11844             B
11772   41                   NOP
11784   41                   NOP
                             ERROR ROUTINE
11796   46 11820 00100       BI
11808   39 11833 00100       WA
11820   47 11844 00300       BNI
11832   48 70767 7  0≠       H
11844   46 11724 00200       BI
11856   49 11916             B
```

ROUTINE 068
CHECK ADD TEN DIGIT NO TO 12 DIGIT NO

```
11868   0̄0 12345 67890   X     AUGEND
11880      2̄3456 78901   X     ADDEND
11892   0̄0 35802 46791   X     COMPARE DATA
11904                     X     WORKING AREA
11916   26 11915 11879    TF    SET AUGEND
11928   21 11915 11891    A     ADD ADDEND TO AUGEND
11940   24 11915 11903    C     CHECK FOR CORRECT ANSWER
11952   47 11976 01200    BNI   CHECK E/Z TRIG FOR E/Z
11964   49 12024          B
                                ERROR ROUTINE
11976   46 12000 00100    BI
11988   39 12013 00100    WA
12000   47 12024 00300    BNI
12012   48 70767 8  0≠    H
12024   46 11916 00200    BI
12036   49 12096          B
```

ROUTINE 069
CHECK SUBT TEN DIGIT NO FROM 12 DIGIT NO

```
12048   0̄0 98765 43210   X     MINUEND
12060      1̄2345 67890   X     SUBTRAHEND
12072   0̄0 86419 75320   X     COMPARE DATA
12084                     X     WORKING AREA
12096   26 12095 12059    TF    SET MINUEND
12108   22 12095 12071    S     SUBT SUBTRAHEND FROM MINUEND
12120   24 12095 12083    C     CHECK FOR CORRECT ANSWER
12132   47 12156 01200    BNI   CHECK E/Z TRIG FOR E/Z
12144   49 12204          B
                                ERROR ROUTINE
12156   46 12180 00100    BI
12168   39 12193 00100    WA
12180   47 12204 00300    BNI
12192   48 70767 9  0≠    H
12204   46 12096 00200    BI
12216   49 12240          B
```

ROUTINE 070
CHECK MULTIPLY

```
12228        0121  1111   X     MULTIPLICAND, MULTIPLIER, COMP. DATA
12240   23 12237 12239     M     MULTIPLY
12252   24 12234 00099     C     CHECK PRODUCT CORRECT
12264   47 12288 01200     BNI   CHECK E/Z TRIG FOR E/Z
12276   49 12336           B
                           ERROR ROUTINE
12288   46 12312 00100     BI
12300   39 12325 00100     WA
12312   47 12336 00300     BNI
12324   48 70777 0  0≠     H
12336   46 12240 00200     BI
12348   49 12372           B
```

ROUTINE 071
CHECK MULTIPLY

```
12360        0484  2222   X     MULTIPLICAND, MULTIPLIER, COMP, DATA
12372   23 12369 12371     M     MULTIPLY
12384   24 12366 00099     C     CHECK PRODUCT CORRECT
12396   47 12420 01200     BNI   CHECK E/Z TRIG FOR E/Z
12408   49 12468           B
                           ERROR ROUTINE
12420   46 12444 00100     BI
12432   39 12457 00100     WA
12444   47 12468 00300     BNI
12456   48 70777 1  0≠     H
12468   46 12372 00200     BI
12480   49 12504           B
```

ROUTINE 072
CHECK MULTIPLY

```
12492        1936  4444   X     MULTIPLICAND, MULTIPLIER, COMP. DATA
12504   23 12501 12503     M     MULTIPLY
12516   24 12498 00099     C     CHECK PRODUCT CORRECT
12528   47 12552 01200     BNI   CHECK E/Z TRIG FOR E/Z
12540   49 12600           B
                           ERROR ROUTINE
12552   46 12576 00100     BI
12564   39 12589 00100     WA
12576   47 12600 00300     BNI
12588   48 70777 2  0≠     H
12600   46 12504 00200     BI
12612   49 12636           B
```

ROUTINE 073
CHECK MULTIPLY

```
12624        7744  8888   X     MULTIPLICAND, MULTIPLIER, COMP. DATA
12636   23 12633 12635     M     MULTIPLY
12648   24 12630 00099     C     CHECK PRODUCT CORRECT
12660   47 12684 01200     BNI   CHECK E/Z TRIG FOR E/Z
12672   49 12732           B
                           ERROR ROUTINE
12684   46 12708 00100     BI
12696   39 12721 00100     WA
12708   47 12732 00300     BNI
12720   48 70777 3  0≠     H
12732   46 12636 00200     BI
12744   49 12768           B
```

ROUTINE 074
CHECK MULTIPLY IMMED

```
12756        00000 0 777    X      MULTIPLICAND
12768    13  12767 00000    MM     MULTIPLY IMMED
12780    47  12840 01200    BNI    CHECK E/Z TRIG FOR E/Z
12792    24  12763 00099    C      CHECK PRODUCT CORRECT
12804    47  12840 01200    BNI    CHECK E/Z TRIG FOR E/Z
12816    49  12888          B
12828
                            ERROR ROUTINE
12840    46  12864 00100    BI
12852    39  12877 00100    WA
12864    47  12888 00300    BNI
12876    48  70777 4  0/   H
12888    46  12768 00200    BI
12900    49  12960          B
```

ROUTINE 075
CHECK MULTIPLY

```
12912        01234 56789    X      MULTIPLICAND
12924        01234 56789    X      MULTIPLIER
12936          000 15241    X      COMPARE DATA
12948    57  87501 90521    X      COMPARE DATA
12960    23  12923 12935    M      MULTIPLY
12972    24  12959 00099    C      CHECK PRODUCT CORRECT
12984    47  13008 01200    BNI    CHECK E/Z TRIG FOR E/Z
12996    49  13056          B
                            ERROR ROUTINE
13008    46  13032 00100    BI
13020    39  13045 00100    WA
13032    47  13056 00300    BNI
13044    48  70777 5  0/   H
13056    46  12960 00200    BI
13068    49  13128          B
```

ROUTINE 076
CHECK MULTIPLY

```
13080   ¯37 92022 34363   X     MULTIPLICAND
13092   ¯82 06972 21257¯  X     MULTIPLIER
13104   ¯31 12102 20036   X     COMPARE DATA
13116   15 97794 5429¯1   X     COMPARE DATA
13128   16 00079 ¯00000   TFM   SET MEM POS 75-79 TO ZERO
13140   23 13091 13103    M     MULTIPLY
13152   24 00099 13127    C     CHECK PRODUCT
13164   47 13200 01200    BNI   CHECK E/Z TRIG FOR E/Z
13176   44 13200 00076    BNF   CHECK HIGH ORDER POS FOR FLAG
13188   49 13248          B
                                ERROR ROUTINE
13200   46 13224 00100    BI
13212   39 13237 00100    WA
13224   47 13248 00300    BNI
13236   48 70777 6  0≠    H
13248   46 13128 00200    BI
13260   49 13992          B
```

ROUTINE 077
CHECK CONTROL OPERATIONS &
WRITE NUM & ALPHA

```
13272   12 345≠6 7890≠    X     NUMERIC DATA
13284   55 6454   4955     X     ALPHA DATA NUM IN
13296   46 56  4 14256     X     ALPHA DATA FO ABO
13308   65 45  5 64646     X     ALPHA DATA VE OFF
13320   62 4563   6356     X     ALPHA DATA SET TO
13332      59494 74863     X     ALPHA DATA RIGHT
13344      63665 6  62     X     ALPHA DATA TWO S
13356   57 41434 562       X     ALPHA DATA PACES
13368   42 45636 64545     X     ALPHA DATA BETWEE
13380   55   75   4155     X     ALPHA DATA N 5 AN
13392   44   76   6348     X     ALPHA DATA D 6 TH
13404   59 4545   5349     X     ALPHA DATA REE LI
13416   55 4562   5646     X     ALPHA DATA NES OF
13428      44416 3410≠     X     ALPHA DATA  DATA.
13440   46 13764 00100    BI    CHECK SW 1 FOR TYPEOUT
```

```
13452   34         00102   K     CARRIAGE RETURN
13464   34         00108   K     TAB
13476   38 13272   00100   WN    TYPEWRITER
13488   34         00101   K     SPACE
13500   34         00101   K     SPACE
13512   38 13278   00100   WN    TYPEWRITER
13524   34         00102   K     CARRIAGE RETURN
13536   34         00108   K     TAB
13548   38 13272   00100   WN    TYPEWRITER
13560   34         00101   K     SPACE
13572   34         00101   K     SPACE
13584   38 13278   00100   WN    TYPEWRITER
13596   34         00101   K     SPACE
13608   34         00101   K     SPACE
13620   38 13272   00100   WN    TYPEWRITER
13632   34         00102   K     CARRIAGE RETURN
13644   34         00108   K     TAB
13656   38 13272   00100   WN    TYPEWRITER
13668   34         00101   K     SPACE
13680   34         00101   K     SPACE
13692   38 13278   00100   WN    TYPEWRITER
13704   34         00102   K     CARRIAGE RETURN
13716   39 13285   00100   WA    TYPEWRITER
13728   34         00102   K     CARRIAGE RETURN
13740   46 13440   00200   BI    CHECK SW 2 FOR LOOP ROUTINE
13752   49 13764           B
```

ROUTINE 078
CHECK DUMP NUMERIC TO
TYPEWRITER & PAPER TAPE PUNCH
FOR CARD I/O, SEE PAGE 55A

```
13764   34         00102   K     CARRIAGE RETURN
13776   35 19976   00100   DN    DUMP NUMERIC-TYPEWRITER
13788   35 19976   00200   DN    DUMP NUMERIC-TAPE PUNCH
13800   49 13944           B
13812   41                 NOP
```

ROUTINE 078
Check Dump Numeric to Typewriter
& Card Punch. For Paper Tape,
See Page 55

13764	34		00102	K	Carriage Return
13776	35	19976	00100	DN	Dump Numeric to Typewriter
13788	35	19920	00400	DN	Dump Numeric to Card Punch
13800	49	13932		B	
13812	41			NOP	

ROUTINE 079
Check WA, Punched Data will then
be read in
For Paper Tape, See Page 56

13824	$\overline{03}$	04101	31420	X	.)+$*-
13836	$\underline{21}$	23243	33400	X	/,(=@
13848	$\overline{41}$	42434	44546	X	ABCDEF
13860	47	48495	15253	X	GHIJKL
13872	54	55565	75859	X	MNOPQR
13884	$\underline{62}$	63646	56667	X	STUVWX
13896	$\overline{68}$	69707	17273	X	YZ0123
13908	74	75767	77879	X	456789
13920	0≠			X	≠
13932	31	16044	13824	TR	Transmit Data to Punch Area
13944	39	16045	00400	WA	Card Punch
13956	39	16045	00400	WA	Card Punch
13968	39	16045	00400	WA	Card Punch
13980	49	19924		B	

Check if Division Installed

13992	49	18808		B	
14004	16	13998	$\overline{1}$4052	TFM	
14016	49	00552		B	

ROUTINE 079
CHECK WA. PUNCHED DATA WILL THEN BE READ IN

```
13824  03 04101 31420    X     .)+$*-
12836  21 23243 33400    X     /,(=@
13848  41 42434 44546    X     ABCDEF
13860  47 48495 15253    X     GHIJKL
13872  54 55565 75859    X     MNOPQR
13884  62 63646 56667    X     STUVWX
13896  68 69707 17273    X     YZ0123
13908  74 75767 77879    X     456789
13920  0≠                X     ≠
13932                     X
13944  39 13825 00200     WA    PAPER TAPE PUNCH
13956  39 13825 00200     WA    PAPER TAPE PUNCH
13968  39 13825 00200     WA    PAPER TAPE PUNCH
13980  49 19924           B
                                 CHECK IF DIVISION INSTALLED
13992  49 18808 _         B
14004  16 13998 14052     TFM
14016  49 00552           B
```

ROUTINE 080
CHECK LOAD DIVIDEND

```
14028  45 67890 12304    X     DIVIDEND
14040  00 00000 00000    X     COMPARE DATA
14052  28 00095 14039    LD    LOAD DIVIDEND
14064  24 14043 00099    C     COMP DIVIDEND WITH COMP DATA
14076  47 14136 01200    BNI   CHECK E/Z TRIG FOR E/Z
14088  32 00080 00000    SF    SET FLAG POS. 80
14100  24 14047 00083    C     CHECK FOR ZERO POS. 80-83
14112  47 14136 01200    BNI   CHECK E/Z TRG FOR E/Z
14124  49 14184 00000    B
                                 ERROR ROUTINE
14136  46 14160 00100    BI
14148  39 14173 00100     WA
14160  47 14184 00300    BNI
14172  48 70787 0  0≠     H
14184  46 14052 00200    BI
14196  49 14244           B
```

ROUTINE 081
CHECK LOAD DIVIDEND

```
14208   12 34567 89086   X     DIVIDEND
14220   12 34567 89086   X     COMPARE DATA
14232   00 00000 0       X     COMPARE DATA
14244   28 00091 14219   LD    LOAD DIVIDEND
14256   24 14239 00099   C     COMP DIVIDEND WITH COMP DATA
14268   47 14304 01200   BNI   CHECK E/Z TRIG FOR E/Z
14280   49 14352         B
14292   41               NOP
                               ERROR ROUTINE
14304   46 14328 00100   BI
14316   39 14341 00100   WA
14328   47 14352 00300   BNI
14340   48 70787 1  0≠   H
14352   46 14244 00200   BI
14364   49 14488         B
14376                    X
14388                    X
14400                    X
14412                    X
14424                    X
14436                    X
14448                    X
14460                    X
14472                    X
```

ROUTINE 082
CHECK LOAD DIVIDEND IMMED

```
14476       78693 00000   X     COMPARE DATA
14488   18 00094 78693   LDM   LOAD DIVIDEND IMMED
14500   24 14487 00099   C     COMP DIVIDEND WITH COMP DATA
14512   47 14488 01200   BNI   CHECK E/Z TRIG FOR E/Z
14524   49 14596         B
14536   41               NOP
                               ERROR ROUTINE
14548   46 14572 00100   BI
14560   39 14585 00100   WA
14572   47 14596 00300   BNI
14584   48 70787 2  0≠   H
14596   46 14488 00200   BI
14608   49 14644         B
```

ROUTINE 083
CHECK DIVIDE

```
14620   Ī2 34567 89Ī23    X      DIVIDEND, DIVISOR
14632   45 Ī0000 0̄6789    X      DIVISOR, COMPARE DATA
14644   28 00099 14628    LD     LOAD DIVIDEND
14656   29 00094 14633    D      DIVIDE
14668   24 14638 00094    C      COMP. QUOTIENT TO COMP DATA
14680   47 14740 01200    BNI    CHECK E/Z TRIG FOR E/Z
14692   24 14643 00099    C      COMP REMAINDER TO COMP DATA
14704   47 14740 01200    BNI    CHECK E/Z TRIG FOR E/Z
14716   49 14788          B
14728   41                NOP
                                 ERROR ROUTINE
14740   46 14764 00100    BI
14752   39 14777 00100    WA
14764   47 14788 00300    BNI
14776   48 70787 3  0/    H
14788   46 14644 00200    BI
14800   49 14836          B
```

ROUTINE 084
CHECK DIVIDE

```
14812   98 76543 21678   X      DIVIDEND, DIVISOR
14824   91 45478 41179   X,     DIVISOR, QUOTIENT, REMAINDER
14836   28 00099 14820   LD     LOAD DIVIDEND
14848   29 00094 14824   D      DIVIDE
14860   24 14830 00095   C      COMPARE QUOTIENT
14872   47 14932 01200   BNI    CHECK E/Z TRIG FOR E/Z
14884   24 14834 00099   C      COMPARE REMAINDER
14896   47 14932 01200   BNI    CHECK E/Z TRIG FOR E/Z
14908   49 14980         B
14920   41               NOP
                         ERROR ROUTINE
14932   46 14956 00100   BI
14944   39 14969 00100   WA
14956   47 14980 00030   BNI
14968   48 70787 4  0/   H
14980   46 14836 00200   BI
14992   49 15028         B
```

ROUTINE 085
CHECK DIVIDE

```
15004   98 76543 21123   X      DIVIDEND, DIVISOR
15016   45 80004 04941   X      DIVISOR, QUOTIENT, REMAINDER
15028   28 00099 15012   LD     LOAD DIVIDEND
15040   29 00095 15017   D      DIVIDE
15052   24 15022 00094   C      COMPARE QUOTIENT
15064   47 15124 01200   BNI    CHECK E/Z TRIG FOR E/Z
15076   24 15027 00099   C      COMPARE REMAINDER
15088   47 15124 01200   BNI    CHECK E/Z TRIG FOR E/Z
15100   49 15172         B
15112   41               NOP
```

ERROR ROUTINE

```
15124   46 15148 00100   BI
15136   39 15161 00100   WA
15148   47 15172 00300   BNI
15160   48 70787 5  0≠   H
15172   46 15028 00200   BI
15184   49 15220         B
```

ROUTINE 086
CHECK DIVIDE

```
15196   67 84219 53476   X      DIVIDEND, DIVISOR
15208   21 42465 3623    X      DIVISOR, QUOTIENT, REMAINDER
15220   28 00099 15204   LD     LOAD DIVIDEND
15232   29 00084 15208   D      DIVIDE
15244   24 00095 15214   C      COMPARE QUOTIENT
15256   47 15316 01200   BNI    CHECK E/Z TRIG FOR E/Z
15268   24 15218 00099   C      COMPARE REMAINDER
15280   47 15316 01200   BNI    CHECK E/Z TRIG FOR E/Z
15292   49 15364         B
15304   41               NOP
                         ERROR ROUTINE
15316   46 15340 00100   BI
15328   39 15353 00100   WA
15340   47 15364 00300   BNI
15352   48 70787 6  0≠   H
15364   46 15220 00200   BI
15376   49 15400         B
```

ROUTINE 087
CHECK DIVIDE IMMEDIATE

```
15388       0902Ø 0          X       QUOTIENT, REMAINDER
15400   18  00099 8Ø592      LDM     LOAD DIVIDEND IMMEDIATE
15412   19  00096 0009Ø      DM      DIVIDE IMMEDIATE
15424   24  15393 00097      C       COMPARE QUOTIENT
15436   47  15496 01200      BNI     CHECK E/Z TRIG FOR E/Z
15448   24  15395 00099      C       COMPARE REMAINDER
15460   47  15496 01200      BNI     CHECK E/Z TRIG FOR E/Z
15472   49  15544            B
15484   41                   NOP
                             ERROR ROUTINE
15496   46  15520 00100      BI
15508   39  15533 00100      WA
15520   47  15544 00300      BNI
15532   48  70787 7  0/      H
15544   46  15400 00200      BI
15556   49  15568            B
```

ROUTINE 088
CHECK DIVIDE BY ZERO INDICATION

```
15568   18  00096 39486      LDM     LOAD DIVIDEND IMMEDIATE
15580   19  00096 Ø0000      DM      DIVIDE IMMEDIATE
15592   47  15628 01400      BNI     CHECK FOR OVERFLOW ON
15604   49  15676            B
15616   41                   NOP
                             ERROR ROUTINE
15628   46  15652 00100      BI
15640   39  15665 00100      WA
15652   47  15676 00300      BNI
15664   48  70787 8  0/      H
15676   46  15568 00200      BI
15688   49  15700            B
```

ROUTINE 089
CHECK OVERFLOW INDIC. FIRST DIGIT GREATER ZERO

```
15700  18 00096 34278     LDM   LOAD DIVIDEND IMMEDIATE
15712  19 00095 00314     DM    DIVIDE IMMEDIATE
15724  47 15760 01400     BNI   CHECK FOR OVERFLOW ON
15736  49 15808           B
15748  41                 NOP
                                 ERROR ROUTINE
15760  46 15784 00100     BI
15772  39 15797 00100     WA
15784  47 15808 00300     BNI
15796  48 70787 9  0≠     H
15808  46 15700 00200     BI
15820  49 18808           B
15832  41                 NOP
```

ROUTINE 090
TIMES 1000 ROUTINE AND CHK NOP

```
15844                000   X     CONSTANTS AND WORKING AREA
15856  41                 NOP
15868  46 15916 01400     BI    TURN OFF OVERFLOW
15880  11 15855 00001     AM    ADD ONE TO P FIELD
15892  46 13440 01400     BI    CHECK FOR OVERFLOW
15904  49 01116           B
                                 ERROR ROUTINE
15916  46 15940 00100     BI
15928  39 15953 00100     WA
15940  47 15856 00300     BNI
15952  48 70797 0  ≠      H
15964  49 15856           B
```

ROUTINE 097
BRANCH INDICATOR CHECK

```
18796  00 00000 11122          Working Area
18808  26 18855 18802   TF     Clear Math Area
18820  21 18855 18802   A      Add 00 to 00 Causing E/Z, H/P or E/Z, Not H/P,
                                and No O/F
18832  46 18856 01300   BI     Check BI H/P or E/Z for H/P or E/Z
18844  49 19228         B      Branch to Error Routine
18856  47 19228 01300   BNI    Check BNI H/P or E/Z for H/P or E/Z
18868  47 18892 01100   BNI    Check BNI H/P for Not H/P
18880  49 19228         B      Branch to Error Routine
18892  46 19228 01100   BI     Check BI H/P for Not H/P
18904  46 18928 01200   BI     Check BI E/Z for E/Z
18916  49 19228         B      Branch to Error Routine
18928  47 19228 01200   BNI    Check BNI E/Z for E/Z
18940  47 18964 01400   BNI    Check BNI O/F for No O/F
18952  49 19228         B      Branch to Error Routine
18964  46 19228 01400   BI     Check BI O/F for No O/F
18976  14 18984 00≠10   CM     Compare 10 to -00 Causing Not H/P, Not E/Z,
                                Not H/P or E/Z, and No O/F
18988  47 19012 01200   BNI    Check BNI E/Z for Not E/Z
19000  49 19228         B      Branch to Error Routine
19012  46 19228 01200   BI     Check BI E/Z for Not E/Z
19024  47 19048 01300   BNI    Check BNI H/P or E/Z for Not H/P or E/Z
19036  49 19228         B      Branch to Error Routine
19048  46 19228 01300   BI     Check BI H/P or E/Z for Not H/P or E/Z
19060  21 18855 18804   A      Add 11 to 00 Causing H/P, H/P or E/Z, Not E/Z, and No
19072  46 19096 01100   BI     Check BI H/P for H/P
19084  49 19228         B      Branch to Error Routine
19096  47 19228 01100   BNI    Check BNI H/P for H/P
19108  46 19132 01300   BI     Check BI H/P or E/Z for H/P or E/Z
19120  49 19228         B      Branch to Error Routine
19132  47 19228 01300   BNI    Check BNI H/P or E/Z for H/P or E/Z
19144  21 18855 18805   A      Add 111 to 11 Causing O/F, H/P, H/P or E/Z, and Not E/Z
19156  46 19180 01400   BI     Check BI O/F for O/F
19168  49 19228         B      Branch to Error Routine
19180  22 18855 18805   A      Add 111 to 22 Causing O/F, H/P, H/P or E/Z, and Not E/Z
19192  47 19228 01400   BNI    Check BNI O/F for O/F
19204  47 19276 01400   BNI
19216  49 19228         B

                                ERROR ROUTINE

19228  46 19252 00100   BI
19240  39 19265 00100   WA
19252  47 19276 00300   BNI
19264  48 70797 7000≠   H
19276  46 18808 00200   BI
19288  49 15856         B
19300
```

ROUTINE 099
CHECK TAPE OUTPUT. READ IN TAPE THEN TYPE
FOR CARD I/O, SEE PAGE 63A

```
16044                          X
16056                          X
16068                          X
16080                          X
16092                          X
16104                          X
16116                          X
16128                          X
16140 —                        X
16152                          X
16164                          X
16176                          X
16188                          X
16200                          X
16212                          X
16224                          X
16236  48                      H
16248  41                      NOP
16260  34          00102       K
16272  36 16124    00300       RN
16284  38 16124    00100       WN
16296  38 16140    00100       WN
16308  34          00102       K
16320  37 16069    00300       RA
16332  39 16069    00100       WA
16344  34          00102       K
16356  37 16069    00300       RA
16368  39 16069    00100       WA
16380  34          00102       K
16392  37 16069    00300       RA
16404  39 16069    00100       WA
16416  34          00102       K
16428  44 16488    16152       BNF
16440  44 16488    16153       BNF
16452  49 16500                B
16464                          X
16476                          X
```

ERROR ROUTINE

```
16488  39 16501    00100       WA
16500  48 70797    9000≠       H
16512  49 00552                B
```

ROUTINE 098
TEST COMPLETED ROUTINE

```
19720  63 45626 3  59          X      TEST R
19732  56 64634 95545          X      OUTLINE
19744  62   435 65457          X      S COMP
19756  53 45634 54403          X      LETED.
19768     4946  6266          X      IF SW
19780  71  564 646             X      I OFF
19792  41 5544  5556          X      AND NO
19804     59566 46349          X      ROUTI
19816  55 45  5 55662          X      NE NOS
19828     63685 74544          X      TYPED
19840     56646 323            X      OUT
```

ROUTINE 099
CHECK CARD OUTPUT. READ IN THEN TYPE
(FOR PAPER TAPE I/O, SEE PAGE 63)

```
16044                                X
16056                                X
16068                                X
16080                                X
16092                                X
16104                                X
16116                                X
16128                                X
16140 —                              X
16152                                X
16164                                X
16176                                X
16188                                X
16200                                X
16212                                X
16224                                X
16236  48                            H
16248  15 16148      ≠               TDM
16260  34           00102           K
16272  36 16068     00500           RN
16284  38 16124     00100           WN
16296  38 16140     00100           WN
16308  34           00102           K
16320  37 16069     00500           RA—
16332  39 16069     00100           WA
16344  34           00102           K
16356  37 16069     00500           RA —
16368  39 16069     00100           WA
16380  34           00102           K
16392  37 16069     00500           RA —
16404  39 16069     00100           WA
16416  34           00102           K
16428  44 16488     16152           BNF
16440  44 16488     16153           BNF
16452  49 16500                     B
16464                                X
16476                                X
```

ERROR ROUTINE

```
16488  39 16501     00100           WA
16500  48 70797     9000≠           H
16512  49 00552                     B
```

```
19852    54 41434 84955    X      MACHIN
19864    45   574 55946    X      E PERF
19876    56 59544 544      X      ORMED
19888    63 45626 362      X      TESTS
19900    57 59565 74559    X      PROPER
19912    53 68030 ≠        X      LY.≠
19924    34       00102    K
19936    39 19721 00100    WA
19948    46 00552 00400    BI
19960    49 16236          B

19972       199 76012    X      DUMP NUMERIC DATA
19984    34 56789 ≠1219  X      DUMP NUMERIC DATA
19996    99 89F          X      DUMP NUMERIC DATA
```