

# IBM 1620 Jr.

## Diagnostic Manual

### Version 0.9





## Introduction

The IBM 1620 was always shipped with a full set of diagnostic programs. These programs were typically used by the IBM Customer Engineer to check the correct operation of the machine and to diagnose / isolate / exercise failures when they occurred. They cover every aspect of the machine from console switches & lights, core memory, and instruction execution to operation of peripherals. A properly maintained IBM 1620 rarely failed, but it did happen. The diagnostics were also used when the computer was first installed to verify that it was fully operational.

While the hardware of the IBM 1620 Jr. is several orders of magnitude more reliable than the original 1960's IBM 1620, the diagnostic programs are still very useful to validate the simulation software in the main unit, the typewriter, and the card reader/punch device. Whenever changes are made to the simulators, the diagnostics should be run.

The Computer History Museum has in its collection, most of the manuals for the IBM 1620 Model 1 Diagnostics and a few paper tape images of the basic ones. Fortunately, for the diagnostics without binary images, the manuals include a simplified machine language listing of each program. One notable exception is the CU06/DT106 floating point diagnostic which is completely missing from the collection. As a replacement, a volunteer, John M. Bohn, wrote an SPS program (FP01) which thoroughly tests all of the 1620's floating point instructions. In addition, the CU02 Error Check diagnostic only tests the memory addressing register (MAR) subset of the IBM 1620's "Check Stop" conditions and depends on an internal maintenance switch, CE #9, which changed the computer's behavior. For the IBM 1620 Jr. it was replaced with a new, comprehensive error checking program (CS01).

IBM supplied all of the diagnostics on paper tape, punched cards, and the customer engineering disk pack. For the IBM 1620 Jr. all of the diagnostic programs have been "built into" the simulator for ease of use. When the IBM 1620 Jr. is powered off, pressing the RESET button loads into simulated core memory one of the diagnostic programs based on the setting of the PROGRAM SWITCHES. When the machine is turned on, pressing the START button will run the program.

Here are the programs available:

| PS 1 | PS 2 | PS 3 | PS 4 | Name     | Description                        |
|------|------|------|------|----------|------------------------------------|
| off  | off  | off  | off  | PowerOf2 | Power of 2 Calculator Demo Program |
| off  | off  | off  | on   | CU00     | Console Diagnostic                 |
| off  | off  | on   | off  | CU01     | General Op Codes Diagnostic        |
| off  | off  | on   | on   | CU05     | Special Instructions Diagnostic    |
| off  | on   | off  | off  | FP01     | Floating Point Diagnostic          |
| off  | on   | off  | on   | CU03     | Indirect Addressing Diagnostic     |
| off  | on   | on   | off  | CS01     | Check Stops Diagnostic             |
| off  | on   | on   | on   | DX05L    | Core Storage 20K Low Diagnostic    |
| on   | off  | off  | off  | DX05H    | Core Storage 20K High Diagnostic   |
| on   | off  | off  | on   | CU04     | Additional Core Diagnostic         |
| on   | off  | on   | off  | DX03     | Typewriter Diagnostic              |
| on   | off  | on   | on   | IO02     | Card I/O Diagnostic                |
| on   | on   | off  | off  | IO03     | Card I/O Reliability Diagnostic    |

The following sections describe all of the diagnostic programs and how to run them.



## **Lights and Switches Tests**



## Lights and Switches Tests

Built into the IBM 1620 Jr. simulator is a way to manually test all of the lights and switches on the front panel. This is the IBM 1620 Jr.'s version of a "Lamp Test" switch found on other computers. The IBM 1620 did not have this feature, but it is a useful capability for maintenance, so it was added to the IBM 1620 Jr. Unlike the IBM 1620 diagnostic test programs, these tests do not involve executing any IBM 1620 code.

There are four different tests available. They are activated when the machine is powered off, the left-most (unlabeled) toggle switch is on, and one PROGRAM SWITCH is turned on.

PROGRAM SWITCH 1: This is the actual "Lights and Switches" test. It begins with all wired lights turned on. This tests all of the lights. As each switch is turned on or button is pressed, one or more lights are turned off. For the toggle switches [not the PROGRAM SWITCHes], the light(s) above it are turned off when the switch is on. The left-most toggle switches and the PROGRAM SWITCHes are checked by selecting the various tests. The button / light correspondence is:

RESET: POWER ON, POWER READY, THERMAL lights

DISPLAY MAR: Pressing this button tests the large MEMORY ADDRESS REGISTER DISPLAY SELECTOR rotary switch. The HUNDREDS row of the MEMORY ADDRESS REGISTER displays a binary value representing the position of the knob as it is rotated, where: OR-1 = 0, OR-2 = 1, OR-3 = 2, ..., IR-2 = 11

SAVE: SAVE light

INSERT: INSERT light

RELEASE: PUNCH NO FEED, READER NO FEED lights

START: AUTOMATIC light

STOP / SIE: MANUAL light

INSTANT STOP / SCE: CHECK STOP light

PROGRAM SWITCH 2: This test displays the full LED brightness range. Each column of lights in the upper front panel displays a different brightness level from off in the left-most column to fully on in the right-most column. The columns in-between are 36 of the 254 intermediate brightness levels available.

PROGRAM SWITCH 3: This "snake" demo moves multiple lights across the upper and lower front panels. The two lights in the upper panels move randomly. The two lights in the lower panels move back and forth across the available wired lights. The speed of animation is controlled by the MEMORY ADDRESS REGISTER DISPLAY SELECTOR rotary switch, where PR-3 is the fastest and OR-4 is the slowest.

PROGRAM SWITCH 4: This one is just for fun. It lights "IBM 1620" in the upper front panels.

One thing to note about the IBM 1620 Jr.'s front panel – not all of the lights are wired and therefore they cannot be turned on. This is due to a combination of design decisions made when Jr. was built. None of the inactive lights were used on a real IBM 1620 Model 1 Level F machine, so it does not affect correct operation of the IBM 1620 Jr. However, the unlit lights are noticeable in the “lights and switches” tests. The inactive lights are:

INSTRUCTION AND EXECUTE CYCLE: E-24, E-25

CONTROL GATES: SET 00080, VRC GATE, END COMPR

INPUT-OUTPUT: *row 1 light 3, row 3 light 1, row 5 light 1*

DIGIT REGISTER: *row 1 light 2, row 2 light 2*

Lower Left Panel: *row 1 light 1, row 1 light 5, row 2 light 1, row 3 light 1*, MBR-E CHK, MBR-O CHK

Status Lights: *light 8, light 11, light 13*

## **CU00 - Console Diagnostic**



```
//=====
//  
// CU00 - Console Diagnostic  
//  
// Program Switch settings:  
//  
//    PS1: not used  
//    PS2: not used  
//    PS3: not used  
//    PS4: not used  
//  
// Check switches settings:  
//  
//    DISK I/O - STOP  
//    PARITY   - STOP  
//    I/O      - STOP  
//    O'FLOW   - STOP  
//  
// Start addresses:  
//  
//    00000 - Full test  
//  
// Directions:  
//  
//    1. Load CC diagnostic  
//    2. Press RESET  
//    3. Press START  
//    4. After printing the diagnostic program, the machine will halt with the  
//       MANUAL light on  
//    5. Verify the register contents:  
//       OPERATION REGISTER - 48  
//       MULTIPLIER - 0  
//       SENSE AND BRANCH - 0  
//       MEMORY BUFFER REGISTER - 22  
//       MEMORY DATA REGISTER - 2  
//       DIGIT REGISTER - 22  
//       MEMORY ADDRESS REGISTER - 11111  
//    6. Press SAVE  
//    7. Verify the MEMORY ADDRESS REGISTER is 11112  
//    8. Turn the MEMORY ADDRESS REGISER DISPLAY SELECTOR, press DISPLAY MAR, and  
//       verity the MAR register contents:  
//       IR-1 - 11112  
//       IR-2 - 00000  
//       OR-1 - 02222  
//       OR-2 - 04444  
//       OR-3 - 04444  
//       PR-1 - 11112  
//       PR-2 - 00000  
//       PR-3 - 00000  
//    9. Press INSERT  
//   10. Type 4911112  
//   11. Press RELEASE-START  
//   12. Verify AUTOMATIC light is on and the MANUAL light is off  
//   13. Type ABCDEFGHIJKLMNOPQRSTUVWXYZ <record mark>  
//   14. Press RELEASE  
//   15. Press START  
//   16. After printing the alphabet, the machine will wait for alphameric input  
//   17. Verify the AUTOMATIC light is on and the SAVE light is off  
//   18. Verify the MEMORY ADDRESS REGISTER is 11123  
//   19. Press RELEASE  
//   20. Verify the AUTOMATIC light is off and the MANUAL light is on  
//=====
```



## Sample Output – CU00

```
3800000000100311100000364911100000004804444022237055550010039055550010042000840
0000
4911112R
ABCDEFGHIJKLMNOPQRSTUVWXYZ#
ABCDEFGHIJKLMNOPQRSTUVWXYZ
```



NO. 2128300  
SHEET 0  
OF 3  
0

# DIAGNOSTIC TEST

TITLE 1620 DATA PROCESSING SYSTEM INDEX AND CONSOLE CHECK-OUT  
MACH. TYPE 1620 BY J. H. M. APPR. G. I. A. DATE 4-11-62

## ENGINEERING CHANGE HISTORY

| E/C NO.  | DATE      | SHEETS AFFECTED |
|----------|-----------|-----------------|
| 404530   | 8-15-60   | 1, 2            |
| 404568   | 12-15-60  | 1, 2, 3         |
| 404618   | 5-15-61   | 1               |
| 404675   | 4-11-62   | 1, 2, 3         |
| 404890-G | 9-17-63   | 1, 2, 3, 4      |
| 404980   | 5-7-64    | 1, 2, 3         |
| 412514   | 6-28-64   | 1               |
| 412553   | 21-SEP-65 | 1               |

|         |        |         |           |  |  |  |  |
|---------|--------|---------|-----------|--|--|--|--|
| E/C NO. | 404980 | 412514  | 412553    |  |  |  |  |
| DATE    | 5-7-64 | 6-28-64 | 21-SEP-65 |  |  |  |  |

## 1620 DATA PROCESSING SYSTEM DIAGNOSTICS

### INDEX

| Name  | Description                     | P/N<br>Manual Page | P/N<br>Paper Tape | P/N<br>Card Deck |
|-------|---------------------------------|--------------------|-------------------|------------------|
| CU01  | *General Op Codes               | 1620               | 2128301           | 2128302          |
| CU02  | *Error Check Test               | 1620               | 2128303           | 2125687          |
| CU03  | Indirect Addressing Feature     | 1620               | 2125574           | 2125688          |
| CU04  | Additional Core Feature         | 1623               | 2125704           | 2125689          |
| CU05  | Special Instructions Feature    | 1620               | 2125637           | 2125639          |
| CU06  | Floating Point Reliability Test | 1620               | 2153435           | 2153436          |
| DX01  | *Header Test                    | 1620               | 2172330           | 2172332          |
| DX02  | *CPU Test                       | 1620               | 2172333           | 2172335          |
| DX03  | *Typewriter Test                | 1620               | 2172336           | 2172338          |
| DX04  | Special Instructions Test       | 1620               | 2172339           | 2172341          |
| DX05L | *Core Storage Test L-20K        | 1620               | 2172342           | 2172344          |
| DX05H | *Core Storage Test H-20K        | 1620               | 2172334           | 2172345          |
| DX06  | Indirect Addressing Test        | 1620               | 2172346           | 2172348          |
| DX07L | Core Storage Test L 40/60K      | 1623               | 2172349           | 2172351          |
| DX07H | Core Storage Test H 40/60K      | 1623               | 2172360           | 2172352          |
| DT106 | Floating Point Feature          | 1620               | 2158959           | 2158990          |
| I002  | Card I/O Feature                | 1622               | 2125684           | -                |
| I003  | Card I/O Reliability Test       | 1622               | 2125682           | -                |
| DT20  | Write Addresses                 | 1311-3             | 2161816           | 2161817          |
| DT21  | Write Test Data                 | 1311-3             | 2161819           | 2161820          |
| DT22  | Fault Isolation                 | 1311-3             | 2161822           | 2161823          |
| DT43  | Printer Test                    | 1443               | 2172153           | 2172155          |
| DT44  | Plotter Test                    | 1625               | 2161849           | -                |
| Dipal | Dipal Monitor                   | 1620               | 2172363           | 2172365          |
| DT09  | *Meter Verification Test        | 1620               | 2172353           | 2172354          |

\* SUPPLIED WITH BASIC SYSTEMS. OTHER DT'S SUPPLIED ONLY TO SYSTEMS INCORPORATING OPTIONAL FEATURE.

## 1620 CONSOLE CHECK OUT

Loading a routine requires proper console and computer unit operation. A quick check of the console operations prior to running the diagnostic tests can be made and is desirable. A suggested procedure for the check out of the console will be given later. The proper execution of these instructions will indicate that valid information can be stored into memory and then read out, that portions of MARS are functioning, and that the console is operating correctly.

To load information into the memory from an input device, it is necessary to execute a read operation (36 or 37). For 1621 input, this operation must be written into memory from the typewriter keyboard. For 1622 I/O, this operation is accomplished by pressing the 1622 load key. The input device must then be placed in a ready condition and the read operation executed. Thus the necessity to check the console.

The console operations to be checked are: Reset, Insert, Release, Read Numeric from Typewriter, Read Alpha from Typewriter, Save, Write Numeric with Typewriter, Write Alpha with Typewriter, Display MARS.

The console check out will consist of keying in a set of instructions, one of which will cause the keyed in information to be typed out. (This will be a check of the read and write numeric information.) A branch operation will then be executed. The instruction branched to will be a halt command. Depression of the Save key will then cause the contents of IR-1 to be stored in PR-1 without replacing the information in IR-1. (IR-1 is now blank.)

The operation of Display MAR can now be checked by setting the indicator switch to the desired register and depressing the Display MAR switch. To continue, insert the instruction branch to 11112. Release and Start. The machine will stop, calling for a Read Alpha from the keyboard. Key in the alphabet, followed by a record mark. Then Release and Start. The alphabet will then be typed out, the branch back instruction executed and the machine will halt with 11123 in MAR.

### SUGGESTED CONSOLE CHECK PROCEDURE

1. Reset (Do not reset again during this check procedure)

2. Insert

3. Key in

38 00000 00100  
31 11100 00036  
49 11100 00000  
48 04444 02222  
37 05555 00100  
39 05555 00100  
42 00084 00000 ≠ (MAR should read 00084)

4. Release and Carriage return

## 1620 Console Check Out

5. Start. The data keyed in should be typed out. (All but record mark). The instructions TR, B, H, WA, BB should be transferred to memory positions 11100 and up. The program should HALT, and the MANUAL light turned on. The following readings should be noted: MAR-11111, MBR-22, MDR-2, DR-22, OP-48, and Sense and Branch CC on machines prior to E suffix; MAR-11111, MBR-22, MDR-2, OP-48, and Digit and Branch-22 on E suffix and later machines.
6. SAVE. MAR should read 11112.
7. Check display MARS (CE SW 9 Must be on, see note)  
IR-1 blank  
OR-1 C2222  
OR-2 C4444  
OR-3 C4444  
PR-1 11112
8. Insert
9. Key In 49 11112 00000
10. Release
11. Start. The machine will stop; call for a Read Alpha from the keyboard.
12. Key in the alphabet followed by a Record Mark.
13. Release
14. Start. The alphabet will be typed out, the program will Branch Back to 11112, and stop with a call for Read Alpha from the keyboard. The save light should have been turned off. MAR will read 11123.

The machine having performed these operations properly, the check-out of the 1620 can be continued with CU01 and CU02 with a degree of confidence that data can be written into and read out of memory.

Note: 1. With CE SW 9 on, the CE remote Start key must be used.  
2. On A suffix machines there is no CE SW 9; set MAR Check SW to "PROGRAM".

## **CU01 - General Op Codes Diagnostic**



```
//=====
// CU01 - General Op Codes Diagnostic
// Program Switch settings:
// PS1: ON - Bypass error type out
//       OFF - Type out routine number on error
// PS2: ON - Loop in routine
//       OFF - Continue to next routine
// PS3: ON - Stop on error
//       OFF - Do not stop on error, continue
// PS4: ON - Repeat test CU01
//       OFF - Run test CU01 once
// Check switches settings:
// DISK I/O - STOP
// PARITY   - STOP
// I/O      - STOP
// O'FLOW   - PROGRAM
// Start addresses:
// 00828 - Full test w/o automatic divide
// 14004 - Full test w/ automatic divide
// Directions:
// 1. Load CU01 diagnostic
// 2. A tab stop is automatically set at column 10
// 3. Press START
// 4. Load blank cards in card punch
// 5. Press START
// 6. After 1620 stops, move card deck from punch to reader
// 7. Press START
//=====
```



## Sample Output – CU01

```
SW 1 OFF SW 2 OFF SW 3 OFF SW 4 OFF SET SWS FOR CUØ1      THEN START
START ROUTINES. ETOS FOLLOW.
12345 6789Ø
12345 6789Ø 12345
12345 6789Ø
NUM INFO ABOVE OFFSET TO RIGHT TWO SPACES BETWEEN 5 AND 6 THREE LINES OF DATA
19976Ø123456789#Ø1Ø199989
TEST ROUTINES COMPLETED. IF SW1 OFF AND NO ROUTINE NOS TYPED OUT, MACHINE PERFOR
MED TESTS PROPERLY.
19976Ø123456789Ø1Ø199989
.Ø+$¤-/,(=@ ABCDEFGHIJKLMNOPQRSTUVWXYZØ123456789
.Ø+$¤-/,(=@ ABCDEFGHIJKLMNOPQRSTUVWXYZØ123456789
.Ø+$¤-/,(=@ ABCDEFGHIJKLMNOPQRSTUVWXYZØ123456789
```



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 4-11-6

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.

CU01

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. yyyy is the first instruction of the subroutine.)
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.

1620 DiagnosticsCU01PRODUCE 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.

1620 Diagnostics  
CU01

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.

199760123456789~~12199989~~

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.

199760123456789~~12199989~~  
 . )+\$\*-/, (=@ 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

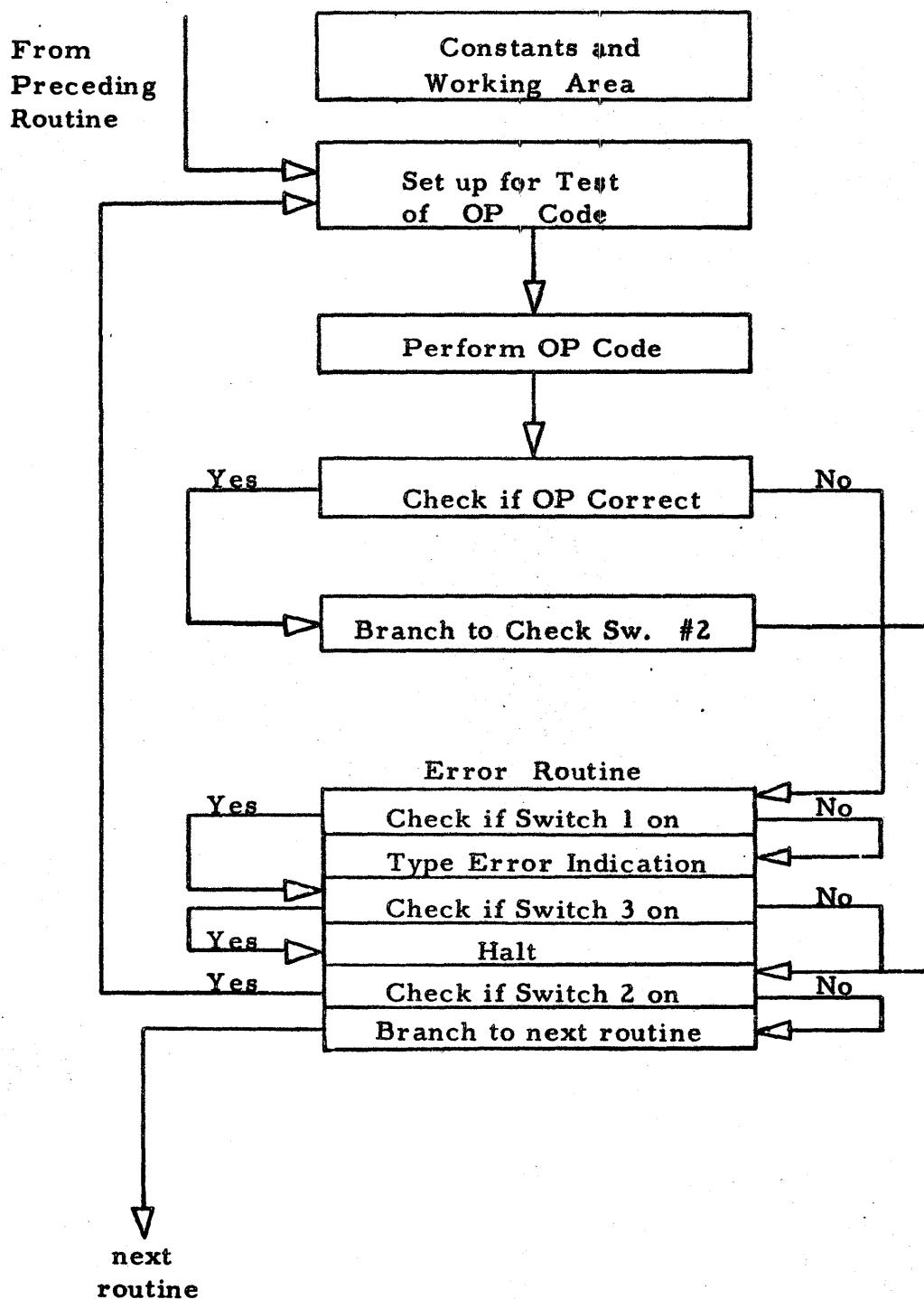
NUM INFO ABOVE OFFSET TO RIGHT TWO SPACES BETWEEN 5 AND  
 6 THREE LINES OF DATA

199760123456789~~12199989~~  
 TEST ROUTINES COMPLETED. IF SW1 OFF AND NO ROUTINE NOS  
 TYPED OUT, MACHINE PERFORMED TESTS PROPERLY.

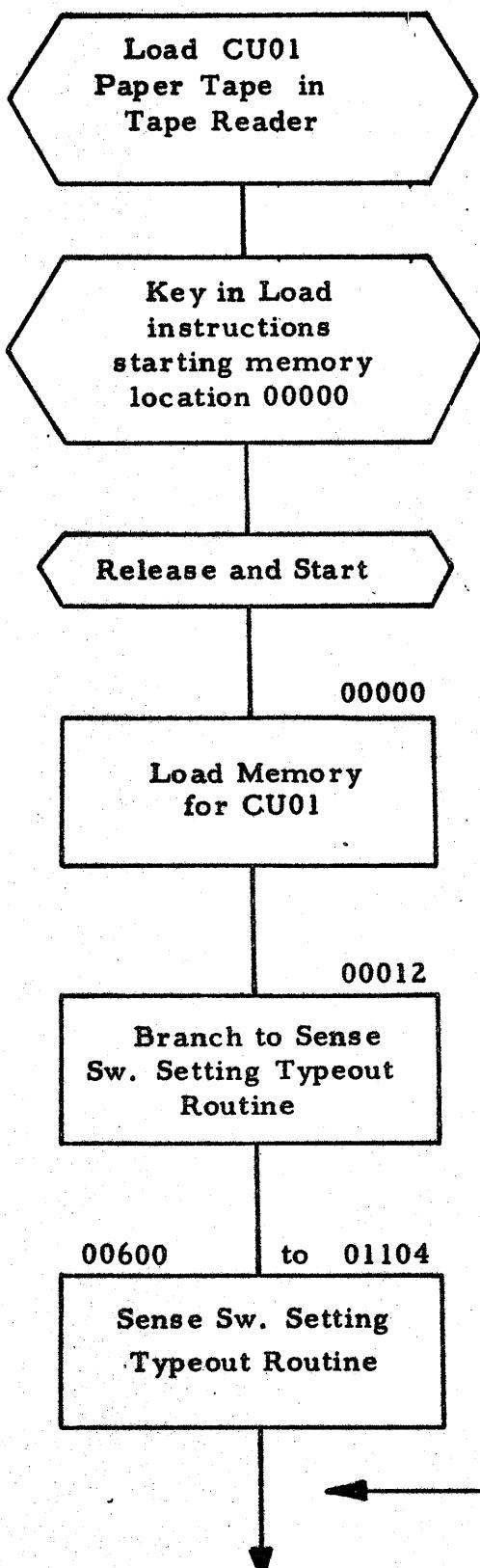
199760123456789~~12199989~~  
 . )+\$\*-/, (=@ ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  
 . )+\$\*-/, (=@ ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  
 . )+\$\*-/, (=@ ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789

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

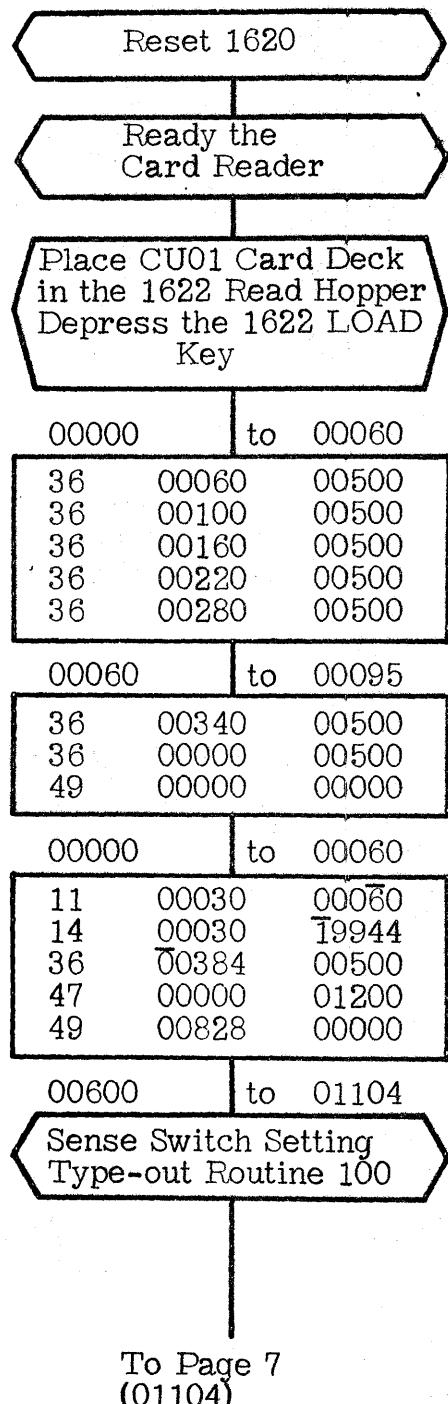
18

19

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

If DIVIDE installed, modify  
BRANCH instruction at 13992  
to check. DIVIDE. Key in  
3613992001004900552. Release  
and start. Key in 4914052,  
Release and Start.

CU01 FLOW CHART  
FOR 1622 I/O



Card #1

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

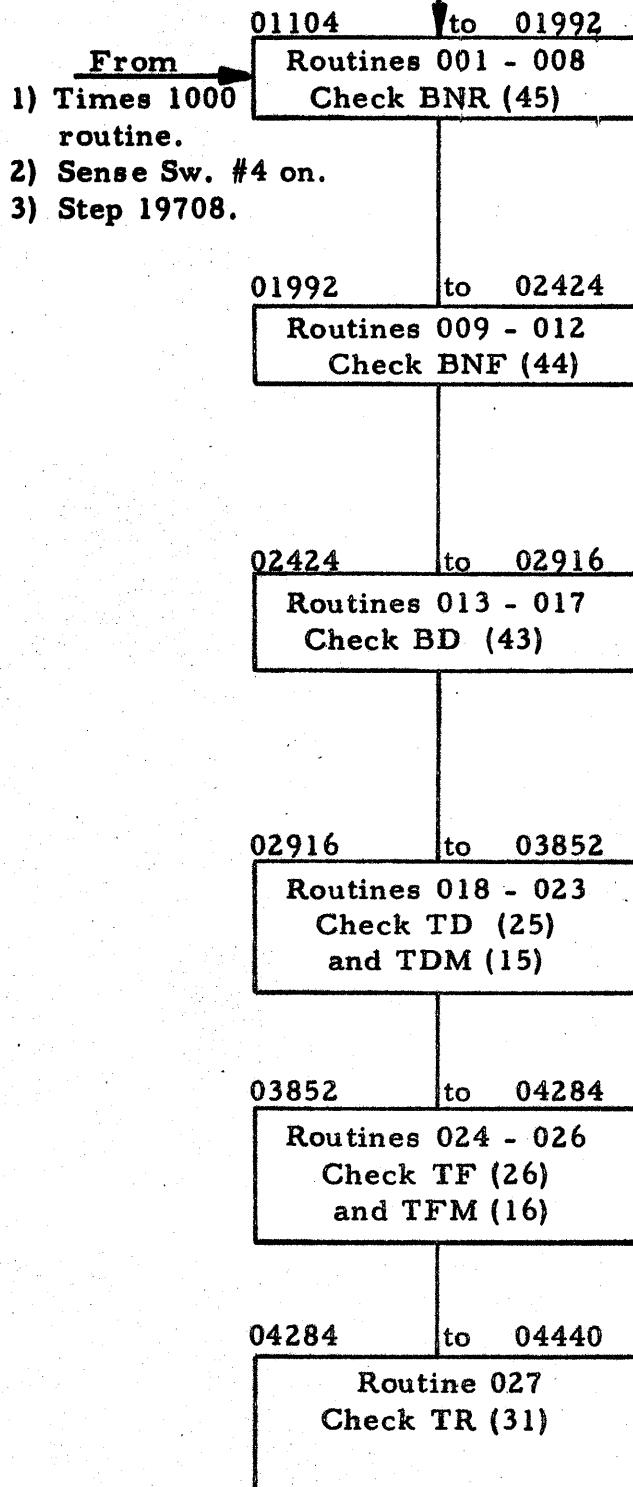
Card #2

Card #8

Load Card #8 contains instruc-  
tions 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)

PN 2128301  
EC 404530

From Page 7

(04284)

04440 to 05004

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

E Cycle Trigs.

BT & BTM  
15 Set up IR-2  
16 Set up IR-1  
26, Transmit  
27, Field

Aux. Trigs.

BT & BTM  
Decr.  
First Cycle  
FM #1

BB

20  
19

BB  
Save control  
status

05004 to 05604

Routines 030 - 033  
Check Set Flag (32)

E Cycle Trigs.

28  
29

Aux. Trigs.

None

05604 to 06228

Routines 034 - 037  
Check Clear Flag (33)

E Cycle Trigs.

28  
29

Aux. Trigs.

None

06228 to 07248

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

E Cycle Trigs.

11  
12  
13  
14  
23

Aux. Trigs.

H/P, Carry In  
E/Z, Carry Out  
T/C, Recomp.,  
#22; Incr./Decr  
First Cycle  
FM #1  
FM #2

07248 to 09024

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

E Cycle Trigs.

11  
12  
13  
14  
23

Aux. Trigs.

H/P  
E/Z  
T/C  
Incr./Decr.  
First Cycle  
FM #1  
FM #2  
Carry Out  
Carry In  
Recomp., #22

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(09024)

PN 2128301  
EC 404530

**From Page 8  
(09024)**

09024 to 09924

Routines 051 - 055  
Check for Correct  
Memory Look Up on  
Add (21); Sub. (021)

E Cycle Trigs.

11  
12  
13  
14  
23

Aux. Trigs.

H/P  
E/Z  
T/C  
FM #1  
FM #2  
Carry Out  
Carry In  
Incr. / Decr.  
First Cycle  
Recomp., #22

09924 to 10596

Routines 056 - 059  
Check Off Trig. On  
Add (21), Sub. (22),  
Add (11), SM (12)

E Cycle Trigs.

11  
12  
13  
14  
23

Aux. Trigs.

H/P #22  
E/Z O'Flow  
T/C  
FM #1  
Carry Out  
Carry In  
Incr. / Decr.  
Recomp.

10596 to 11064

Routines 060 - 062  
Check Comp. (24)  
For H/P

E Cycle Trigs.

Depends upon length  
and sign of fields.  
If all trigs. used:  
11  
12  
13  
14  
21

Aux. Trigs.

T/C, H/P, E/Z,  
Incr. / Decr.  
First Cycle  
FM #1  
FM #2  
Carry Out  
Carry In

11604 to 11544

Routines 063, 064  
Check Comp. (24)  
For E/Z

E Cycle Trigs.

Depends upon length  
and sign of fields.  
If all trigs. used,  
they are:  
11  
12  
13  
14  
21

Aux. Trigs.

T/C, H/P, E/Z,  
First Cycle,  
FM #1  
FM #2  
Carry Out  
Carry In  
Incr. / Decr.

To Page 10  
(11544)

PN 2128301  
EC 404530

From Page 9

(11544)

11544 to 11712

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

E Cycle Trigs.Depends upon length  
and sign of fields.

If all used:

11  
12  
13  
14  
21Aux. Trigs.

T/C, H/P, E/Z,  
First Cycle  
FM #1  
FM #2  
Incr. / Decr.  
Carry Out  
Carry In

11712 to 11868

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

E Cycle Trigs.11  
12  
13  
14Aux. Trigs.

T/C, H/P, E/Z  
First Cycle  
FM #1  
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.11  
12  
13  
14  
21Aux. Trigs.

E/Z, H/P, T/C  
First Cycle  
FM #1  
FM #2  
Incr. / Decr.  
Carry Out  
Carry In

12228 to 13272

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

E Cycle Trigs.32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
19Aux. Trigs.

E/Z, H/P  
T/C  
First Cycle  
Carry Out  
Carry In  
FM #1  
FM #2  
Incr. / Decr.  
Cycle Control  
00080

From Page 10  
(13272)

13992 to 14028

Bypass Divide  
Programs Unless  
this instruction  
changed to  
(49 14052)

Bypass Divide

14052 to 14620

Routines 080 - 082  
Check Load  
Dividend(28) and Load  
Dividend Immed.(18)

E Cycle Trigs.

|    |
|----|
| 32 |
| 26 |
| 27 |
| 28 |
| 29 |

Aux. Trigs.

|                |
|----------------|
| H/P            |
| Incr. / Decr.  |
| 00080          |
| First Cycle    |
| Cycle Control  |
| FM #1          |
| FM #2          |
| Dividend and   |
| Remainder Sign |

Optional

Feature  
Divide

14620 to 15568

Routines 083 - 087  
Check Divide (29)  
Divide Immed. (19)

E Cycle Trigs.

|    |    |
|----|----|
| 32 | 13 |
| 26 | 14 |
| 27 | 21 |
| 28 | 42 |
| 29 | 43 |
| 11 | 44 |
| 12 | 45 |

Aux. Trigs.

|                  |
|------------------|
| Incr. / Decr.    |
| 00080            |
| First Cycle      |
| H/P;Cycle Con.   |
| FM #1; FM #2     |
| Dividend and Re- |
| mainder Sign,    |
| First Divide     |
| Cycle; T/C       |
| Divide add       |
| Carry Out        |
| Carry In         |
| Last Div. Cycle  |

15568 to 15844

Routines 088 and 089  
Check Divide  
By Zero Indication  
and O/F Indication

E Cycle Trigs.

|    |    |
|----|----|
| 32 | 13 |
| 26 | 14 |
| 27 | 21 |
| 28 | 42 |
| 29 | 43 |
| 11 | 44 |
| 12 | 45 |

Aux Trigs.

|                 |
|-----------------|
| Incr. / Decr.   |
| 00080           |
| First Cycle     |
| H/P;Cycle Con   |
| FM #1; FM #2    |
| Dividend & Re-  |
| mainder sign;   |
| First Divide    |
| Cycle; T/C      |
| Divide Add      |
| Carry Out       |
| Carry In        |
| Last Div. Cycle |

To Page 11A  
(18808)

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)

15844 to 15916

Times 1000 Routine  
Overflow Indicates  
X1000. CHK NOP

No O'Flow  
Start 001  
(01116)

O'Flow

E Cycle Trigs.

11 18  
12 19  
13  
14  
21

Aux. Trigs.

Branch Test  
T/C, H/P, E/Z  
First Cycle  
FM #1; FM #2  
Incr./Decr.  
Carry Out  
Carry In

13272 to 13764

Routine 077  
Check Control (34),  
WN, (38), WA(39)  
Visual Check of type-  
writer output

E Cycle Trigs.

30  
31

Aux. Trigs.

I/O Hold  
RSP GATE  
R/W Call  
Discon. Gate  
I/O Exit  
I/O Sync.

13764 to 13836

Routine 078  
Check DN (35)  
Visual Check of  
Type READ IN  
PUNCHED DATA

Data for DN Test  
19976 - 19999

E Cycle Trigs.

30  
31

Aux. Trigs.

I/O Hold  
RSP Gate  
R/W Call  
Discon. Gate  
I/O Exit  
I/O Sync.  
19999 Stop

13836 to 13992

Routine 079  
Check Write Alpha(39)

E Cycle Trigs.

30  
31

Aux. Trigs.

I/O Hold  
RSP Gate  
R/W Call  
Discon. Gate  
I/O Exit  
I/O Sync.

19720 to 19972

Test Completed  
Routine  
K, WA, BI

E Cycle Trigs.

30  
31

Aux. Trigs.

I/O Hold  
RSP GATE  
R/W Call  
Discon. Gate  
I/O Exit  
I/O Sync.

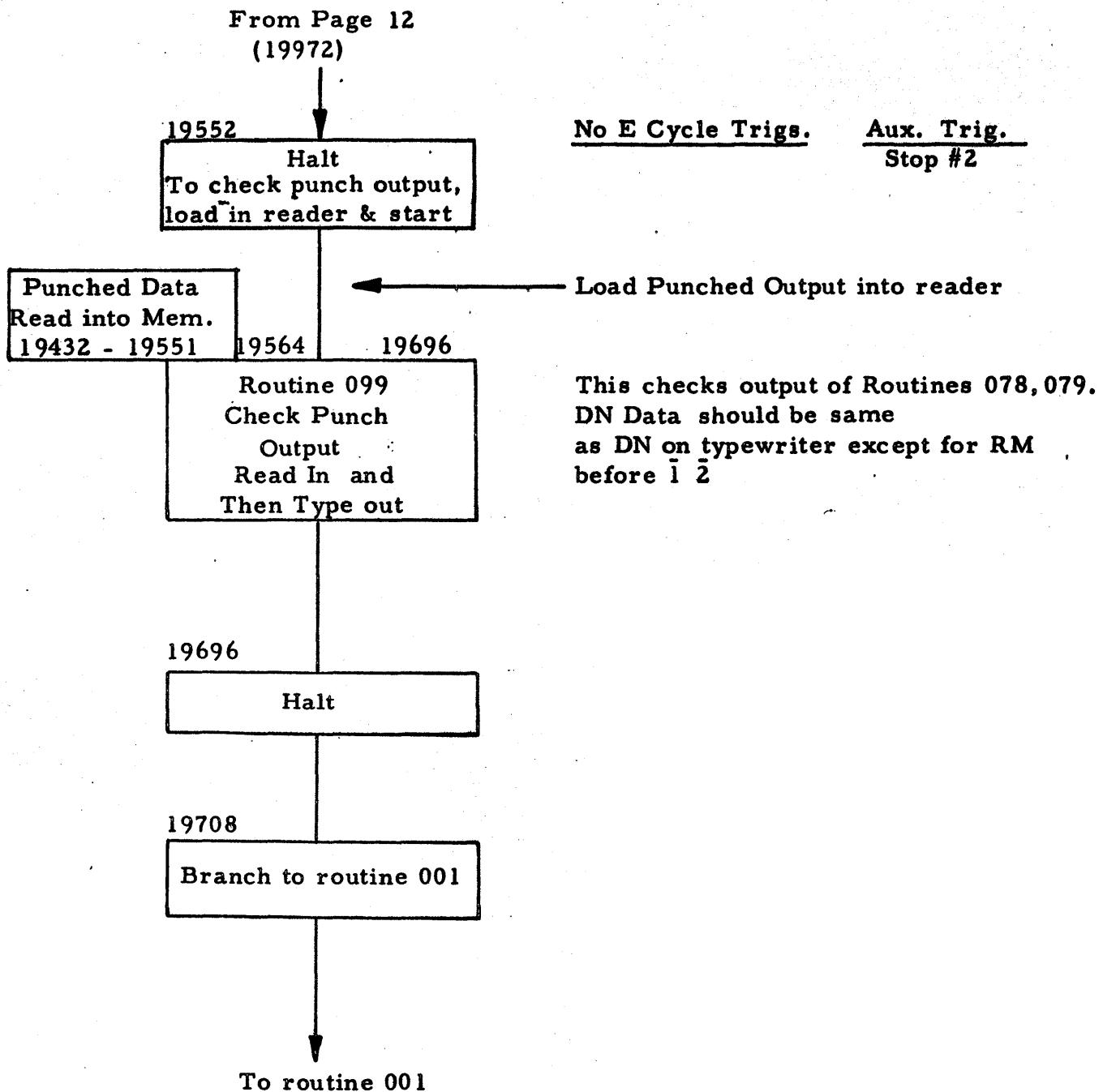
Branch to  
Routine 001

ON

Sense  
Sw.#4

To Page 13  
(19552)

PN 2128301  
EC 404675



## 1620 DIAGNOSTIC PROGRAM

CUO1

|     |                |     |
|-----|----------------|-----|
| MEM | 00PPPPPQQQQQ   | OP  |
| LOC | 01 23456 78901 | 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 89013 45678 | AT | ADD TABLES     |
| 336 | 90 12456 78901 | AT | ADD TABLES     |
| 348 | 23 56789 01234 | AT | ADD TABLES     |
| 360 | 67 89012 34578 | AT | ADD TABLES     |
| 372 | 90 12345 68901 | AT | ADD TABLES     |
| 384 | 23 45679 01234 | AT | ADD TABLES     |
| 396 | 56 787         | 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         |

 PN 2128301  
 EC 404568

|     |    |       |       |    |    |                             |
|-----|----|-------|-------|----|----|-----------------------------|
| 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 07  | 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 07  | H   |
| 1320 | 46 | 01236 | 00200 | BI  |
| 1332 | 49 | 01356 |       | B   |

**ROUTINE 003**  
**BRANCH NO RECORD MARK ON 8 IN EVEN MEMORY POSITION**

|      |    |       |           |     |                 |
|------|----|-------|-----------|-----|-----------------|
| 144  | 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 07      | 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 07      | H   |                 |
| 1536 | 46 | 01464 | 00200     | BI  |                 |
| 1548 | 49 | 01572 |           | B   |                 |

**ROUTINE 005**  
**BRANCH NO RECORD MARK ON 2 IN EVEN MEMORY POS**

|      |                |     |                      |
|------|----------------|-----|----------------------|
| 1560 | 2              | X   | CONSTANTS            |
| 1572 | 45 01644 01570 | BNR | CHECK FOR NO RM      |
| 1584 | 49 01596       | B   |                      |
|      |                |     | <b>ERROR ROUTINE</b> |
| 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   |                      |
|      |                |     | <b>ERROR ROUTINE</b> |
| 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   | <b>ERROR ROUTINE</b> |
| 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 | I              | X   | CONSTANTS            |
| 2004 | 44 02028 02002 | BNF | CHECK FOR FLAG       |
| 2016 | 49 02076       | B   | <b>ERROR ROUTINE</b> |
| 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 | I        | 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         |

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**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 |                      |
|      |                |     | <b>ERROR ROUTINE</b> |
| 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          |                      |
|      |                |              | <b>ERROR ROUTINE</b> |
| 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 |                      |
|      |                |     | <b>ERROR ROUTINE</b> |
| 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 (1 #) TO ODD MEMORY POS**

|      |                |     |                            |
|------|----------------|-----|----------------------------|
| 3852 | 17             | 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 |                            |
|      |                |     | <b>ERROR ROUTINE</b>       |
| 3924 | 46 03948 00100 | BI  |                            |
| 3936 | 39 03961 00100 | WA  |                            |
| 3948 | 47 03972 C0300 | BNI |                            |
| 3960 | 48 70727 4 0#  | H   |                            |
| 3972 | 46 03864 00200 | BI  |                            |
| 3984 | 49 04008       | B   |                            |

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**ROUTINE 025**  
**TRANS FIELD - 2 CHAR (I#) TO EVEN MEMORY POS**

|               |                |     |                            |
|---------------|----------------|-----|----------------------------|
| 3996          | I#             | X   | CONSTANTS AND WORKING AREA |
| 4008          | 26 04002 04006 | TF  | TRANS I#                   |
| 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 (I7#)**

|               |                |              |                |
|---------------|----------------|--------------|----------------|
| 4140          | X              | WORKING AREA |                |
| 4152          | 16 04145 0017# | TFM          | TRANS I7#      |
| 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 (I2480#) TO ODD MEMORY POS

|      |                |               |                           |
|------|----------------|---------------|---------------------------|
| 4284 | I 2480#        | X             | CONSTANTS                 |
| 4296 |                | X             | WORKING AREA              |
| 4308 | 31 04301 04290 | TR            | TRANS RECORD - I2480#     |
| 4320 | 44 04368 04301 | BNF           | CHECK FOR FIRST CHARACTER |
| 4332 | 45 04368 04306 | BNR           | CHECK FOR LAST CHARACTER  |
| 4344 | 49 04416       | B             |                           |
| 4356 | 41             | NOP           |                           |
|      |                | ERROR 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 (I2480#)

|      |                |               |                                 |
|------|----------------|---------------|---------------------------------|
| 4440 | I 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 I 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 00001 | TDM | TRANS I TO 04594          |

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|      |                |     |                         |
|------|----------------|-----|-------------------------|
| 4632 | 16 04593 00000 | 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 70727 8 07  | H   |                         |
| 4704 | 46 04452 00200 | BI  |                         |
| 4716 | 49 04728       | B   |                         |

**ROUTINE 029**  
**BRANCH AND TRANS IMMED TRANS 3 CHAR FIELD (I77)**

|      |                |     |                                 |
|------|----------------|-----|---------------------------------|
| 4728 | 17 04872 00177 | 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 07  | 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 1 AND BB TO MAIN ROUTINE**

|      |     |                           |
|------|-----|---------------------------|
| 4860 | X   | WORKING AREA              |
| 4872 | BNR | CHECK LOW ORDER FOR RM    |
| 4884 | BNF | CHECK HIGH ORDER FOR FLAG |
| 4896 | TFM | TRANS FIELD TO 1 IMMED    |
| 4908 | BB  | BRANCH BACK TO 04740      |
| 4920 | NOP |                           |

## ERROR ROUTINE

|      |                |     |
|------|----------------|-----|
| 4932 | 46 04956 00100 | BI  |
| 4944 | 39 04969 00100 | WA  |
| 4956 | 47 04980 00300 | BNI |
| 4968 | 48 75727 9 07  | H   |
| 4980 | 46 04728 00200 | BI  |
| 4992 | 49 05016       | B   |

## ROUTINE 030

## SET FLAG ON CHAR WITH FLAG AND C BIT (8)

|      |                |                            |
|------|----------------|----------------------------|
| 5004 | 8              | X WORKING AREA             |
| 5016 | 46 05028 01600 | BI TURN OFF MBR E CHECK    |
| 5028 | 32 05014       | SF SET FLAG ON 8           |
| 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 07  | H   |
| 5124 | 46 05016 00200 | BI  |
| 5136 | 49 05160       | B   |

## ROUTINE 031

## SET FLAG ON CHAR WITH FLAG AND NO C BIT 6

|      |                |                            |
|------|----------------|----------------------------|
| 5148 | 6              | X WORKING AREA             |
| 5160 | 46 05172 01700 | BI TURN OFF MBR O CHECK    |
| 5172 | 32 05157       | SF SET FLAG ON 6           |
| 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 |                      |
|      |                |     | <b>ERROR ROUTINE</b> |
| 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 |                          |
|      |                |     | <b>ERROR ROUTINE</b>     |
| 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 |                         |
|      |                |     | <b>ERROR ROUTINE</b>    |
| 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 (5)**

|      |                |     |                         |
|------|----------------|-----|-------------------------|
| 5916 | 5              | X   | WORKING AREA            |
| 5928 | 33 05926       | CF  | CLEAR FLAG ON 5         |
| 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   |                         |
|      |                |     | <b>ERROR ROUTINE</b>    |
| 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 (7)**

|      |                |     |                   |
|------|----------------|-----|-------------------|
| 6072 | 7              | X   | WORKING AREA      |
| 6084 | 33 06081       | CF  | CLEAR FLAG ON 7   |
| 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   |                      |
|      |                |     | <b>ERROR ROUTINE</b> |
| 6156 | 46 06180 00100 | BI  |                      |
| 6168 | 39 06193 00100 | WA  |                      |
| 6180 | 47 06204 00300 | BNI |                      |
| 6192 | 48 70737 7 07  | 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 |                            |
|      |                |     | <b>ERROR ROUTINE</b>       |
| 6324 | 46 06276 00100 | BI  |                            |
| 6336 | 38 06355 00100 | WN  |                            |
| 6348 | 49 06276 0387  | B   |                            |
| 6360 | 46 06384 00100 | BI  |                            |
| 6372 | 39 06397 00100 | WA  |                            |
| 6384 | 47 06408 00300 | BNI |                            |
| 6396 | 48 75737 8 07  | 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 | 22             | 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 | 8811           | 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                 | 8844           | 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 |                            |
| <b>ERROR ROUTINE</b> |                |     |                            |
| 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                 | 4444           | 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 |                            |
| <b>ERROR ROUTINE</b> |                |     |                            |
| 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 | 1188           | 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 |                            |
|      |                |     | <b>ERROR ROUTINE</b>       |
| 7344 | 46 07296 00100 | BI  |                            |
| 7356 | 38 07375 00100 | WN  |                            |
| 7368 | 49 07296 0437  | B   |                            |
| 7380 | 46 07404 00100 | BI  |                            |
| 7392 | 39 07417 00100 | WA  |                            |
| 7404 | 47 07428 00300 | BNI |                            |
| 7416 | 48 75747 3 07  | 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 | 1188           | 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 |                            |
|      |                |     | <b>ERROR ROUTINE</b>       |
| 7548 | 46 07500 00100 | BI  |                            |
| 7560 | 38 07579 00100 | WN  |                            |
| 7572 | 49 07500 0447  | B   |                            |
| 7584 | 46 07608 00100 | BI  |                            |
| 7596 | 39 07621 00100 | WA  |                            |
| 7608 | 47 07632 00300 | BNI |                            |
| 7620 | 48 75747 4 07  | 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 07  | H   |                            |
| 7800          | 49 07704       | B   |                            |
| 7812          | 46 07836 00100 | BI  |                            |
| 7824          | 39 07849 00100 | WA  |                            |
| 7836          | 47 07860 00300 | BNI |                            |
| 7848          | 48 75747 5 07  | 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 07  | H   |                            |
| 8028          | 49 07932       | B   |                            |

|      |                |     |
|------|----------------|-----|
| 8040 | 46 08064 00100 | BI  |
| 8052 | 39 08077 00100 | WA  |
| 8064 | 47 08088 00300 | BNI |
| 8076 | 48 75747 6 07  | 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 | 4422           | 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 08222 00100 | BI  |
| 8220 | 39 08245 00100 | WA  |
| 8232 | 47 08256 00300 | BNI |
| 8244 | 48 70747 7 07  | H   |
| 8256 | 49 08160       | B   |
| 8268 | 46 08292 00100 | BI  |
| 8280 | 39 08305 00100 | WA  |
| 8292 | 47 08316 00300 | BNI |
| 8304 | 48 75747 7 07  | 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 | 8822           | 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   |                            |

PN 2128301  
EC 404530

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 |                            |
| <b>ERROR ROUTINE</b> |                |     |                            |
| 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 |                            |
| <b>ERROR ROUTINE</b> |                |     |                            |
| 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 | B I  |
| 9312 | 39 09337 | 00100 | WA   |
| 9324 | 47 09348 | 00300 | BN I |
| 9336 | 48 70757 | 2 0#  | H    |
| 9348 | 15 00396 | 5     | TDM  |
| 9360 | 46 09216 | 00200 | B I  |
| 9372 | 49 09396 |       | B    |

**RESTORE ADD TABLE POS. 396**

**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               |
| 9432 | 45 09480 | 09389 | BNR CHECK RESULT FOR RM           |
| 9444 | 49 09528 |       | B                                 |
| 9456 | 41       |       | NOP                               |
| 9468 | 41       |       | NOP                               |

**ERROR ROUTINE**

|      |          |       |      |
|------|----------|-------|------|
| 9480 | 46 09504 | 00100 | B I  |
| 9492 | 39 09517 | 00100 | WA   |
| 9504 | 47 09528 | 00300 | BN I |
| 9516 | 48 70757 | 3 0#  | H    |
| 9528 | 15 00303 | 3     | TDM  |
| 9540 | 46 09396 | 00200 | B I  |
| 9552 | 49 09576 |       | B    |

ROUTINE 054  
CHECK FOR CORRECT MEMORY LOOK UP ON SUBT

|               |    |       |       |                                  |
|---------------|----|-------|-------|----------------------------------|
| 9564          | T  | 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 | B I                              |
| 9672          | 39 | 09697 | 00100 | WA                               |
| 9684          | 47 | 09708 | 00300 | BN I                             |
| 9696          | 48 | 70757 | 4 0≠  | H                                |
| 9708          | 15 | 00305 | 5     | TDM RESTORE ADD TABLE POS. 305   |
| 9720          | 46 | 09576 | 00200 | B I                              |
| 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 | B I                              |
| 9852          | 39 | 09877 | 00100 | WA                               |
| 9864          | 47 | 09888 | 00300 | BN I                             |
| 9876          | 48 | 70757 | 5 0≠  | H                                |
| 9888          | 15 | 00301 | 1     | TDM RESTORE ADD TABLE POS. 301   |
| 9900          | 46 | 09756 | 00200 | B I                              |
| 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 C0100 | 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   |                            |

PN 2128301  
EC 404530

ROUTINE 058  
CHECK OVERFLOW TRIG

|       |    |             |     |                            |
|-------|----|-------------|-----|----------------------------|
| 10260 |    | 73          | 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 27    | 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 |    | 99          | 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 111   | 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 |                            |
| <b>ERROR ROUTING</b> |                |     |                            |
| 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 |                            |
| <b>ERROR ROUTINE</b> |                |     |                            |
| 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 07  | 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 07  | 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 07  | H   |                            |
| 11688         | 46 11556 00200 | BI  |                            |
| 11700         | 49 11724       | B   |                            |

ROUTINE 067  
CHECK COMPARE IMMED FOR E/Z

|               |                |     |                            |
|---------------|----------------|-----|----------------------------|
| 11712         | 10248          | X   | CONSTANTS AND WORKING AREA |
| 11724         | 26 11718 11723 | TF  | SET 10248 IN P FIELD       |
| 11736         | 14 11718 10248 | 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 07  | H   |                            |
| 11844         | 46 11724 00200 | BI  |                            |
| 11856         | 49 11916       | B   |                            |

**ROUTINE 068**  
**CHECK ADD TEN DIGIT NO TO 12 DIGIT NO**

|       |    |       |       |     |                          |
|-------|----|-------|-------|-----|--------------------------|
| 11868 | 00 | 12345 | 67890 | X   | AUGEND                   |
| 11880 |    | 23456 | 78901 | X   | ADDEND                   |
| 11892 | 00 | 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 | 00 | 98765 | 43210 | X   | MINUEND                      |
| 12060 |    | 12345 | 67890 | X   | SUBTRAHEND                   |
| 12072 | 00 | 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 | 54291 | 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 07  | H   |                               |
| 13248 | 46 | 13128 | 00200 | BI  |                               |
| 13260 | 49 | 13992 |       | B   |                               |

ROUTINE 077  
CHECK CONTROL OPERATIONS &  
WRITE NUM & ALPHA

|       |    |       |         |    |                        |
|-------|----|-------|---------|----|------------------------|
| 13272 | 12 | 34546 | 78907   | 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 BETWEEN     |
| 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 | 34107   | 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 | 06400 | 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 | <u>03</u> | 04101 | 31420 | X  | . )+\$*-                    |
| 13836 | <u>21</u> | 23243 | 33400 | X  | /, (@                       |
| 13848 | <u>41</u> | 42434 | 44546 | X  | ABCDEF                      |
| 13860 | <u>47</u> | 48495 | 15253 | X  | GHJKLM                      |
| 13872 | <u>54</u> | 55565 | 75859 | X  | MNOPQR                      |
| 13884 | <u>62</u> | 63646 | 56667 | X  | STUVWX                      |
| 13896 | <u>68</u> | 69707 | 17273 | X  | YZ0123                      |
| 13908 | <u>74</u> | 75767 | 77879 | X  | 456789                      |
| 13920 | <u>07</u> |       |       | X  | £                           |
| 13932 | <u>31</u> | 16044 | 13824 | TR | Transmit Data to Punch Area |
| 13944 | <u>39</u> | 16045 | 00400 | WA | Card Punch                  |
| 13956 | <u>39</u> | 16045 | 00400 | WA | Card Punch                  |
| 13968 | <u>39</u> | 16045 | 00400 | WA | Card Punch                  |
| 13980 | <u>49</u> | 19924 |       | B  |                             |

## Check if Division Installed

|       |    |       |       |     |
|-------|----|-------|-------|-----|
| 13992 | 49 | 18808 |       | B   |
| 14004 | 16 | 13998 | 14052 | TFM |
| 14016 | 49 | 00552 |       | B   |

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

|       |           |       |       |    |                  |
|-------|-----------|-------|-------|----|------------------|
| 13824 | <u>03</u> | 04101 | 31420 | X  | . )+\$*-         |
| 12836 | <u>21</u> | 23243 | 33400 | X  | /, (=@           |
| 13848 | <u>41</u> | 42434 | 44546 | X  | ABCDEF           |
| 13860 | <u>47</u> | 48495 | 15253 | X  | GHIJKL           |
| 13872 | <u>54</u> | 55565 | 75859 | X  | MNOPQR           |
| 13884 | <u>62</u> | 63646 | 56667 | X  | STUVWX           |
| 13896 | <u>68</u> | 69707 | 17273 | X  | YZ0123           |
| 13908 | <u>74</u> | 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 | <u>45</u> | 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         | I2 34567 89086 | X   | DIVIDEND                     |
| 14220         | I2 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 07  | 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 07  | H   |                              |
| 14596         | 46 14488 00200 | BI  |                              |
| 14608         | 49 14644       | B   |                              |

ROUTINE 083  
CHECK DIVIDE

|                      |    |       |       |     |                             |
|----------------------|----|-------|-------|-----|-----------------------------|
| 14620                | 12 | 34567 | 89123 | X   | DIVIDEND, DIVISOR           |
| 14632                | 45 | 10000 | 06789 | 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 |                             |
| <b>ERROR ROUTINE</b> |    |       |       |     |                             |
| 14740                | 46 | 14764 | 00100 | BI  |                             |
| 14752                | 39 | 14777 | 00100 | WA  |                             |
| 14764                | 47 | 14788 | 00300 | BNI |                             |
| 14776                | 48 | 70787 | 3 07  | H   |                             |
| 14788                | 46 | 14644 | 00200 | BI  |                             |
| 14800                | 49 | 14836 |       | B   |                             |

**ROUTINE 084**  
**CHECK DIVIDE**

|                      |                |     |                              |
|----------------------|----------------|-----|------------------------------|
| 14812                | 98 76543 21678 | X   | DIVIDEND, DIVISOR            |
| 14824                | 91 45478 4179  | 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 |                              |
| <b>ERROR ROUTINE</b> |                |     |                              |
| 14932                | 46 14956 00100 | BI  |                              |
| 14944                | 39 14969 00100 | WA  |                              |
| 14956                | 47 14980 00030 | BNI |                              |
| 14968                | 48 70787 4 07  | 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 07  | H   |
| 15172 | 46 | 15028 | 00200 | BI  |
| 15184 | 49 | 15220 |       | B   |

## ROUTINE 086

## CHECK DIVIDE

|       |           |       |       |     |                              |
|-------|-----------|-------|-------|-----|------------------------------|
| 15196 | <u>67</u> | 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 07  | H   |
| 15364 | 46 | 15220 | 00200 | BI  |
| 15376 | 49 | 15400 |       | B   |

ROUTINE 087  
CHECK DIVIDE IMMEDIATE

|       |                |     |                         |
|-------|----------------|-----|-------------------------|
| 15388 | 09020 0        | X   | QUOTIENT, REMAINDER     |
| 15400 | 18 00099 86592 | LDM | LOAD DIVIDEND IMMEDIATE |
| 15412 | 19 00096 00096 | 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 07  | 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 00000 | 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 07  | 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 | T1122 |     | 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,<br>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,<br>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   |   |
| <b>ERROR ROUTINE</b> |    |       |       |     |   |
| 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               |
| 16488 | 39 | 16501 00100 WA  |
| 16500 | 48 | 70797 9000/ H   |
| 16512 | 49 | 00552 B         |

**ERROR ROUTINE**

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

**ERROR ROUTINE**

|       |     |       |       |    |                   |
|-------|-----|-------|-------|----|-------------------|
| 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  | 89    | L     | X  | DUMP NUMERIC DATA |



## **CU05 - Special Instructions Diagnostic**



```
//=====
// CU05 - Special Instructions Diagnostic
// Program Switch settings:
// PS1: ON - Bypass error type out
//       OFF - Type out routine number on error
// PS2: ON - Loop in routine
//       OFF - Continue to next routine
// PS3: ON - Stop on error
//       OFF - Do not stop on error, continue
// PS4: ON - Repeat test CU05
//       OFF - Run test CU05 once
// Check switches settings:
// DISK I/O - STOP
// PARITY   - STOP
// I/O      - STOP
// O'FLOW   - PROGRAM
// Start addresses:
// 00828 - Full test
// Directions:
// 1. Load CU05 diagnostic
// 2. Press START
// 3. Press START
//=====
```



## Sample Output – CU05

```
SW 1 OFF SW 2 OFF SW 3 OFF SW 4 OFF SET SENSE SWS FOR CU05, SPECIAL INSTS TEST.  
THEN START.  
START ROUTINES. ETOS FOLLOW.  
TEST COMPLETED. IF SW 1 OFF AND NO ROUTINE NOS TYPED, TEST PERFORMED PROPERLY.
```



NO. 2125637  
SHEET 0  
OF 18

# DIAGNOSTIC TEST

TITLE 1620 SPECIAL INSTRUCTIONS DIAGNOSTIC TEST - CU05  
MACH. TYPE 1620 BY J.H.M. APPR. G.I.A. DATE 4-11-62

## ENGINEERING CHANGE HISTORY

| E/C NO. | DATE    | SHEETS AFFECTED  |
|---------|---------|--|
| 404618  | 5-15-61 | 1-18   |
| 404675  | 4-11-62 | 2A, 3A, 6, 6A, 7, 8, 9, 10, 12, 14,<br>15, 16, 17, 17A, 18 |
|         |         |  |
|         |         |  |
|         |         |  |
|         |         |  |
|         |         |  |
|         |         |  |
|         |         |  |
|         |         |  |
|         |         |  |
|         |         |  |
|         |         |  |

|         |         |         |  |  |  |  |  |
|---------|---------|---------|--|--|--|--|--|
| E/C NO. | 404618  | 404675  |  |  |  |  |  |
| DATE    | 5-15-61 | 4-11-62 |  |  |  |  |  |

## 1620 DIAGNOSTICS

CU05

### SPECIAL INSTRUCTIONS

#### A. SCOPE:

This test is essentially a fault detection test designed to check for the proper operation of the special instructions Transfer Numeric Strip, Transfer Numeric Fill and Move Flag.

#### B. SET UP:

Suggested setting of 1620 switches:

1. Check Switches set to STOP.
2. Sense Switches set OFF.

The sense switches have the following functions in this test:

|                 |     |                                  |
|-----------------|-----|----------------------------------|
| Sense Switch #1 | ON  | Bypass error type out            |
|                 | OFF | Type out routine number on error |
| Sense Switch #2 | ON  | Loop in routine                  |
|                 | OFF | Continue to next routine         |
| Sense Switch #3 | ON  | Stop on error                    |
|                 | OFF | Bypass Halt in error routine     |
| Sense Switch #4 | ON  | Repeat Test                      |
|                 | OFF | Halt                             |

#### NORMAL LOAD

This test is designed to be used with a 1620-1622 system. The cards must be run in the 1622 by using the LOAD key. Depressing the 1620 START key will initiate the loading of the instructions.

If these features are to be used with a 1620-1621 system, then the instructions to load the test instructions must be inserted in the 1620.

These are:

36 00096 00300  
49 00828

#### PRODUCE NEW TAPE

1. Load tape in paper tape reader and ready reader.
2. Insert the following instructions in 1620:

PN 2125637  
EC 404618

PRODUCE NEW TAPE (cont'd)

36 14960 00300  
35 14960 00200  
37 15201 00300  
39 15201 00200  
48

3. Release and start.

C. TEST METHOD:

The test is comprised of a group of routines (15) to check the various aspects of these three special instructions.

Routine 001 types the setting of the sense switches, the name of the test, and reads in the data for checking Transfer Numeric Strip.

Routines 002-005 check the Transfer Numeric Strip circuits. The zone data of the numeric fields read in in the alpha mode in routine 001 is removed. Routines 002 and 003 remove the zone data from positive fields. The addressed position of the Q field in routine 002 is odd; while the addressed position of the Q field in routine 003 is even. Routines 004 and 005 remove the zone data from negative fields; the addressed position of the Q fields being odd and even respectively.

Routines 006-009 check the Transfer Numeric Fill Circuits. Zone data for ten digit numeric fields is added. Routines 006 and 007 add zone data to positive fields. The addressed Q field for routine 006 is an odd memory location and for routine 007 it is an even position. A test is made to determine that a flag bit is not inserted in the high order position of the P field. Routines 008 and 009 add zone data to negative fields. The addressed Q field in routine 008 is odd and in routine 009 it is even. Flag bits should not be inserted in the high order position of the P field.

Routines 010-013 check the Move Flag circuits. The flag conditions of the Q addressed position is moved to the flag position of the P address, leaving the Q address without a flag. The four conditions, moving a flag to a no flag position, flag to flag position, no flag to flag, and no flag to no flag, are checked by the routines 010-013 respectively.

Routine 014 is the repeat routine, and routine 015 is the test completed routine.

Error typeouts consist of an "H" followed by the routine number and a statement of the error that occurred or the field that is in question. Comparing the typed field with the compare data will indicate what caused the error type out.

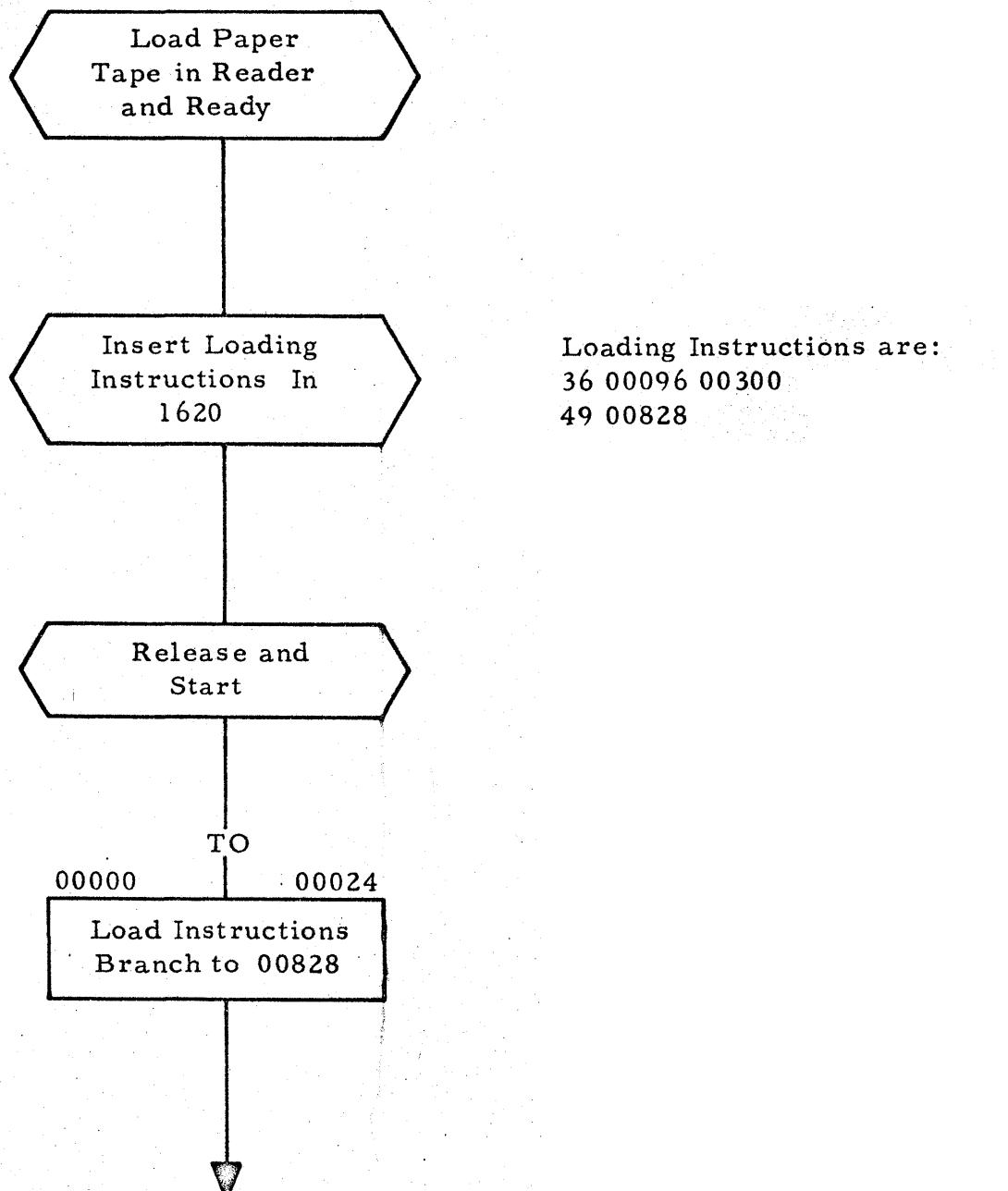
PN 2125637 EC 404618

Rev 19396

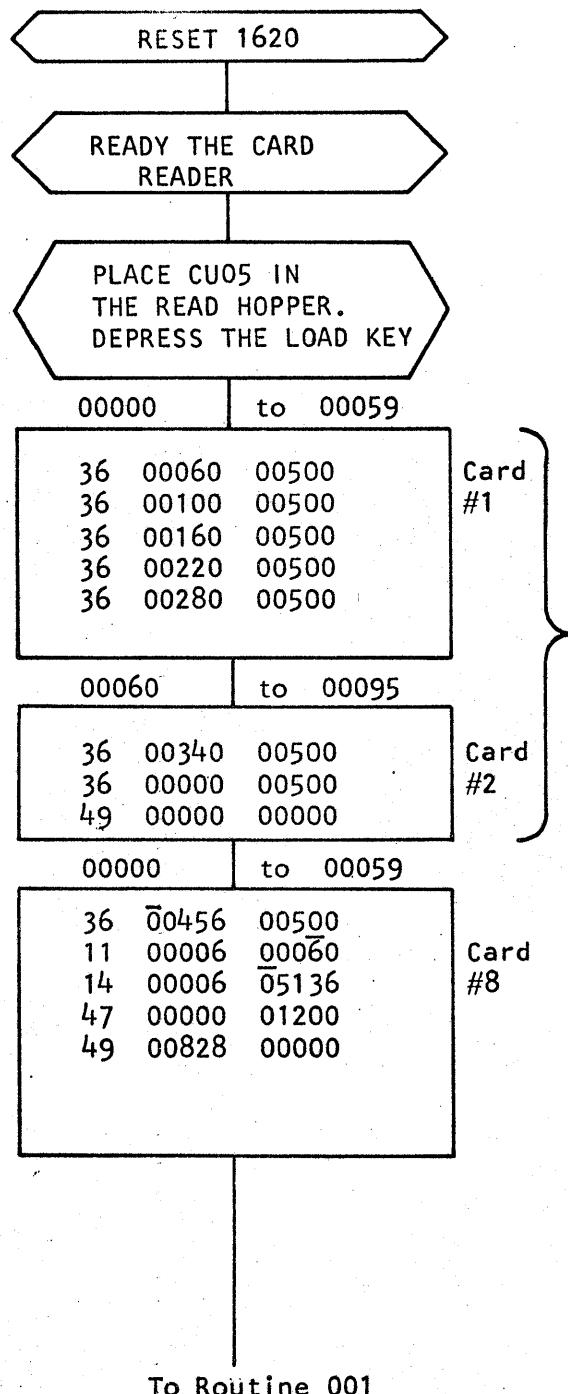
The complete normal typeout information will be as follows:

SW 1 OFF SW 2 OFF SW 3 OFF SW 4 OFF SET SENSE SWS FOR  
CU05 SPECIAL INSTS TEST. THEN START.  
START ROUTINES. ETOS FOLLOW,  
TEST COMPLETED. IF SW 1 OFF AND NO ROUTINE NOS TYPED,  
TEST PERFORMED PROPERLY.

1620 DIAGNOSTICS  
CU0\$  
SPECIAL INSTRUCTIONS  
FLOW CHART

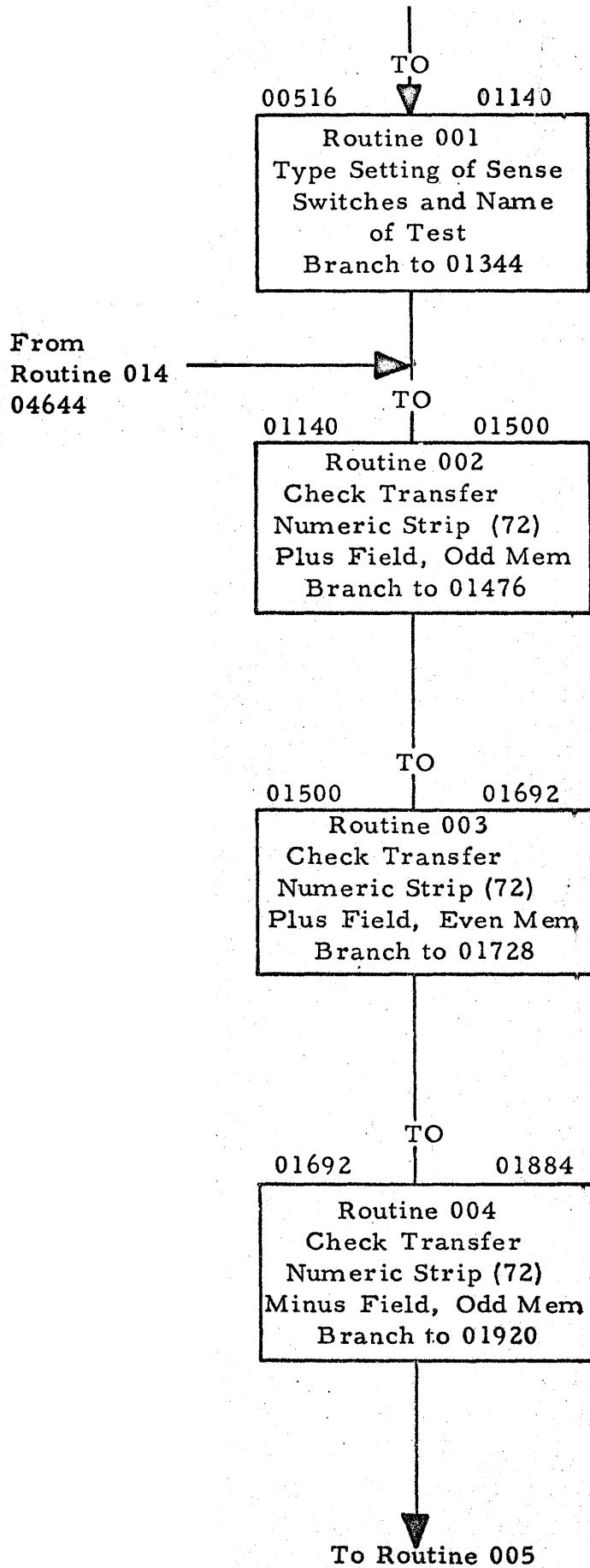


PN 2125637  
EC 404618

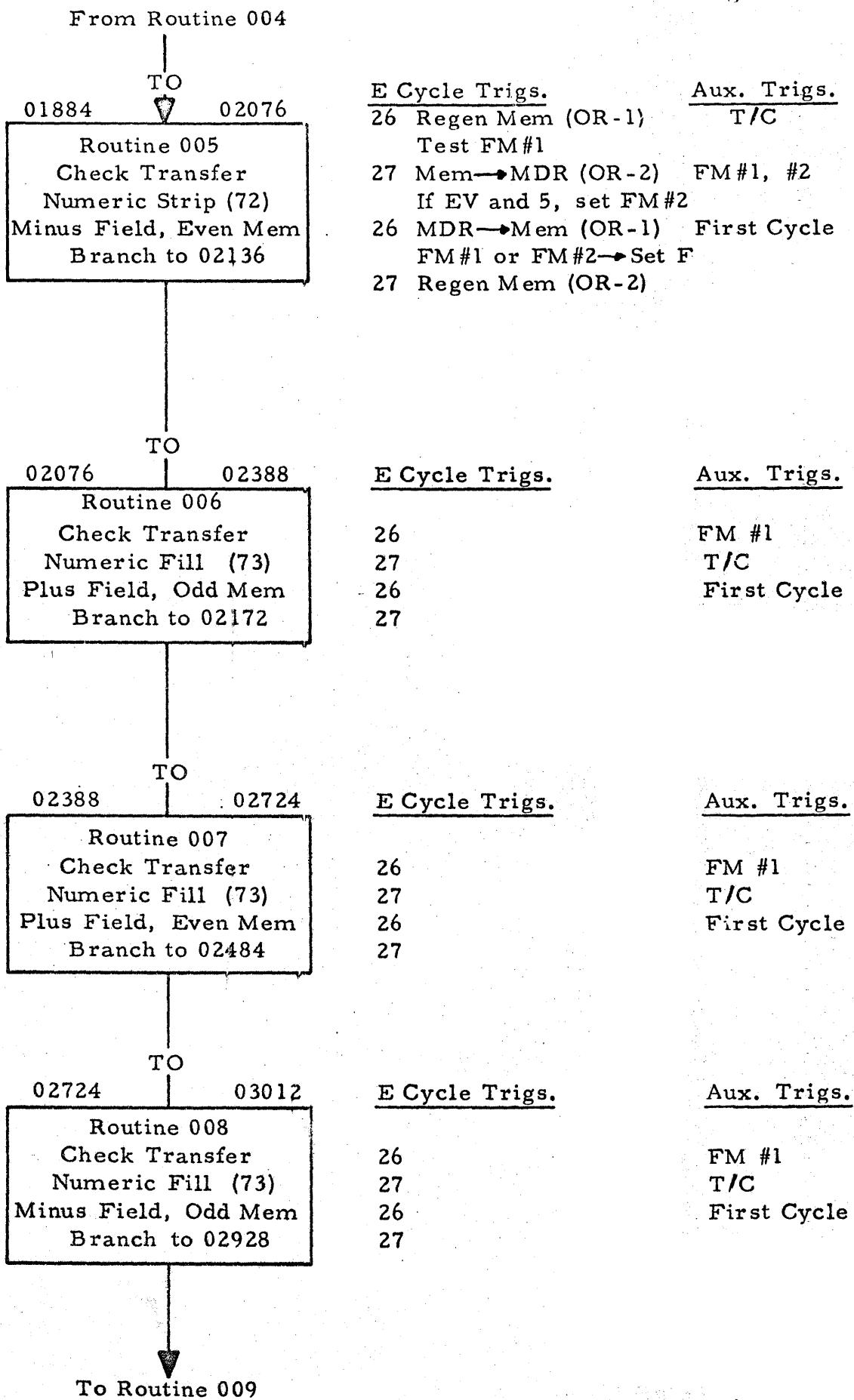
CU05 FLOW CHART  
WITH 1622 I/O

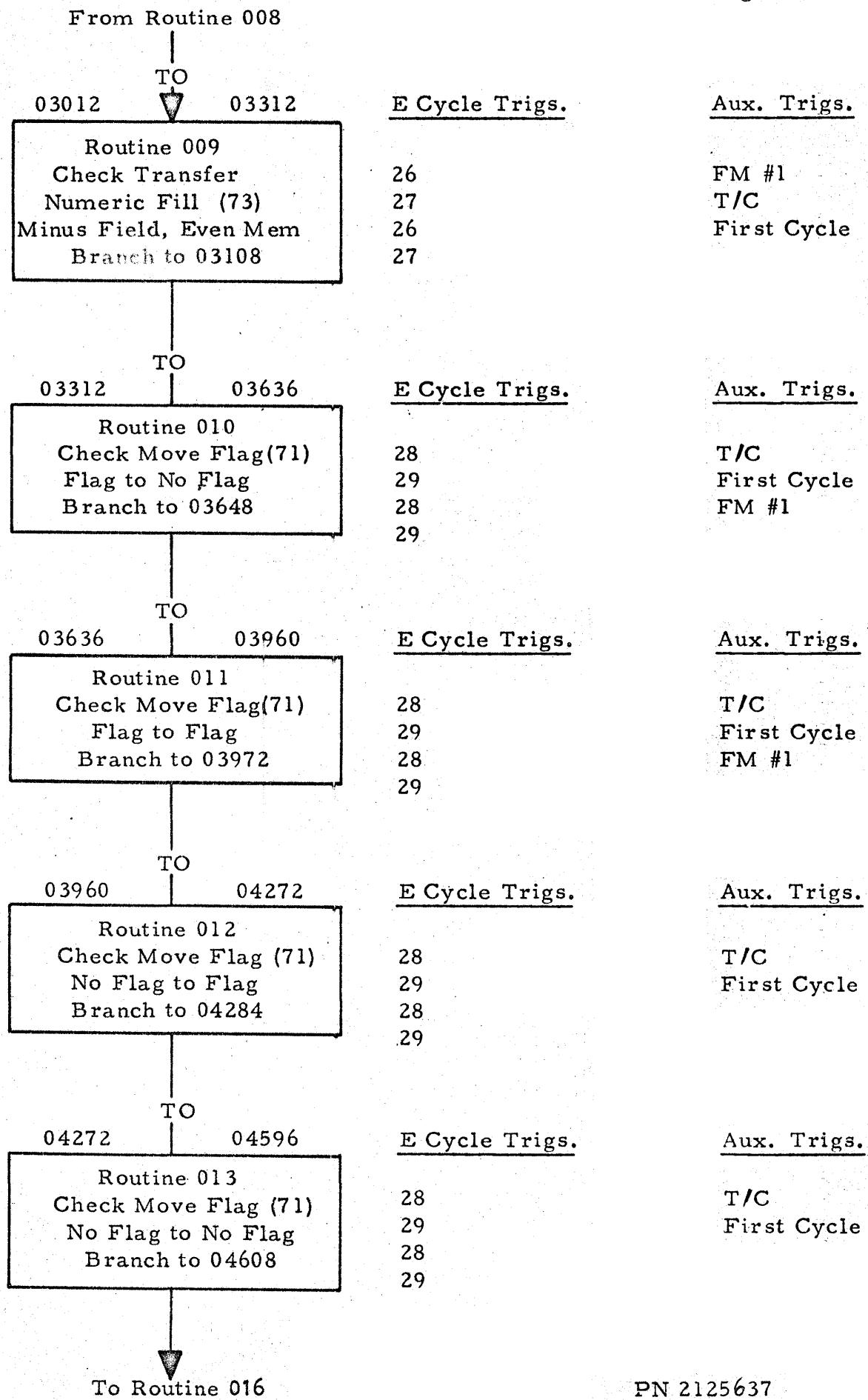
First and second Load Cards load the math tables and Program Load Card.  
(Cards 3 through 7 contain the math tables.)

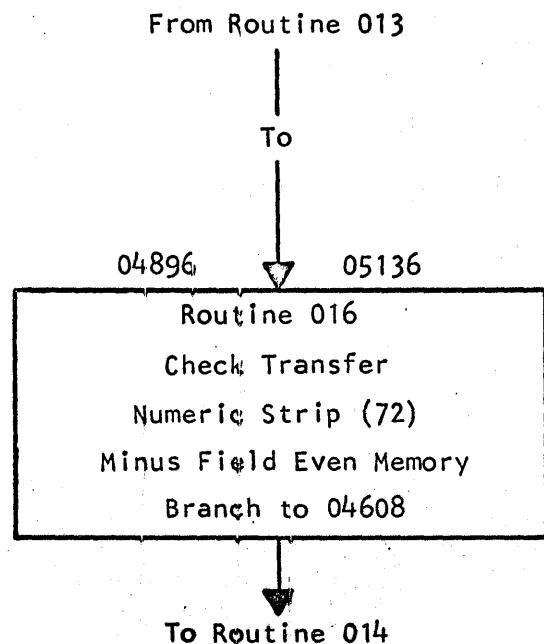
Eighth Load Card contains instructions for loading core storage.

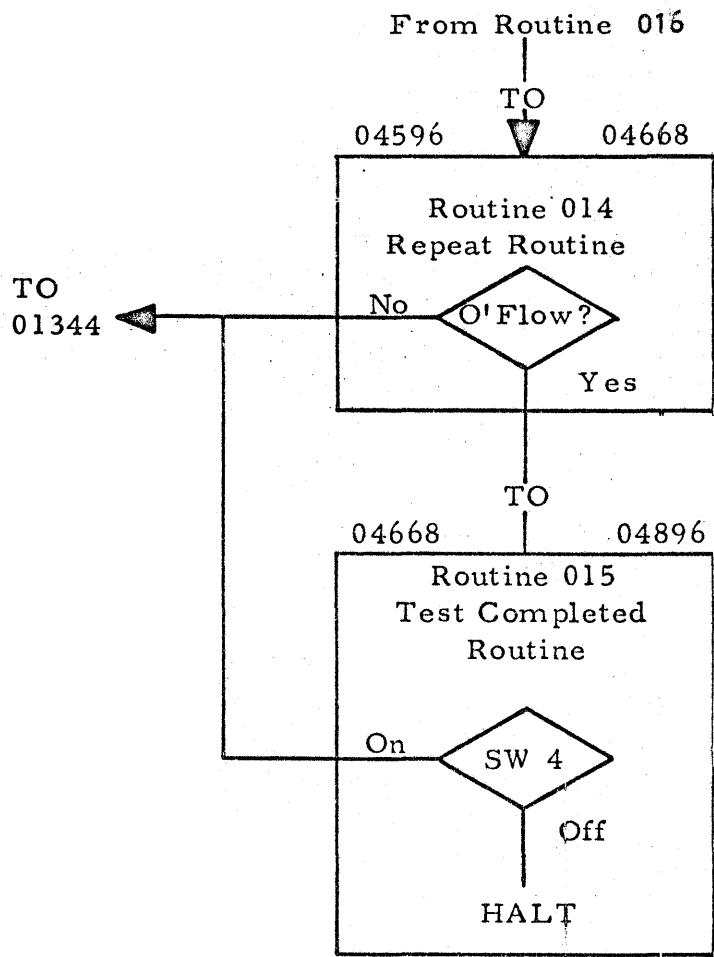


| <u>E Cycle Trigs.</u> | <u>Aux. Trigs.</u> |
|-----------------------|--------------------|
| 26 Regen Mem (OR-1)   | T/C                |
| Test for FM#1         |                    |
| 27 Mem → MDR (OR-1)   | FM #1              |
| 26 MDR → Mem (OR-1)   | First Cycle        |
| FM#1 → Set F          |                    |
| 27 Regen Mem          |                    |
| <br><br><br><br><br>  |                    |
| <u>E Cycle Trigs.</u> | <u>Aux. Trigs.</u> |
| 26 Regen Mem (OR-1)   | T/C                |
| Test FM#1             |                    |
| 27 Mem → MDR (OR-2)   | FM #1              |
| 26 MDR → Mem (OR-1)   | First Cycle        |
| FM#1 → Set F          |                    |
| 27 Regen Mem (OR-2)   |                    |
| <br><br><br><br><br>  |                    |
| <u>E Cycle Trigs.</u> | <u>Aux. Trigs.</u> |
| 26 Regen Mem (OR-1)   | T/C                |
| Test FM#1             |                    |
| 27 Mem → MDR (OR-2)   | FM#1, #2           |
| If EV and 5, set FM#2 |                    |
| 26 MDR → Mem (OR-1)   | First Cycle        |
| FM#1 or FM#2 → Set F  |                    |
| 27 Regen Mem (OR-2)   |                    |









PN 2125637  
EC 404675

1620 DIAGNOSTICS  
CU05  
SPECIAL INSTRUCTIONS

| Mem<br>Loc | 00<br>01 | PPPPP<br>23456 | QQQQQ<br>78901 | OP<br>TYP | DESCRIPTION    |
|------------|----------|----------------|----------------|-----------|----------------|
| 00096      |          | 0000           | 00000          | MT        | MULTIPLY TABLE |
| 00108      | 00       | 00102          | 03040          | MT        | MULTIPLY TABLE |
| 00120      | 00       | 20406          | 08000          | MT        | MULTIPLY TABLE |
| 00132      | 30       | 60902          | 10040          | MT        | MULTIPLY TABLE |
| 00144      | 80       | 21610          | 05001          | MT        | MULTIPLY TABLE |
| 00156      | 51       | 02006          | 02181          | MT        | MULTIPLY TABLE |
| 00168      | 42       | 00704          | 11282          | MT        | MULTIPLY TABLE |
| 00180      | 00       | 80614          | 22300          | MT        | MULTIPLY TABLE |
| 00192      | 90       | 81726          | 30000          | MT        | MULTIPLY TABLE |
| 00204      | 00       | 00005          | 06070          | MT        | MULTIPLY TABLE |
| 00216      | 80       | 90012          | 14161          | MT        | MULTIPLY TABLE |
| 00228      | 81       | 51811          | 24272          | MT        | MULTIPLY TABLE |
| 00240      | 02       | 42822          | 36352          | MT        | MULTIPLY TABLE |
| 00252      | 03       | 53045          | 40363          | MT        | MULTIPLY TABLE |
| 00264      | 24       | 84455          | 32494          | MT        | MULTIPLY TABLE |
| 00276      | 65       | 36048          | 46546          | MT        | MULTIPLY TABLE |
| 00288      | 27       | 54453          | 62718          | MT        | MULTIPLY TABLE |
| 00300      | 01       | 23456          | 78912          | AT        | ADD TABLE      |
| 00312      | 34       | 56789          | 02345          | AT        | ADD TABLE      |
| 00324      | 67       | 89013          | 45678          | AT        | ADD TABLE      |
| 00336      | 90       | 12456          | 78901          | AT        | ADD TABLE      |
| 00348      | 23       | 56789          | 01234          | AT        | ADD TABLE      |
| 00360      | 67       | 89012          | 34578          | AT        | ADD TABLE      |
| 00372      | 90       | 12345          | 68901          | AT        | ADD TABLE      |
| 00384      | 23       | 45679          | 01234          | AT        | ADD TABLE      |
| 00396      | 56       | 78#            |                | AT        | ADD TABLE      |
| 00408      |          |                |                | X         |                |
| 00420      |          |                |                | X         |                |
| 00432      |          |                |                | X         |                |
| 00444      |          |                |                | X         |                |
| 00456      |          |                |                | X         |                |
| 00468      |          |                |                | X         |                |
| 00480      |          |                | 62             | X         |                |
| 00492      | 63       | 41596          | 3 59           | X         |                |
| 00504      | 56       | 64634          | 95545          | X         |                |

ROUTINE 001  
CHECK SENSE SWITCH SETTINGS

|       |    |       |       |     |                    |
|-------|----|-------|-------|-----|--------------------|
| 00516 | 62 | 03 4  | 56356 | X   | ETO                |
| 00528 | 62 | 465   | 65353 | X   | S FOLL             |
| 00540 | 56 | 6603  | 0#62  | X   | OW. #S             |
| 00552 | 66 | 71    | 5655  | X   | W 1 ON             |
| 00564 |    | 0#626 | 6 71  | X   | # SW 1             |
| 00576 |    | 56464 | 6 0#  | X   | OFF #              |
| 00588 | 62 | 66 7  | 2 56  | X   | SW 2 0             |
| 00600 | 55 | 0#6   | 266   | X   | N #SW              |
| 00612 | 72 | 564   | 646   | X   | 2 OFF              |
| 00624 | 0# | 6266  | 73    | X   | # SW 3             |
| 00636 | 56 | 55 0  | #6266 | X   | ON # SW            |
| 00648 |    | 73 5  | 64646 | X   | 3 OFF              |
| 00660 |    | 0#626 | 6 74  | X   | # SW 4             |
| 00672 |    | 5655  | 0#62  | X   | ON #S              |
| 00684 | 66 | 74    | 5646  | X   | W 4 OF             |
| 00696 | 46 | 0#6   | 24563 | X   | F # SET            |
| 00708 |    | 62455 | 56245 | X   | SENSE              |
| 00720 |    | 62666 | 2 46  | X   | SWS F              |
| 00732 | 56 | 59 4  | 36470 | X   | OR CUO             |
| 00744 | 75 | 23 6  | 25745 | X   | 5, SPE             |
| 00756 | 43 | 49415 | 3 49  | X   | CIAL I             |
| 00768 | 55 | 62636 | 2 63  | X   | NSTS T             |
| 00780 | 45 | 62630 | 3 63  | X   | EST. T             |
| 00792 | 48 | 4555  | 6263  | X   | HEN ST             |
| 00804 | 41 | 59630 | 3 0#  | X   | ART. #             |
| 00816 |    |       |       | X   |                    |
| 00828 | 46 | 00852 | 00100 | BI  | CHECK FOR SW 1 ON  |
| 00840 | 47 | 00876 | 00100 | BNI | CHECK FOR SW 1 OFF |
| 00852 | 39 | 00551 | 00100 | WA  | TYPE SW 1 ON       |
| 00864 | 49 | 00888 |       | B   |                    |
| 00876 | 39 | 00569 | 00100 | WA  | TYPE SW 1 OFF      |
| 00888 | 46 | 00912 | 00200 | BI  | CHECK FOR SW 2 ON  |
| 00900 | 47 | 00936 | 00200 | BNI | CHECK FOR SW 2 OFF |
| 00912 | 39 | 00589 | 00100 | WA  | TYPE SW 2 ON       |
| 00924 | 49 | 00948 |       | B   |                    |
| 00936 | 39 | 00607 | 00100 | WA  | TYPE SW 2 OFF      |
| 00948 | 46 | 00972 | 00300 | BI  | CHECK FOR SW 3 ON  |
| 00960 | 47 | 00996 | 00300 | BNI | CHECK FOR SW 3 OFF |
| 00972 | 39 | 00627 | 00100 | WA  | TYPE SW 3 ON       |
| 00984 | 49 | 01008 |       | B   |                    |
| 00996 | 39 | 00645 | 00100 | WA  | TYPE SW 3 OFF      |
| 01008 | 46 | 01032 | 00400 | BI  | CHECK FOR SW 4 ON  |
| 01020 | 47 | 01056 | 00400 | BNI | CHECK FOR SW 4 OFF |
| 01032 | 39 | 00665 | 00100 | WA  | TYPE SW 4 ON       |
| 01044 | 49 | 01068 |       | B   |                    |

|       |    |       |       |    |   |
|-------|----|-------|-------|----|---|
| 01056 | 39 | 00683 | 00100 | WA | TYPE SW 4 OFF                             |
| 01068 | 39 | 00703 | 00100 | WA | TYPE SET SWS, NAME OF TEST,<br>THEN START |
| 01080 | 48 |       |       | H  | HALT                                      |
| 01092 | 34 |       | 00102 | K  |   |
| 01104 | 39 | 00491 | 00100 | WA | TYPE START ROUTINES. ETOS FOLLOW          |
| 01116 | 37 | 01141 | 00300 | RA | READ ALPHA *FOR CARD I/O = 5              |
| 01128 | 49 | 01344 |       | B  |   |

ROUTINE 002  
CHECK TRANSFER NUMERIC STRIP  
10 DIGITS + TO ODD MEM.

|       |    |       |       |                |                                |
|-------|----|-------|-------|----------------|--------------------------------|
| 01140 |    |       | X     | READ CARD AREA |                                |
| 01152 |    |       | X     | READ CARD AREA |                                |
| 01164 |    |       | X     | READ CARD AREA |                                |
| 01176 |    |       | X     | READ CARD AREA |                                |
| 01188 |    |       | X     | READ CARD AREA |                                |
| 01200 |    |       | X     | READ CARD AREA |                                |
| 01212 |    |       | X     | READ CARD AREA |                                |
| 01224 |    |       | X     | READ CARD AREA |                                |
| 01236 |    |       | X     | READ CARD AREA |                                |
| 01248 |    |       | X     | READ CARD AREA |                                |
| 01260 |    |       | X     | READ CARD AREA |                                |
| 01272 |    |       | X     | READ CARD AREA |                                |
| 01284 |    |       | X     | READ CARD AREA |                                |
| 01296 |    |       | X     | READ CARD AREA |                                |
| 01308 |    |       | X     | WORKING AREA   |                                |
| 01320 |    | 0     | X     | WORKING AREA   |                                |
| 01332 | #  | 12345 | 67890 | X              | COMPARE DATA                   |
| 01344 | 72 | 01159 | 01331 | TNS            | TRANSFER NUMERIC STRIP + FIELD |
| 01356 | 24 | 01331 | 01343 | C              | CHECK FOR CORRECT RESULTS      |
| 01368 | 47 | 01416 | 01200 | BNI            | CHECK FOR E/Z                  |
| 01380 | 49 | 01476 |       | B              |                                |
| 01392 |    |       | X     |                |                                |
| 01404 |    |       | X     |                |                                |
|       |    |       |       |                | ERROR ROUTINE                  |
| 01416 | 46 | 01452 | 00100 | BI             | CHECK SW 1                     |
| 01428 | 39 | 01465 | 00100 | WA             | TYPE ROUTINE NO.               |
| 01440 | 38 | 01322 | 00100 | WN             | TYPE TNS FIELD                 |
| 01452 | 47 | 01476 | 00300 | BNI            | CHECK SW 3                     |
| 01464 | 48 | 70707 | 2 0#  | H              | HALT                           |
| 01476 | 46 | 01344 | 00200 | BI             | CHECK SW 2                     |
| 01488 | 49 | 01536 |       | B              |                                |

ROUTINE 003  
CHECK TRANSFER NUMERIC STRIP  
10 DIGITS + TO EVEN MEMORY

|       |       |       |       |              |                                |
|-------|-------|-------|-------|--------------|--------------------------------|
| 01500 |       |       | X     | WORKING AREA |                                |
| 01512 | 0     | #     | X     | WORKING AREA |                                |
| 01524 | 98765 | 40321 | X     | COMPARE DATA |                                |
| 01536 | 72    | 01179 | 01522 | TNS          | TRANSFER NUMERIC STRIP + FIELD |
| 01548 | 24    | 01522 | 01535 | C            | CHECK FOR CORRECT RESULTS      |
| 01560 | 47    | 01608 | 01200 | BNI          |                                |
| 01572 | 49    | 01668 |       | B            |                                |
| 01584 |       |       | X     |              |                                |
| 01596 |       |       | X     |              |                                |
|       |       |       |       |              | ERROR ROUTINE                  |
| 01608 | 46    | 01644 | 00100 | BI           | CHECK SW 1                     |
| 01620 | 39    | 01657 | 00100 | WA           | TYPE ROUTINE NO.               |
| 01632 | 38    | 01513 | 00100 | WN           | TYPE TNS FIELD                 |
| 01644 | 47    | 01668 | 00300 | BNI          | CHECK SW 3                     |
| 01656 | 48    | 70707 | 3 0#  | H            | HALT                           |
| 01668 | 46    | 01536 | 00200 | BI           | CHECK SW 2                     |
| 01680 | 49    | 01728 |       | B            |                                |

ROUTINE 004  
CHECK TRANSFER NUMERIC STRIP  
10 DIGITS - TO ODD MEMORY

|       |    |       |       |              |                                |
|-------|----|-------|-------|--------------|--------------------------------|
| 01692 |    |       | X     | WORKING AREA |                                |
| 01704 | 0  |       | X     | WORKING AREA |                                |
| 01716 | #  | 54321 | 06789 | X            | COMPARE DATA                   |
| 01728 | 72 | 01199 | 01715 | TNS          | TRANSFER NUMERIC STRIP - FIELD |
| 01740 | 24 | 01715 | 01727 | C            | CHECK FOR CORRECT RESULTS      |
| 01752 | 47 | 01800 | 01200 | BNI          | CHECK FOR E/Z                  |
| 01764 | 49 | 01860 |       | B            |                                |
| 01776 |    |       | X     |              |                                |
| 01788 |    |       | X     |              |                                |
|       |    |       |       |              | ERROR ROUTINE                  |
| 01800 | 46 | 01836 | 00100 | BI           | CHECK SW 1                     |
| 01812 | 39 | 01849 | 00100 | WA           | TYPE ROUTINE NO.               |
| 01824 | 38 | 01706 | 00100 | WN           | TYPE TNS FIELD                 |
| 01836 | 47 | 01860 | 00300 | BNI          | CHECK SW 3                     |
| 01848 | 48 | 70707 | 4 0#  | H            | HALT                           |
| 01860 | 46 | 01728 | 00200 | BI           | CHECK SW 2                     |
| 01872 | 49 | 01920 |       | B            |                                |

ROUTINE 005  
CHECK TRANSFER NUMERIC STRIP  
10 DIGITS - TO EVEN MEMORY

|               |       |       |       |                                    |
|---------------|-------|-------|-------|------------------------------------|
| 01884         |       |       | X     | WORKING AREA                       |
| 01896         | 0     | #     | X     | WORKING AREA                       |
| 01908         | 67890 | 12340 | X     | COMPARE DATA                       |
| 01920         | 72    | 01219 | 01906 | TNS TRANSFER NUMERIC STRIP - FIELD |
| 01932         | 24    | 01906 | 01919 | C CHECK FOR CORRECT RESULTS        |
| 01944         | 47    | 01992 | 01200 | BNI CHECK FOR E/Z                  |
| 01956         | 49    | 02052 |       | B                                  |
| 01968         |       |       | X     |                                    |
| 01980         |       |       | X     |                                    |
| ERROR ROUTINE |       |       |       |                                    |
| 01992         | 46    | 02028 | 00100 | BI CHECK SW 1                      |
| 02004         | 39    | 02041 | 00100 | WA TYPE ROUTINE NO.                |
| 02016         | 38    | 01897 | 00100 | WN TYPE TNS FIELD                  |
| 02028         | 47    | 02052 | 00300 | BNI CHECK SW 3                     |
| 02040         | 48    | 70707 | 5 0#  | H HALT                             |
| 02052         | 46    | 01920 | 00200 | BI CHECK SW 2                      |
| 02064         | 49    | 02136 |       | B                                  |

ROUTINE 006  
CHECK TRANSFER NUMERIC FILL  
10 DIGITS + FROM ODD MEMORY

|               |    |       |       |                                   |
|---------------|----|-------|-------|-----------------------------------|
| 02076         | 0  |       | X     | WORKING AREA                      |
| 02088         |    |       | X     | WORKING AREA                      |
| 02100         | #  | 12345 | 09876 | X NUMERIC FIELD                   |
| 02112         |    | 0717  | 27374 | X COMPARE DATA                    |
| 02124         | 75 | 70797 | 87776 | X COMPARE DATA                    |
| 02136         | 73 | 02099 | 02111 | TNF TRANSFER NUMERIC FILL + FIELD |
| 02148         | 44 | 02172 | 02080 | BNF CHECK FOR NO FLAG             |
| 02160         | 49 | 02340 |       | B BRANCH TO ERROR ROUTINE         |
| 02172         | 24 | 02099 | 02135 | C CHECK FOR CORRECT RESULTS       |
| 02184         | 47 | 02208 | 01200 | BNI CHECK FOR E/Z                 |
| 02196         | 49 | 02268 |       | B                                 |
| ERROR ROUTINE |    |       |       |                                   |
| 02208         | 46 | 02244 | 00100 | BI CHECK SW 1                     |
| 02220         | 39 | 02257 | 00100 | WA TYPE ROUTINE NO.               |
| 02232         | 38 | 02080 | 00100 | WN TYPE TNF FIELD                 |
| 02244         | 47 | 02268 | 00300 | BNI CHECK SW 3                    |
| 02256         | 48 | 70707 | 6 0#  | H HALT                            |
| 02268         | 46 | 02136 | 00200 | BI CHECK SW 2                     |
| 02280         | 49 | 02448 |       | B                                 |

|       |    |       |       |    |                              |
|-------|----|-------|-------|----|------------------------------|
| 02292 | 49 | 55624 | 55963 | X  | INSERT                       |
| 02304 | 45 | 44 4  | 65341 | X  | ED FLA                       |
| 02316 | 47 | 57    | 4649  | X  | G P FI                       |
| 02328 | 45 | 53440 | 3 0‡  | X  | ELD. ‡                       |
| 02340 | 46 | 02376 | 00100 | BI | CHECK SW 1                   |
| 02352 | 39 | 02257 | 00100 | WA | TYPE ROUTINE NO.             |
| 02364 | 39 | 02293 | 00100 | WA | TYPE REMOVED FLAG P FIELD    |
| 02376 | 49 | 02172 |       | B  | BRANCH TO COMPARE OF RESULTS |

ROUTINE 007  
CHECK TRANSFER NUMERIC FILL  
10 DIGITS + FROM EVEN MEMORY

|       |    |       |       |     |                               |
|-------|----|-------|-------|-----|-------------------------------|
| 02388 |    | 0     |       | X   | WORKING AREA                  |
| 02400 |    |       |       | X   | WORKING AREA                  |
| 02412 | #6 | 78901 | 2345  | X   | NUMERIC FIELD                 |
| 02424 |    | 0767  | 77879 | X   | COMPARE DATA                  |
| 02436 | 70 | 71727 | 37475 | X   | COMPARE DATA                  |
| 02448 | 73 | 02411 | 02422 | TNF | TRANSFER NUMERIC FILL + FIELD |
| 02460 | 44 | 02484 | 02392 | BNF | CHECK FOR NO FLAG             |
| 02472 | 49 | 02676 |       | B   | BRANCH TO ERROR ROUTINE       |
| 02484 | 24 | 02411 | 02447 | C   | CHECK FOR CORRECT RESULTS     |
| 02496 | 47 | 02544 | 01200 | BNI | CHECK FOR E/Z                 |
| 02508 | 49 | 02604 |       | B   |                               |
| 02520 |    |       |       | X   |                               |
| 02532 |    |       |       | X   |                               |
| 02544 | 46 | 02580 | 00100 | BI  | ERROR ROUTINE                 |
| 02556 | 39 | 02593 | 00100 | WA  | CHECK SW 1                    |
| 02568 | 38 | 02391 | 00100 | WN  | TYPE ROUTINE NO.              |
| 02580 | 47 | 02604 | 00300 | BNI | TYPE TNF FIELD                |
| 02592 | 48 | 70707 | 7 0‡  | H   | CHECK SW 3                    |
| 02604 | 46 | 02448 | 00200 | BI  | HALT                          |
| 02616 | 49 | 02784 |       | B   | CHECK SW 2                    |
| 02628 | 49 | 55624 | 55963 | X   | INSERT                        |
| 02640 | 45 | 44 4  | 65341 | X   | ED FLA                        |
| 02652 | 47 | 57    | 4649  | X   | G P FI                        |
| 02664 | 45 | 53440 | 3 0‡  | X   | ELD. ‡                        |
| 02676 | 46 | 02712 | 00100 | BI  | CHECK SW 1                    |
| 02688 | 39 | 02593 | 00100 | WA  | TYPE ROUTINE NO.              |
| 02700 | 39 | 02629 | 00100 | WA  | TYPE INSERTED FLAG P FIELD    |
| 02712 | 49 | 02484 |       | B   | BRANCH TO COMPARE OF RESULTS  |

ROUTINE 008  
CHECK TRANSFER NUMERIC FILL  
10 DIGITS - FROM ODD MEMORY

|       |    |       |       |     |                               |
|-------|----|-------|-------|-----|-------------------------------|
| 02724 |    | 0     |       | X   | WORKING AREA                  |
| 02736 |    |       |       | X   | WORKING AREA                  |
| 02748 | #  | 98765 | 01234 | X   | NUMERIC FIELD                 |
| 02760 |    | 0797  | 87776 | X   | COMPARE DATA                  |
| 02772 | 75 | 70717 | 27354 | X   | COMPARE DATA                  |
| 02784 | 73 | 02747 | 02759 | TNF | TRANSFER NUMERIC FILL - FIELD |
| 02796 | 44 | 02820 | 02728 | BNF | CHECK FOR NO FLAG             |
| 02808 | 49 | 02964 |       | B   | BRANCH TO ERROR ROUTINE       |
| 02820 | 24 | 02747 | 02783 | C   | CHECK FOR CORRECT RESULTS     |
| 02832 | 47 | 02868 | 01200 | BNI | CHECK FOR E/Z                 |
| 02844 | 49 | 02928 |       | B   |                               |
| 02856 |    |       |       | X   |                               |
|       |    |       |       |     | ERROR ROUTINE                 |
| 02868 | 46 | 02904 | 00100 | BI  | CHECK FOR SW 1                |
| 02880 | 39 | 02917 | 00100 | WA  | TYPE ROUTINE NO.              |
| 02892 | 38 | 02728 | 00100 | WN  | TYPE TNF FIELD                |
| 02904 | 47 | 02928 | 00300 | BNI | CHECK SW 3                    |
| 02916 | 48 | 70707 | 8 0#  | H   | HALT                          |
| 02928 | 46 | 02784 | 00200 | BI  | CHECK SW 2                    |
| 02940 | 49 | 03072 |       | B   |                               |
| 02952 |    |       |       | X   |                               |
| 02964 | 46 | 03000 | 00100 | BI  | CHECK SW 1                    |
| 02976 | 39 | 02917 | 00100 | WA  | TYPE ROUTINE NO.              |
| 02988 | 39 | 02293 | 00100 | WA  | TYPE INSERTED FLAG P FIELD    |
| 03000 | 49 | 02820 |       | B   | BRANCH TO COMPARE RESULT.     |

ROUTINE 009  
CHECK TRANSFER NUMERIC FILL  
10 DIGITS - FROM EVEN MEMORY

|       |    |       |       |     |                               |
|-------|----|-------|-------|-----|-------------------------------|
| 03012 |    | 0     |       | X   | WORKING AREA                  |
| 03024 |    |       |       | X   | WORKING AREA                  |
| 03036 | #1 | 06273 | 8490  | X   | NUMERIC FIELD                 |
| 03048 |    | 0717  | 07672 | X   | COMPARE DATA                  |
| 03060 | 77 | 73787 | 47950 | X   | COMPARE DATA                  |
| 03072 | 73 | 03035 | 03046 | TNF | TRANSFER NUMERIC FILL - FIELD |
| 03084 | 44 | 03108 | 03016 | BNF | CHECK FOR NO FLAG             |
| 03096 | 49 | 03264 |       | B   | BRANCH TO ERROR ROUTINE       |
| 03108 | 24 | 03035 | 03071 | C   | CHECK FOR CORRECT RESULTS     |
| 03120 | 47 | 03168 | 01200 | BNI | CHECK FOR E/Z                 |
| 03132 | 49 | 03228 |       | B   |                               |
| 03144 |    |       |       | X   |                               |
| 03156 |    |       |       | X   |                               |

|       |    |       |       |     | ERROR ROUTINE               |
|-------|----|-------|-------|-----|-----------------------------|
| 03168 | 46 | 03204 | 00100 | BI  | CHECK SW 1                  |
| 03180 | 39 | 03217 | 00100 | WA  | TYPE ROUTINE NO.            |
| 03192 | 38 | 03015 | 00100 | WN  | TYPE TNF FIELD              |
| 03204 | 47 | 03228 | 00300 | BNI | CHECK SW 3                  |
| 03216 | 48 | 70707 | 9 0#  | H   | HALT                        |
| 03228 | 46 | 03072 | 00200 | BI  | CHECK SW 2                  |
| 03240 | 49 | 03324 |       | B   |                             |
| 03252 |    |       |       | X   |                             |
| 03264 | 47 | 03300 | 00100 | BI  | CHECK SW 1                  |
| 03276 | 39 | 03217 | 00100 | WA  | TYPE ROUTINE NO.            |
| 03288 | 39 | 02629 | 00100 | WA  | TYPE INSERTED FLAG P FIELD  |
| 03300 | 49 | 03108 |       | B   | BRANCH TO COMPARE OF RESULT |

ROUTINE 010  
CHECK MOVE FLAG - FLAG TO NO FLAG

|       |    |       |       |     | WORKING AREA                                    |
|-------|----|-------|-------|-----|---|
| 03312 |    | 76    | # 44# | X   |   |
| 03324 | 15 | 03318 | 6     | TQM | RESTORE P WORKING AREA TO<br>ORIGINAL CONDITION |
| 03336 | 15 | 03322 | 4     | TQM | RESTORE Q WORKING AREA TO<br>ORIGINAL CONDITION |
| 03348 | 71 | 03318 | 03322 | MR  | MOVE FLAG                                       |
| 03360 | 14 | 03318 | 76    | CM  | CHECK FLAG MOVED TO P FIELD                     |
| 03372 | 47 | 03444 | 01200 | BNI | CHECK FOR E/Z                                   |
| 03384 | 14 | 03322 | 44    | CM  | CHECK FLAG REMOVED FROM Q FIELD                 |
| 03396 | 47 | 03528 | 01200 | BNI | CHECK FOR E/Z                                   |
| 03408 | 49 | 03588 |       | B   |   |
| 03420 |    |       |       | X   |   |
| 03432 |    |       |       | X   |   |
|       |    |       |       |     | ERROR ROUTINE                                   |
| 03444 | 46 | 03480 | 00100 | BI  | CHECK SW 1                                      |
| 03456 | 39 | 03493 | 00100 | WA  | TYPE ROUTINE NO.                                |
| 03468 | 38 | 03317 | 00100 | WN  | TYPE P FIELD                                    |
| 03480 | 47 | 03504 | 00300 | BNI | CHECK SW 3                                      |
| 03492 | 48 | 70717 | 0570# | H   | HALT  |
| 03504 | 46 | 03324 | 00200 | BI  | CHECK SW 2                                      |
| 03516 | 49 | 03384 |       | B   | BRANCH TO Q FLAG CHECK                          |
| 03528 | 46 | 03564 | 00100 | BI  | CHECK SW 1                                      |
| 03540 | 39 | 03577 | 00100 | WA  | TYPE ROUTINE NO.                                |
| 03552 | 38 | 03321 | 00100 | WN  | TYPE Q FIELD                                    |
| 03564 | 47 | 03588 | 00300 | BNI | CHECK SW 3                                      |
| 03576 | 48 | 70717 | 0580# | H   |   |
| 03588 | 46 | 03324 | 00200 | BI  | CHECK SW 2                                      |
| 03600 | 49 | 03648 |       | B   |   |
| 03612 |    |       |       | X   |   |
| 03624 |    |       |       | X   |   |

ROUTINE 011  
MOVE FLAG - FLAG TO FLAG

|       |    |       |       |     |  |
|-------|----|-------|-------|-----|--|
| 03636 |    | 75    | # 11# | X   | WORKING AREA                                 |
| 03648 | 15 | 03642 | 5     | TDM | RESTORE P WORKING AREA TO ORIGINAL CONDITION |
| 03660 | 15 | 03646 | 1     | TDM | RESTORE Q WORKING AREA TO ORIGINAL CONDITION |
| 03672 | 71 | 03642 | 03646 | MF  | MOVE FLAG                                    |
| 03684 | 14 | 03642 | 75    | CM  | CHECK FLAG REMAINED IN P FIELD               |
| 03696 | 47 | 03768 | 01200 | BNI | CHECK FOR E/Z                                |
| 03708 | 14 | 03646 | 11    | CM  | CHECK FLAG REMOVED FROM Q FIELD              |
| 03720 | 47 | 03852 | 01200 | BNI | CHECK FOR E/Z                                |
| 03732 | 49 | 03912 |       | B   |  |
| 03744 |    |       |       | X   |  |
| 03756 |    |       |       | X   |  |

## ERROR ROUTINE

|       |    |       |       |     |                        |
|-------|----|-------|-------|-----|------------------------|
| 03768 | 46 | 03804 | 00100 | BI  | CHECK SW 1             |
| 03780 | 39 | 03817 | 00100 | WA  | TYPE ROUTINE NO.       |
| 03792 | 38 | 03641 | 00100 | WN  | TYPE P FIELD           |
| 03804 | 47 | 03828 | 00300 | BNI | CHECK SW 3             |
| 03816 | 48 | 70717 | 1570# | H   | HALT                   |
| 03828 | 46 | 03648 | 00200 | BI  | CHECK SW 2             |
| 03840 | 49 | 03708 |       | B   | BRANCH TO Q FLAG CHECK |
| 03852 | 46 | 03888 | 00100 | BI  | CHECK SW 1             |
| 03864 | 39 | 03901 | 00100 | WA  | TYPE ROUTINE NO.       |
| 03876 | 38 | 03645 | 00100 | WN  | TYPE Q FIELD           |
| 03888 | 47 | 03912 | 00300 | BNI | CHECK SW 3             |
| 03900 | 48 | 70717 | 1580# | H   | HALT                   |
| 03912 | 46 | 03648 | 00200 | BI  | CHECK SW 2             |
| 03924 | 49 | 03972 |       | B   |                        |
| 03936 |    |       |       | X   |                        |
| 03948 |    |       |       | X   |                        |

ROUTINE 012  
MOVE FLAG - NO FLAG TO FLAG

|       |    |       |       |     |  |
|-------|----|-------|-------|-----|--|
| 03960 |    | 79    | # 33# | X   | WORKING AREA                                 |
| 03972 | 15 | 03966 | 9     | TDM | RESTORE P WORKING AREA TO ORIGINAL CONDITION |
| 03984 | 15 | 03970 | 3     | TDM | RESTORE Q WORKING AREA TO ORIGINAL CONDITION |
| 03996 | 71 | 03966 | 03970 | MF  | MOVE FLAG                                    |
| 04008 | 14 | 03966 | 79    | CM  | CHECK FLAG REMOVED FROM P FIELD              |
| 04020 | 47 | 04080 | 01200 | BNI | CHECK FOR E/Z                                |
| 04032 | 14 | 03970 | 33    | CM  | CHECK Q FIELD REMAINED THE SAME              |
| 04044 | 47 | 04164 | 01200 | BNI | CHECK FOR E/Z                                |
| 04056 | 49 | 04224 |       | B   |  |
| 04068 |    |       |       | X   |  |

|       |    |       |       |     | ERROR ROUTINE          |
|-------|----|-------|-------|-----|------------------------|
| 04080 | 46 | 04116 | 00100 | BI  | CHECK SW 1             |
| 04092 | 39 | 04129 | 00100 | WA  | TYPE ROUTINE NO.       |
| 04104 | 38 | 03965 | 00100 | WN  | TYPE P FIELD           |
| 04116 | 47 | 04140 | 00300 | BNI | CHECK SW 3             |
| 04128 | 48 | 70717 | 2570# | H   | HALT                   |
| 04140 | 46 | 03972 | 00200 | BI  | CHECK SW 2             |
| 04152 | 49 | 04032 |       | B   | BRANCH TO Q FLAG CHECK |
| 04164 | 46 | 04200 | 00100 | BI  | CHECK SW 1             |
| 04176 | 39 | 04213 | 00100 | WA  | TYPE ROUTINE NO.       |
| 04188 | 38 | 03969 | 00100 | WN  | TYPE Q FIELD           |
| 04200 | 47 | 04224 | 00300 | BNI | CHECK SW 3             |
| 04212 | 48 | 70717 | 2580# | H   | HALT                   |
| 04224 | 46 | 03972 | 00200 | BI  | CHECK SW 2             |
| 04236 | 49 | 04284 |       | B   |                        |
| 04248 |    |       |       | X   |                        |
| 04260 |    |       |       | X   |                        |

ROUTINE 013  
MOVE FLAG - NO FLAG TO NO FLAG

|       |    |       |       |     | WORKING AREA                                    |
|-------|----|-------|-------|-----|---|
| 04272 |    | 78    | # 22# | X   | WORKING AREA                                    |
| 04284 | 15 | 04278 | 8     | TDM | RESTORE P WORKING AREA TO<br>ORIGINAL CONDITION |
| 04296 | 15 | 04282 | 2     | TDM | RESTORE Q WORKING AREA TO<br>ORIGINAL CONDITION |
| 04308 | 71 | 04278 | 04282 | MF  | MOVE FLAG - NO FLAG TO NO FLAG                  |
| 04320 | 14 | 04278 | 78    | CM  | CHECK FOR NO FLAG IN P FIELD                    |
| 04332 | 47 | 04404 | 01200 | BNI | CHECK FOR E/Z                                   |
| 04344 | 14 | 04282 | 22    | CM  | CHECK FOR NO FLAG IN Q FIELD                    |
| 04356 | 47 | 04488 | 01200 | BNI | CHECK FOR E/Z                                   |
| 04368 | 49 | 04548 |       | B   |   |
| 04380 |    |       |       |     |   |
| 04392 |    |       |       |     |   |
|       |    |       |       |     | ERROR ROUTINE                                   |
| 04404 | 46 | 04440 | 00100 | BI  | CHECK SW 1                                      |
| 04416 | 39 | 04453 | 00100 | WA  | TYPE ROUTINE NO.                                |
| 04428 | 38 | 04277 | 00100 | WN  | TYPE P FIELD                                    |
| 04440 | 47 | 04464 | 00300 | BNI | CHECK SW 3                                      |
| 04452 | 48 | 70717 | 3570# | H   | HALT  |
| 04464 | 46 | 04284 | 00200 | BI  | CHECK SW 2                                      |
| 04476 | 49 | 04344 |       | B   | BRANCH TO Q FLAG CHECK                          |
| 04488 | 46 | 04524 | 00100 | BI  | CHECK SW 1                                      |
| 04500 | 39 | 04537 | 00100 | WA  | TYPE ROUTINE NO.                                |
| 04512 | 38 | 04281 | 00100 | WN  | TYPE Q FIELD                                    |
| 04524 | 47 | 04548 | 00300 | BNI | CHECK SW 3                                      |
| 04536 | 48 | 70717 | 3580# | H   | HALT  |
| 04548 | 46 | 04284 | 00200 | BI  | CHECK SW 2                                      |
| 04560 | 49 | 04932 |       | B   |   |
| 04572 |    |       |       | X   |   |
| 04584 |    |       |       | X   |   |

## ROUTINE 016

Check Transfer Numeric Strip  
9 Digits v to Even Memory

|       |      |       |       |                                    |
|-------|------|-------|-------|------------------------------------|
| 04896 |      |       | X     | WORKING AREA                       |
| 04908 | 0    | #     | X     | WORKING AREA                       |
| 04920 | 2345 | 67890 | X     | COMPARE DATA                       |
| 04932 | 72   | 01237 | 04918 | TNS TRANSFER NUMERIC STRIP - FIELD |
| 04944 | 24   | 04918 | 04931 | C COMPARE FOR CORRECT RESULTS      |
| 04956 | 47   | 05004 | 01200 | BNI BRANCH TO ERROR ROUTINE        |
| 04968 | 49   | 05064 |       | B                                  |
| 04980 |      |       |       | X                                  |
| 04992 |      |       |       | X                                  |

## ERROR ROUTINE

|       |    |       |       |     |                   |
|-------|----|-------|-------|-----|-------------------|
| 05004 | 46 | 05040 | 00100 | BI  | CHECK SW1         |
| 05016 | 39 | 05053 | 00100 | WA  | TYPE ROUTINE NO.  |
| 05028 | 38 | 04910 | 00100 | WN  | TYPE COMPARE DATA |
| 05040 | 47 | 05064 | 00300 | BNI | CHECK SW 3        |
| 05052 | 48 | 70717 | 6 0#  | H   | HALT              |
| 05064 | 46 | 04932 | 00200 | BI  | CHECK SW 2        |
| 05076 | 49 | 04608 |       | B   |                   |
| 05088 |    |       |       | X   |                   |
| 05100 |    |       |       | X   |                   |
| 05112 |    |       |       | X   |                   |
| 05124 |    | E     |       | X   |                   |

ROUTINE 014  
REPEAT ROUTINE

|       |    |       |       |     |                            |
|-------|----|-------|-------|-----|----------------------------|
| 04596 |    |       | 000   | X   | WORKING AREA               |
| 04608 | 46 | 04620 | 01400 | BI  | TURN OFF OVERFLOW          |
| 04620 | 11 | 04607 | 01    | AM  | ADD ONE TO REPEAT CONSTANT |
| 04632 | 47 | 01344 | 01400 | BNI | CHECK FOR OVERFLOW         |
| 04644 | 34 |       | 00102 | K   |                            |
| 04656 | 49 | 04836 |       | B   |                            |

ROUTINE 015  
TEST COMPLETED ROUTINE

|       |    |       |       |    |                      |
|-------|----|-------|-------|----|----------------------|
| 04668 | 63 | 45626 | 3 43  | X  | TEST C               |
| 04680 | 56 | 54575 | 34563 | X  | OMPLET               |
| 04692 | 45 | 4403  | 4946  | X  | E D . I F            |
| 04704 |    | 6266  | 71    | X  | S W 1                |
| 04716 | 56 | 4646  | 4155  | X  | O F F A N            |
| 04728 | 44 | 555   | 6 59  | X  | D N O R              |
| 04740 | 56 | 64634 | 95545 | X  | O U T I N E          |
| 04752 |    | 55566 | 2 63  | X  | N O S T              |
| 04764 | 68 | 57454 | 423   | X  | Y P E D ,            |
| 04776 | 63 | 45626 | 3 57  | X  | T E S T P            |
| 04788 | 45 | 59465 | 65954 | X  | E R F O R M          |
| 04800 | 45 | 44 5  | 75956 | X  | E D P R O            |
| 04812 | 57 | 45595 | 36803 | X  | P E R L Y .          |
| 04824 | 0# |       |       | X  | #                    |
| 04836 | 39 | 04669 | 00100 | WA | TYPE TESTS COMPLETED |
| 04848 | 46 | 01344 | 00400 | BI | CHECK SW 4           |
| 04860 |    |       |       |    | HALT                 |
| 04872 |    |       |       |    |                      |
| 04884 |    |       |       | X  |                      |
| 10000 | 12 | 34567 | 89098 | X  |                      |
| 10001 | 76 | 54032 | INMLK | X  |                      |
| 10002 | J0 | OPQR0 | 12345 | X  |                      |
| 10003 | OP | Q-234 | 56789 | X  |                      |
| 10004 | +L |       |       |    |                      |



## **FP01 - Floating Point Instructions Diagnostic**



```
//=====
//  
// FP01 - Floating Point Instructions Diagnostic  
//  
// Program Switch settings:  
//  
//    PS1:    ON - Bypass error type out  
//            OFF - Type out routine number on error  
//    PS2:    ON - Loop in routine  
//            OFF - Continue to next routine  
//    PS3:    ON - Stop on error  
//            OFF - Do not stop on error, continue  
//    PS4:    not used  
//  
// Check switches settings:  
//  
//    DISK I/O - STOP  
//    PARITY   - STOP  
//    I/O       - STOP  
//    O'FLOW    - PROGRAM  
//  
// Start addresses:  
//  
//    00402 - Full test  
//  
// Directions:  
//  
//    1. Load FP01 diagnostic  
//    2. Press START  
//=====
```



## Sample Output – FP01

=====

To be supplied when Floating Point  
is implemented in the Simulator.

=====



----- 1: fp10-main.sps -----

```
1:1          * ****
1:2          * IBM 1620 FLOATING POINT PACKAGE TEST
1:3          * ****
1:4          *
1:5          *
1:6          * -----
1:7          * RUNNING IN 1620 SIMH
1:8          *      SET CPU FP
1:9          *      SET CPU DIV
1:10         *      SET CPU IA
1:11         *      SET CPU MOD1
1:12         *      SET CPU 60K
1:13         *
1:14         *      TURN ARITHMETIC CHECK STOP SWITCH OFF
1:15         *      DEPOSIT ARSTOP 0
1:16         *
1:17         *      SENSE SWITCHES OFF
1:18         *      DEPOSIT SW1 0
1:19         *      DEPOSIT SW2 0
1:20         *      DEPOSIT SW3 0
1:21         *      DEPOSIT SW4 0
1:22         *
1:23         *
1:24         * SENSE SWITCH SETTINGS
1:25         *      SW1 ON = DO NOT PRINT ERROR
1:26         *      SW2 ON = REPEAT TEST
1:27         *      SW3 ON = HALT ON ERROR
1:28         *
1:29         *
1:30         *
=====
1:31          * REF 1. 227-5630-1 IBM 1620 FLOATING POINT FEATURE CE
MANUAL 1962
1:32          *      2. G26-5595-0 AUTOMATIC FLOATING POINT OPERATIONS
SEP61
1:33          *
1:34          * P = P ADDRESS
1:35          * Q = Q ADDRESS
1:36          * PF (MP) = CONTENTS OF P
1:37          * QF (MQ) = CONTENTS OF Q
1:38          * PE (EP) = EXPONENT OF THE FIELD AT THE P ADDRESS
1:39          * QE (EQ) = EXPONENT OF THE FIELD AT THE Q ADDRESS
1:40          * L = NUMBER OF DIGITS IN THE MANTISSA
1:41          * D = PE-QE (EP-EQ)
1:42          *
1:43          * REF 2 USES MP, MQ, AND EP, EQ
1:44          *
1:45          *
=====
1:46          * SUMMARY
1:47          * DATA
1:48          *      FLOATING SHIFT RIGHT (FSR-08)
1:49          *      FLOATING SHIFT LEFT (FSL-05)
1:50          *      TRANSMIT FLOATING (TFL-06)
1:51          *
1:52          *      BRANCH AND TRANSMIT FLOATING (BTFL-07)
1:53          *
```

1:54 \* ARITHMETIC - FROM REF 1 FLOATING POINT ARITHMETIC  
 EXAMPLES  
 1:55 \* FLOATING POINT ARITHMETIC COMMAND RESULTS  
 1:56 \* ARE VERIFIED WITH FIXED POINT COMMANDS  
 1:57 \* -----
 --  
 1:58 \* FLOATING ADD (FADD-01)  
 1:59 \* EXAMPLES 1-5 EXPONENT CONFIGURATION  
 1:60 \* EXAMPLES 6-11 FRACTION (MANTISSA) CONFIGURATION  
 1:61 \*  
 1:62 \* EXAMPLE 1 PE = QE / D = 0  
 1:63 \* EXAMPLE 2 (PE GT QE) SCAN Q -- FRACTION (MANTISSA)  
 ADD-- D LT L  
 1:64 \* QF SHIFTED D (PE-QE) RIGHT TO ALIGN  
 DECIMAL POINTS  
 1:65 \* EXAMPLE 3 (PE GT QE) SCAN Q -- FP EXIT -- D GT L  
 1:66 \* QE IS TOO SMALL-- Q DISCARDED-RESULT IS  
 P  
 1:67 \* EXAMPLE 4 (PE LT QE) EXP TRANSMIT SCAN P -  
 FRACTION (MANTISSA) ADD-  
 1:68 \* D LT L - PF SHIFTED D (PE-QE) RIGHT TO  
 ALIGN DECIMALS  
 1:69 \* EXAMPLE 5 (PE LT QE) EXP TRANSMIT SCAN P -- FP  
 EXIT -- D GT L  
 1:70 \* PE IS TOO SMALL-- P DISCARDED-RESULT IS  
 Q  
 1:71 \* EXAMPLE 6 NO NORMALIZING REQUIRED---NO CARRY OUT  
 1:72 \* EXAMPLE 7 NORMALIZING SHIFT RIGHT REQUIRED --  
 CARRY OUT  
 1:73 \* EXPONENT ADJUST  
 1:74 \* EXAMPLE 8 NORMALIZING SHIFT RIGHT REQUIRED --  
 MACHINE INFINITY  
 1:75 \* 9...9 99 - CARRY OUT CAUSES EXPONENT  
 OVERFLOW  
 1:76 \* EXAMPLE 9 ZERO FRACTION (MANTISSA) RESULT --  
 MACHINE ZERO 0...0 -99  
 1:77 \* EXAMPLE 10 NORMALIZING SHIFT LEFT -- SHIFT LEFT --  
 ZERO FILL  
 1:78 \* EXPONENT ADJUST  
 1:79 \* EXAMPLE 11 NORMALIZING SHIFT LEFT -- EXPONENT  
 OVERFLOW  
 1:80 \* MACHINE ZERO  
 1:81 \*  
 1:82 \* FLOATING SUBTRACT (FSUB-02)  
 1:83 \* SAME AS FLOATING ADD EXCEPT THAT SIGN CONTROL  
 1:84 \* PROCEDURES FOR MQ ARE REVERSED.  
 1:85 \*  
 1:86 \* FLOATING MULTIPLY (FMUL-03)  
 1:87 \* EXAMPLE 1. NO EXPONENT MODIFY REQUIRED  
 1:88 \* EXAMPLE 2. EXPONENT MODIFY REQUIRED  
 1:89 \* EXAMPLE 3. DIGIT FORCE -- MACHINE INFINITY  
 1:90 \* EXAMPLE 4. EXPONENT OVERFLOW -- MODIFY PE TO 99  
 1:91 \* EXAMPLE 5. SPECIAL CASE 999 X 199  
 1:92 \*  
 1:93 \* FLOATING DIVIDE (FDIV-09)  
 1:94 \*  
 1:95 \*  
 1:96 \*  
 ======  
 1:97  
 1:98 00402 41 00000 00000 FPMAIN NOP 00000, 00000  
 1:99  
 1:100 00414 34 00000 00102 RCTY

```

1:101    00426 34 00000 00102      RCTY
1:102    00438 39 10319 00100      WATY   TITLE
1:103    00450 34 00000 00102      RCTY
1:104          *
=====
1:105          *      RUN ALL TESTS
1:106          *
1:107          *
1:108          *ALL TESTS
1:109          *
=====
1:110
1:111    00462 41 00000 00000  FIRST NOP
1:112
1:113    00474 17 08614 00486      BTM    SETS1, *+12,,      SET SW SUBROUTINE
1:114
1:115
1:116    00486 17 01236 00600      BTM    TFTST, *+114,,      TFL TEST
1:117    00499 06                  DC     2, 06,,,          TFL INSTRUCTION
1:118    00501 333333..33330@      DAC    50,===== TRANSMIT FLOATING (TFL 06) TESTS
=====
1:119
1:120
1:121    00600 17 01236 00714      BTM    TFTST, *+114,,      FSL TEST
1:122    00613 05                  DC     2, 05,,,          FSL INSTRUCTION
1:123    00615 333333..33330@      DAC    50,===== FLOATING SHIFT LEFT (FSL 05) TESTS
=====
1:124
1:125
1:126    00714 17 01236 00828      BTM    TFTST, *+114,,      FSR TEST
1:127    00727 08                  DC     2, 08,,,          FSR INSTRUCTION
1:128    00729 333333..33330@      DAC    50,===== FLOATING SHIFT RIGHT (FSR 08) TESTS
=====
1:129
1:130
1:131    00828 17 01236 00942      BTM    TFTST, *+114,,      BTFL TEST
1:132    00841 07                  DC     2, 07,,,          BTFL INSTRUCTION
1:133    00843 333333..33330@      DAC    50,== BRANCH AND TRANSMIT FLOAT (BTFL 07)
TESTS ==@
1:134
1:135
1:136
1:137    00942 17 02466 01038      BTM    FATST, *+96,,      FADD TEST
1:138    00955 01                  DC     2, 01,,,          FADD INSTRUCTION
1:139    00957 21                  DC     2, 21,,,          ADD INSTRUCTION
1:140    00959 333333..33330@      DAC    40,===== FLOATING ADD (FADD) TESTS =====@

```

1:141  
1:142  
1:143

1:144 01038 17 02466 01134 BTM FATST, \*+96,, FSUB TEST  
1:145 01051 02 DC 2, 02,,, FSUB INSTRUCTION  
1:146 01053 22 DC 2, 22,,, SUBTRACT INSTRUCTION  
1:147 01055 333333..33330@ DAC 40,===== FLOATING SUB (FSUB) TESTS =====@  
1:148  
1:149

1:150 01134 17 06372 01146 BTM FMTST, \*+12,, FMUL TEST  
1:151  
1:152 \* ----- PRINT END OF TESTING MESSAGE AND HALT  
1:153  
1:154 01146 41 00000 00000 ALDON NOP  
1:155 01158 34 00000 00102 RCTY  
1:156 01170 34 00000 00102 RCTY  
1:157 01182 39 10389 00100 WATY DONE  
1:158 01194 34 00000 00102 RCTY  
1:159 01206 48 00000 00000 H 00000, 00000,, END OF PROGRAM  
1:160 01218 48 00000 00000 H 00000, 00000,, WILL SHOW (H) AS NEXT

## INSTRUCTION

1:161  
1:162  
1:163 \*

=====  
1:164 \* TEST SUBROUTINES FOLLOW  
1:165 \*  
=====  
1:166 \*  
=====  
1:167 \*  
=====  
1:168

----- 2: fp20-tftest.sps -----

2:1 \* ======  
2:2 \* TFL, BTFL, FSL, FSR TESTS  
2:3 \*  
2:4 \*TFTST  
2:5 \* ======  
2:6 01234 00005 DS 5,,, RETURN ADDRESS FROM BTM  
2:7 01236 41 00000 00000 TFTST NOP 00000, 00000  
2:8  
2:9 \* INSTRUCTION ARG  
2:10 01248 26 01283 01235 TF \*+35, TFTST-1,,  
2:11 01260 12 01283 00101 SM \*+23, 101,,  
2:12 01272 26 01290 00000 TF TFINS+6, 0,, TO FLOATING POINT  
INSTRUCTION  
2:13 01284 41 00000 00000 TFINS NOP 00000,00000,, KEEP INSTRUCTION ARG IN P  
ADDRESS  
2:14  
2:15 \* TEST TITLE ARG  
2:16 01296 26 01331 01235 TF \*+35, TFTST-1,,  
2:17 01308 12 01331 00099 SM \*+23, 99,,

-

2:18 01320 16 01362 00000 TFM TFWT+6, 0,, TO WRITE TITLE  
 2:19  
 2:20 \* TITLE  
 2:21  
 2:22 01332 34 00000 00102 RCTY  
 2:23 01344 34 00000 00102 RCTY  
 2:24 01356 39 00000 00100 TFWT WATY 00000,,6, MAIN TEST TITLE  
 2:25 01368 34 00000 00102 RCTY  
 2:26  
 2:27  
 2:28 \* INITIALIZE TABLE POINTER  
 2:29  
 2:30 01380 16 10767 00000 TFM TFINC, 0,, TABLE POINTER  
 2:31  
 2:32 \* POINT TO TEST DATA TABLES  
 2:33 \* RESET  
 2:34 01392 16 10782 10802 TFM TFTBL, TFTBI  
 2:35 01404 16 10787 10837 TFM TFTBL+5, TFTBD  
 2:36 01416 26 10777 10782 TF TFTBP, TFTBL  
 2:37 01428 26 10782 10787 TF TFTBP+5, TFTBL+5  
 2:38  
 2:39  
 2:40 01440 41 00000 00000 TFNXT NOP  
 2:41  
 2:42 \* ADVANCE TO NEXT ADDRESS IN TABLES  
 2:43  
 2:44 01452 21 10777 10767 A TFTBP, TFINC,, ID MESSAGE TABLE  
 2:45 01464 14 10777 00000 CM TFTBP, 00000, 6, RETURN ON ZERO ADDRESS  
 2:46 01476 46 01235 01200 BE TFTST-1,,6, RETURN  
 2:47  
 2:48 01488 21 10782 10767 A TFTBP+5, TFINC,, DATA TABLE  
 2:49  
 2:50 01500 16 10767 00005 TFM TFINC, 5  
 2:51  
 2:52 01512 26 10792 10777 TF TFI, TFTBP,11  
 2:53 01524 26 10797 10782 TF TFD, TFTBP+5,11  
 2:54  
 2:55 \* START OF CURRENT TEST  
 2:56 01536 34 00000 00102 TFRPT RCTY  
 2:57 01548 39 10792 00100 WATY TFI,,6, TEST TITLE  
 2:58 01560 34 00000 00101 SPTY  
 2:59  
 2:60 \* FP INSTRUCTION TEST FOLLOW.  
 2:61 \* TEST DATA FIELD IN ADDRESS REFERENCED  
 2:62 \* BY TFD ASSUMED TO BE A 100 DIGIT MANTISSA  
 2:63  
 2:64 \* SELECT INSTRUCTION (TFINS)  
 2:65 01572 25 14955 14953 TD STAT, FALSE  
 2:66 01584 26 10658 10554 TF WK1, WK1Z,, ZERO WK1  
 2:67 01596 33 10558 00000 CF WK1-100  
 2:68 01608 26 10761 10554 TF WK2, WK1Z,, ZERO WK2  
 2:69 01620 33 10661 00000 CF WK2-100  
 2:70

2:71 01632 26 02195 10797 TF TEXCK+11, TFD,, EXP COMPARE  
 2:72  
 2:73 \* WHEN TFL(06)  
 2:74 01644 14 01290 000<sup>0</sup>6 CM TFINS+6, 06, 10,, TFL  
 2:75 01656 47 01740 01200 BNE TFSL  
 2:76 01668 06 10658 10797 TFL WK1, TFD,11  
 2:77 01680 26 01715 10797 TF \*+35, TFD,, MANTISSA COMPARE  
 2:78 01692 12 01715 00002 SM \*+23, 2  
 2:79 01704 24 10656 00000 C WK1-2, 00000,, MANTISSA  
 2:80 01716 46 02184 01200 BE TEXCK,,, EXPONENT  
 2:81 01728 49 02220 00000 B TER  
 2:82  
 2:83 \* WHEN FSL(05)  
 2:84 \* FSL LEAVES SIGN FLAG IN ORIGINAL POSITION  
 2:85 \* THE COMPARE (C) COMPARES THE SHIFTED DATA  
 2:86 \* TO THE ORIGINAL. IF THE ORIGINAL IS NEGATIVE  
 2:87 \* THEN TO MAKE THE COMPARE WORK THE SHIFTED DATA  
 2:88 \* NEEDS A SIGN (FLAG LOW ORDER)  
 2:89 01740 14 01290 000<sup>0</sup>5 TFSL CM TFINS+6, 05, 10,, FSL  
 2:90 01752 47 01896 01200 BNE TFSR  
 2:91 01764 26 01799 10797 TF \*+35, TFD  
 2:92 01776 12 01799 00101 SM \*+23, 101  
 2:93 01788 31 10557 00000 TR WK1-101, 00000,, COPY FP NUMBER TO WORK  
 2:94 01800 05 10578 10656 FSL WK1-80, WK1-2  
 2:95 01812 26 01871 10797 TF TFSLC+11, TFD  
 2:96 01824 12 01871 00002 SM TFSLC+11, 2  
 2:97 01836 44 01860 01871 BNF TFSLC, TFSLC+11, 11  
 2:98 01848 32 10627 00000 SF WK1-31  
 2:99 01860 24 10627 00000 TFSLC C WK1-31, 00000,, MANTISSA  
 2:100 01872 46 02184 01200 BE TEXCK,,, EXPONENT  
 2:101 01884 49 02220 00000 B TER  
 2:102  
 2:103 \* WHEN FSR(08)  
 2:104 \* FIRST MAKE LEFT SHIFTED COPY TO WK1 AND CORRECT SIGN  
 2:105 01896 14 01290 000<sup>0</sup>8 TFSR CM TFINS+6, 08, 10,, FSR  
 2:106 01908 47 02112 01200 BNE TBTFL  
 2:107 01920 26 01955 10797 TF \*+35, TFD  
 2:108 01932 12 01955 00002 SM \*+23, 2  
 2:109 01944 26 10608 00000 TF WK1-50, 00000,, COPY FP NUMBER TO WORK  
 2:110 01956 26 01979 10797 TF \*+23, TFD  
 2:111 01968 26 10658 00000 TF WK1, 00000,, AND EXPONENT  
 2:112 01980 26 02015 10797 TF \*+35, TFD  
 2:113 01992 12 02015 00002 SM \*+23, 2  
 2:114 02004 44 02040 00000 BNF TFSRF, 00000  
 2:115 02016 33 10608 00000 CF WK1-50  
 2:116 02028 32 10656 00000 SF WK1-2  
 2:117 02040 08 10656 10608 TFSRF FSR WK1-2, WK1-50  
 2:118 02052 26 02087 10797 TF TFSRC+11, TFD  
 2:119 02064 12 02087 00002 SM TFSRC+11, 2  
 2:120 02076 24 10656 00000 TFSRC C WK1-2, 00000,, MANTISSA  
 2:121 02088 46 02184 01200 BE TEXCK,,, EXPONENT  
 2:122 02100 49 02220 00000 B TER

```

2:123
2:124
2:125 * WHEN BTFL(07)
2:126 02112 26 02183 10797 TBTFL TF *+71, TFD
2:127 02124 26 02159 10797 TF *+35, TFD

2:128 02136 12 02159 00101 SM *+23, 101
2:129 02148 31 10557 00000 TR WK1-101, 00000,, COPY FP NUMBER TO WORK

2:130 02160 16 02460 02184 TFM RETAD, *+24,, BTFL RETURN
2:131 02172 07 02392 00000 BTFL BTSUB, 00000,, USES WK1 AND SETS STAT
2:132
2:133 02184 24 10658 00000 TEXCK C WK1, 00000,, EXPONENT
2:134 02196 47 02220 01200 BNE TER
2:135 02208 25 14955 14952 TD STAT, TRUE
2:136
2:137
2:138
2:139 * CHECK COMPARE STATUS
2:140 * CALL ERROR ROUTINE AND RETURN ITS STATUS IN ESTAT

2:141 02220 17 09518 02242 TER BTM ERTN, *+22,, TRANSMIT ADDRESS OF NEXT
INSTRUCTION

2:142 02236 14955 14954 DSA STAT, ESTAT
2:143
2:144 02242 43 02266 14954 BD TFEND, ESTAT
2:145 02254 49 01536 00000 B TFRPT,,, RERUN TEST
2:146
2:147 02266 41 00000 00000 TFEND NOP 00000, 00000
2:148
2:149 02278 49 01440 00000 B TFNXT,,, GOTO NEXT TEST
2:150
2:151

```

----- 3: fp21-tftest.sps -----

```

3:1 * -----
3:2 * SUBROUTINE STATUS = BTSUB(FP1, WK1)
3:3 * FP1 IS COPIED TO WK1
3:4 * BRANCH AND TRANSMIT COPIES WK1 TO SUBROUTINE-BTSUB
3:5 * BTSUB GETS WK1 CONTENTS JUST BEFORE BTSUB ADDRESS
(BTSUB-1)
3:6 * BTSUB CALLS CF -COMPARE FLOATING SUBROUTINE TO
3:7 * COMPARE WK1 TO ORIGINAL FP1
3:8 * CF RETURNS COMPARE STATUS IN STAT
3:9 *
3:10 *
3:11 *
3:12 *BTSUB
3:13 *
3:14 *

3:15 02339 000000..000000 DC 50, 0
3:16 02340 000000..000000 DSC 50, 0
3:17 02390 00 DSC 2, 0
3:18 02392 41 00000 00000 BTSUB NOP

3:19
3:20
3:21 *COMPARE MANTISSA AND EXPONENT SEPARATELY
3:22 * WITH SUBROUTINE CF (COMPARE FLOATING)

3:23 02404 17 09922 02432 BTM CF, *+28,, TRANSMIT RETURN ADDRESS

```

```

3:24    02420 023911..814955      DSA    BTSUB-1, WK1, STAT
3:25
3:26    02432 41 00000 00000     NOP    00000, 00000,,   RETURN TO HERE
3:27
3:28          * RETURN
3:29          * NOTE BB WILL NOT WORK HERE,
3:30          * BECAUSE THIS SUBROUTINE CONTAINS A BTM
3:31    02444 49 02460 00000      B      RETAD,,6
3:32
3:33          * -----
3:34          * SUBROUTINE BTFL RETURN ADDRESS
3:35    02460 00005      RETAD DS 5
3:36
3:37

```

----- 4: fp30-fadd.sps -----

```

4:1          * =====
4:2          * FADD TEST
4:3          *
4:4          *FADD
4:5          * =====
4:6    02465 00005      DS 5,,,           RETURN ADDRESS FROM BTM
4:7    02466 41 00000 00000  FATST NOP 00000, 00000
4:8
4:9          * GET ADD / SUBTRACT INST AND TITLE
4:10   02478 26 02513 02465      TF  *+35, FATST-1,,,
4:11   02490 12 02513 00083      SM  *+23, 83,,,
4:12   02502 26 03043 00000      TF  FARIT+1, 0,,       TO FLOATING POINT
INSTRUCTION
4:13
4:14   02514 26 02549 02465      TF  *+35, FATST-1,,,
4:15   02526 12 02549 00081      SM  *+23, 81,,,
4:16   02538 16 03118 00000      TFM  ADSA, 0,,       FIXED INST TO FIXED ADD/SUB SUB
4:17
4:18   02550 26 02585 02465      TF  *+35, FATST-1,,,
4:19   02562 12 02585 00079      SM  *+23, 79,,,
4:20   02574 16 02616 00000      TFM  WTITL+6, 0,,       TO WRITE TITLE
4:21
4:22          * TITLE
4:23
4:24   02586 34 00000 00102      RCTY
4:25   02598 34 00000 00102      RCTY
4:26   02610 39 00000 00100  WTITL WATY 00000,,6,       MAIN FADD / FSUB TEST TITLE
4:27   02622 34 00000 00102      RCTY
4:28
4:29
4:30          * INITIALIZE TABLE POINTER
4:31
4:32   02634 16 11713 00000      TFM  FAINC, 0,,   TABLE POINTER
4:33
4:34   02646 14 03043 00002      CM   FARIT+1, 02, 10,  CHOOSE FADD / SUB TABLES
4:35   02658 46 02754 01200      BE   SUBTB

```

4:36  
 4:37 \* POINT TO FADD TEST DATA TABLES  
 4:38 \* RESET  
  
 4:39 02670 16 11733 11778 TFM FATBL, FATBI  
  
 4:40 02682 16 11738 11833 TFM FATBL+5, FATBP  
  
 4:41 02694 16 11743 11888 TFM FATBL+10, FATBQ  
 4:42 02706 26 11728 11733 TF ASTBL, FATBL  
 4:43 02718 26 11733 11738 TF ASTBL+5, FATBL+5  
 4:44 02730 26 11738 11743 TF ASTBL+10, FATBL+10  
 4:45 02742 49 02826 00000 B FANXT  
  
 4:46  
 4:47 \* POINT TO FSUB TEST DATA TABLES  
 4:48 \* RESET  
  
 4:49 02754 16 11748 11943 SUBTB TFM FSTBL, FSTBI  
  
 4:50 02766 16 11753 11998 TFM FSTBL+5, FSTBP  
  
 4:51 02778 16 11758 12053 TFM FSTBL+10, FSTBQ  
 4:52 02790 26 11728 11748 TF ASTBL, FSTBL  
 4:53 02802 26 11733 11753 TF ASTBL+5, FSTBL+5  
 4:54 02814 26 11738 11758 TF ASTBL+10, FSTBL+10  
  
 4:55  
 4:56  
 4:57 02826 41 00000 00000 FANXT NOP  
  
 4:58 \* ADVANCE TO NEXT ADDRESS IN TABLES  
 4:59 02838 21 11728 11713 A ASTBL, FAINC,, ID MESSAGE TABLE  
  
 4:60 02850 14 11728 00000 CM ASTBL, 00000, 6, RETURN ON ZERO ADDRESS  
  
 4:62 02862 46 02465 01200 BE FATST-1,,6, RETURN  
  
 4:63  
 4:64 02874 21 11733 11713 A ASTBL+5, FAINC,, P DATA TABLE  
 4:65 02886 21 11738 11713 A ASTBL+10, FAINC,, Q DATA TABLE  
  
 4:66  
  
 4:67 02898 16 11713 00005 TFM FAINC, 5  
  
 4:68  
  
 4:69 02910 26 11763 11728 TF FAI, ASTBL,11  
  
 4:70 02922 26 11768 11733 TF FAP, ASTBL+5,11  
  
 4:71 02934 26 11773 11738 TF FAQ, ASTBL+10,11  
  
 4:72  
  
 4:73 \* START OF CURRENT FADD TEST  
 4:74 02946 41 00000 00000 FARPT NOP  
 4:75 02958 34 00000 00102 RCTY  
  
 4:76 02970 39 11763 00100 WATY FAI,,6, FADD TEST TITLE  
 4:77 02982 34 00000 00101 SPTY  
  
 4:78  
  
 4:79 \*--- NEED TO PRESERVE AUGEND - MOVE TO FASUM FIRST  
 4:80 \*--- AVOID TFL FOR FLOATING POINT TESTS  
  
 4:81  
  
 4:82 02994 26 12205 11768 TF FASUM, FAP, 11, P POINTS TO EXPONENT  
  
 4:83 03006 12 11768 00002 SM FAP, 00002,, P NOW POINTS TO MANTISSA

4:84 03018 26 12203 11768 TF FASUM-2, FAP, 11,  
 4:85 03030 11 11768 00002 AM FAP, 00002,, P AGAIN POINTS TO EXPONENT  
 4:86 \* FADD / FSUB INST ARE PASSED IN ARGS, WHICH REPLACE FADD  
 BELOW  
 4:88  
 4:89 03042 01 12205 11773 FARIT FADD FASUM, FAQ, 11, FLOAT ARIITHMETIC  
 4:90  
 4:91  
 4:92 \* INDICATOR CHECK  
 4:93 03054 47 03078 01400 BNV \*+24  
 4:94 03066 39 15015 00100 WATY OVM1,,, OVERFLOW MESSAGE  
 4:95 03078 47 03102 01500 BNXV \*+24  
 4:96 03090 39 15037 00100 WATY XCKM1,,, EXPONENT OVERFLOW MESSAGE  
 4:97  
 4:98  
 4:99 \* CALL SUBROUTINE A21  
 4:100 \* A (21) MANTASSAS AND COMPUTE EXPONENTS  
 4:101 03102 17 03216 03140 BTM A21, \*+38,, TRANSMIT RETURN ADDRESS  
 4:102 03118 000001..514955 ADSA DSA 00000, -FAP, -FAQ, FASUM, STAT  
 4:103  
 4:104  
 4:105 \* CHECK COMPARE STATUS  
 4:106 \* CALL ERROR ROUTINE AND RETURN ITS STATUS IN ESTAT  
 4:107 03140 17 09518 03162 BTM ERTN, \*+22,, TRANSMIT ADDRESS OF NEXT  
 INSTRUCTION  
 4:108 03156 1495514954 DSA STAT, ESTAT  
 4:109  
 4:110 03162 43 03186 14954 BD FAEND, ESTAT  
 4:111 03174 49 02946 00000 B FARPT,,, RERUN TEST  
 4:112  
 4:113 03186 41 00000 00000 FAEND NOP 00000, 00000  
 4:114  
 4:115 03198 49 02826 00000 B FANXT,,, GOTO NEXT FADD TEST  
 4:116

----- 5: fp31-fixadd.sps -----

5:1 \* -----  
 5:2 \* SUBROUTINE STATUS = A21(FXARI, FP1, FP2, FP-SUM)  
 5:3 \* COMPARES FADD SUM WITH A(21)/EX (EX ADJUST)  
 5:4 \* -- OR -- FSUB WITH S(22) PER FIRST ARGUMENT (FXARI)  
 5:5 \*  
 5:6 \* REF (1) 227-5630-1 IBM 1620 FLOATING POINT FEATURE CE  
 MANUAL 1962  
 5:7 \*  
 5:8 \* VERIFIES FADD RESULT BY USING A(21) TO ADD MANTISSAS  
 5:9 \* AND SEPARATELY HANDLES EXPONENTS.  
 5:10 \* FLOATING POINT NUMBER IS CREATED FROM A(21) SUM AND  
 5:11 \* (ADJUSTED) EXPONENTS  
 5:12 \*  
 5:13 \* HANDLES CASES DESCRIBED IN REF (1) FLOATING ADD EXAMPLES  
 5:14 \*  
 5:15 \* EXAMPLE 1 PE = QE / D = 0 NO NORMALIZING - NO CARRY OUT  
 5:16 \* EXAMPLE 2 PE GT QE - D LT L QF SHIFTED RT TO ALIGN  
 DECIMAL POINTS

5:17 \* EXAMPLE 3 PE GT QE - D GT L - Q DISCARDED-RESULT IS P  
 5:18 \* EXAMPLE 4 PE LT QE- D LT L PF SHIFTED RT TO ALIGN  
 DECIMAL POINTS  
 5:19 \* EXAMPLE 5 PE LT QE - D GT L P DISCARDED-RESULT IS Q  
 5:20 \*  
 5:21 \* EXAMPLE 6 NO NORMALIZING REQUIRED-NO CARRY OUT-SAME AS  
 EXAMPLE 1  
 5:22 \*  
 5:23 \* EXAMPLE 7 NORMALIZING SHIFT RT - CARRY OUT- EXP ADJUST  
 5:24 \* EXAMPLE 8 NORM SHIFT RT-CARRY OT CAUSES EXP OV MACH  
 INFINITY (9...9 99)  
 5:25 \* EXAMPLE 9 ZERO FRACTION RESULT - MACHINE ZERO (0...0 -  
 99)  
 5:26 \* EXAMPLE 10 NORMALIZING SHIFT LEFT - SHIFT LEFT- EXP ADJ  
 5:27 \* EXAMPLE 11 NORMALIZING SHIFT LEFT- EXP OV MACHINE ZERO  
 (0...0 -99)  
 5:28 \*  
 5:29 \* USAGE  
 5:30 \* BTM A21, \*+38,, TRANSMIT RETURN ADDRESS  
 5:31 \* DSA FXARI, -FAP, -FAQ, FASUM, STAT  
 5:32 \* NOP 00000, 00000,, RETURN TO HERE  
 5:33 \*  
 5:34 \* FXARI = A OR S ARITHMETIC INSTRUCTION  
 5:35 \* A21A1 = -FAP (INDIRECT ADDRESS) FLOATING POINT NUMBER  
 5:36 \* A21A2 = -FAQ (INDIRECT ADDRESS) FLOATING POINT NUMBER  
 5:37 \* A21D1 = FASUM (DATA FIELD) FLOATING POINT FADD SUM  
 5:38 \* A21RC = STAT ( DATA, RETURN CODE )  
 5:39 \* RETURNS STATUS OF COMPARE  
 5:40 \*  
 5:41 \*  
 5:42 \*A21  
 5:43 \* -----  
 5:44 03214 00005 DS 5,, RETURN ADDRESS  
 5:45 03216 41 00000 00000 A21 NOP 00000, 00000  
 5:46  
 5:47  
 5:48 \* GET FIRST ARGUMENT  
 5:49 03228 26 03263 03215 TF \*+35, A21-1,,  
 5:50 03240 12 03263 00022 SM \*+23, 00022,,  
 5:51 03252 26 03275 00000 TF \*+23, 0,,  
 5:52 03264 26 04165 00000 TF FXAR1+1, 0,, -- A / S FIXED POINT ARITH  
 INSTRUCTION  
 5:53 03276 26 03299 03275 TF \*+23, \*-1  
 5:54 03288 26 04789 00000 TF FXAR2+1, 0,, -- A / S FIXED POINT ARITH  
 INSTRUCTION  
 5:55  
 5:56  
 5:57 \* GET SECOND ARGUMENT (INDIRECT)  
 5:58 03300 26 03335 03215 TF \*+35, A21-1,,  
 5:59 03312 12 03335 00017 SM \*+23, 00017,,  
 5:60 03324 26 03359 00000 TF \*+35, 0,,  
 5:61 03336 33 03359 00000 CF \*+23  
 5:62 03348 26 06253 00000 TF A21A1, 0,,  
 5:63  
 5:64  
 5:65 \* GET THIRD ARGUMENT (INDIRECT)  
 5:66 03360 26 03395 03215 TF \*+35, A21-1,,  
 5:67 03372 12 03395 00012 SM \*+23, 00012,,  
 5:68 03384 26 03419 00000 TF \*+35, 0,,  
 5:69 03396 33 03419 00000 CF \*+23

5:70 03408 26 06258 00000 TF A21A2, 0,,  
 5:71  
 5:72  
 5:73 \* GET FOURTH ARGUMENT  
 5:74 03420 26 03455 03215 TF \*+35, A21-1,,  
 5:75 03432 12 03455 00007 SM \*+23, 00007,,  
 5:76 03444 26 03467 00000 TF \*+23, 0,,  
 5:77 03456 26 06360 00000 TF A21D1, 0,, -- GETS EXP  
 5:78  
 5:79 03468 26 03503 03467 TF \*+35, \*-1,,  
 5:80 03480 12 03503 00002 SM \*+23, 00002,  
 5:81 03492 26 06358 00000 TF A21D1-2, 0,, -- GETS MANTISSA  
 5:82  
 5:83  
 5:84 \* EXPONENT  
 5:85 \* HANDLE RESULTANT EXPONENT BASED ON L AND D  
 5:86 \* AML = MANTISSA LENGTH AED = ABS(EP-EQ)  
 5:87  
 5:88 03504 26 05403 06042 TF AEP, AZ5,, CLEAR  
 5:89 03516 26 05511 06042 TF AEQ, AZ5,, CLEAR  
 5:90 03528 21 05403 06253 A AEP, A21A1, 11, EXPONENT P  
 5:91 03540 21 05511 06258 A AEQ, A21A2, 11, EXPONENT Q  
 5:92  
 5:93  
 5:94 \* SUBTRACT MP AND MQ EXPONENTS AED = ABS(EP-EQ)  
 5:95 03552 26 05281 06042 TF AED, AZ5,, CLEAR  
 5:96 03564 21 05281 05403 A AED, AEP,, EXPONENT P  
 5:97 03576 22 05281 05511 S AED, AEQ,, EXPONENT Q  
 5:98 03588 33 05281 00000 CF AED,,, CLEAR SIGN FLAG TO GET  
 ABS VAL  
 5:99  
 5:100  
 5:101 \* MANTISSA  
 5:102 03600 12 06253 00002 SM A21A1, 00002  
 5:103 03612 12 06258 00002 SM A21A2, 00002  
 5:104 03624 26 05397 06243 TF AMP, AZ101  
 5:105 03636 26 05505 06243 TF AMQ, AZ101  
 5:106 03648 26 05397 06253 TF AMP, A21A1, 11, MANTISSA P  
 5:107 03660 26 05505 06258 TF AMQ, A21A2, 11, MANTISSA Q  
 5:108  
 5:109  
 5:110 \* MANTISSA LENGTH OF FIRST ARG IN AML  
 5:111 \* L REPRESENTS MANTISSA LENGTH  
 5:112 03672 16 05276 00001 TFM AML, 00001,  
 5:113 03684 26 05296 06253 TF AMPA, A21A1,, AMPA HIGH ORDER  
 ADDRESS OF AMP  
 5:114  
 5:115 03696 12 05296 00001 AL SM AMPA, 1  
 5:116 03708 11 05276 00001 AM AML, 1  
 5:117 03720 44 03696 05296 BNF AL, AMPA, 11  
 5:118

5:119  
 5:120 \* ALIGN DECIMAL POINTS  
 5:121 03732 24 05403 05511 C AEP, AEQ  
 5:122 03744 46 04104 01200 BE ADDM,,, NO ALIGN-ADD MANTISSAS  
 UNCHANGED  
 5:123 03756 47 03780 01300 BL ADJP,,, PE LT QE  
 5:124 03768 46 03936 01100 BH ADJQ,,, PE GT QE  
 5:125  
 5:126  
 5:127 \* ADJUST P MANTISSA  
 5:128 \* PE LT QE - D GT L - P DISCARDED-RESULT IS Q  
 5:129 03780 24 05281 05276 ADJP C AED, AML,, COMPARE D TO L  
 5:130 03792 47 03840 01300 BL ADJP1  
 5:131 03804 26 05613 05505 TF AMPQ, AMQ  
 5:132 03816 26 05619 05511 TF AEPQ, AEQ  
 5:133 03828 49 05148 00000 B AMKFP,,, GOTO MAKE FP NUMBER FROM Q  
 ONLY  
 5:134  
 5:135 03840 16 03875 05397 ADJP1 TFM \*+35, AMP,, RESTORE ADDRESS IN TF  
 BELOW  
 5:136 03852 22 03875 05281 S \*+23, AED,, ALIGN DECIMAL POINTS  
 5:137 03864 26 05397 05397 TF AMP, AMP  
 5:138 03876 16 03918 05397 TFM \*+42, AMP,, RESTORE ADDRESS IN MF  
 BELOW  
 5:139 03888 22 03918 05276 S \*+30, AML  
 5:140 03900 11 03918 00001 AM \*+18, 00001  
 5:141 03912 71 05397 05397 MF AMP, AMP  
 5:142 03924 49 04104 00000 B ADDM  
 5:143  
 5:144  
 5:145 \* ADJUST Q MANTISSA  
 5:146 \* PE GT QE - D GT L - Q DISCARDED-RESULT IS P  
 5:147 03936 41 00000 00000 ADJQ NOP 00000, 00000,,  
 5:148 03948 24 05281 05276 C AED, AML,, COMPARE D TO L  
 5:149 03960 47 04008 01300 BL ADJQ1  
 5:150 03972 26 05613 05397 TF AMPQ, AMP  
 5:151 03984 26 05619 05403 TF AEPQ, AEP  
 5:152 03996 49 05148 00000 B AMKFP,,, GOTO MAKE FP NUMBER FROM P  
 ONLY  
 5:153  
 5:154 04008 16 04043 05505 ADJQ1 TFM \*+35, AMQ,, RESTORE ADDRESS IN TF  
 BELOW  
 5:155 04020 22 04043 05281 S \*+23, AED,, ALIGN DECIMAL POINTS  
 5:156 04032 26 05505 05505 TF AMQ, AMQ  
 5:157 04044 16 04086 05505 TFM \*+42, AMQ,, RESTORE ADDRESS IN MF  
 BELOW  
 5:158 04056 22 04086 05276 S \*+30, AML  
 5:159 04068 11 04086 00001 AM \*+18, 00001  
 5:160 04080 71 05505 05505 MF AMQ, AMQ  
 5:161 04092 49 04104 00000 B ADDM  
 5:162  
 5:163  
 5:164 \* ADD (ADJUSTED) P TO Q MANTISSAS  
 5:165 04104 41 00000 00000 ADDM NOP 00000, 00000,,  
 5:166 04116 25 05622 14953 TD ANRM, FALSE,, CLEAR NORMALIZE FLAG  
 5:167 04128 25 05621 14953 TD AOV, FALSE,, CLEAR OVERFLOW FLAG  
 5:168 04140 26 05613 06243 TF AMPQ, AZ101,, CLEAR

5:169 04152 26 05613 05397 TF AMPQ, AMP  
 5:170 04164 21 05613 05505 FXAR1 A AMPQ, AMQ,, ARGs MAY REPLACE A  
 WITH S  
 5:171  
 5:172  
 5:173 \* CARRY-OUT OVERFLOW INDICATOR CHECK  
 5:174 04176 47 04212 01400 BNV ASHFT  
 5:175 04188 25 05621 14952 TD AOV, TRUE,, SET OVERFLOW FLAG  
 5:176 04200 49 04548 00000 B AZCK  
 5:177  
 5:178  
 5:179 \* NOMRALIZE MANTISSA IN AMPQ  
 5:180 \* SHIFT LEFT  
 5:181 \* COUNT LEADING ZEROS IN AZCNT  
 5:182 \* REQUIRES EXPONENT ADJUST  
 5:183 04212 41 00000 00000 ASHFT NOP 00000, 00000  
 5:184 04224 24 05613 06243 C AMPQ, AZ101,, ZERO MANTISSA CHECK  
 5:185 04236 46 04572 01200 BE AZRO  
 5:186  
 5:187 04248 25 05622 14953 TD ANRM, FALSE,, CLEAR NORMALIZE FLAG  
 5:188 04260 16 05291 00000 TFM AZCNT, 00000,, CLEAR LEADING ZERO  
 COUNTER  
 5:189  
 5:190 04272 16 04319 05613 TFM \*+47, AMPQ  
 5:191 04284 22 04319 05276 S \*+35, AML  
 5:192 04296 11 04319 00001 AM \*+23, 00001  
 5:193 04308 43 04548 05613 BD AZCK, AMPQ,, LEADING ZERO CHECK  
 5:194  
 5:195 04320 26 06034 06243 TF AWK1, AZ101,, CLEAR WORK  
 5:196 04332 25 05622 14952 TD ANRM, TRUE,, SET NORMALIZE FLAG  
 5:197 04344 16 05286 00000 TFM AFLG, 00000  
 5:198 04356 16 05296 05613 TFM AMPA, AMPQ,, POINTS HI MANTISSA  
 ADDR  
 5:199  
 5:200 04368 12 05296 00001 AFLAG SM AMPA, 00001,, SEARCH FOR ORIGINAL  
 FLAG  
 5:201 04380 44 04368 05296 BNF AFLAG, AMPA, 11  
 5:202 04392 33 05296 00000 CF AMPA, 00000, 6,  
 5:203 CLEAR IT  
 5:204 04404 43 04464 05296 ADIGT BD ASF, AMPA, 11,  
 LEFT 1ST DIGIT TO SHIFT  
 5:205 04416 11 05291 00001 AM AZCNT, 00001,, COUNT LEADING ZEROS  
 5:206 04428 11 05286 00001 AM AFLG, 00001  
 5:207 04440 11 05296 00001 AM AMPA, 00001  
 5:208 04452 49 04404 00000 B ADIGT  
 5:209  
 5:210 04464 16 04530 05613 ASF TFM ASF2+6, AMPQ,, INITIALIZE TF P  
 ADDRESS  
 5:211 04476 32 05296 00000 SF AMPA, 00000, 6,  
 FLAG 1ST DIGIT

5:212 04488 26 06034 05613 TF AWK1, AMPQ,, NOW LEFT SHIFT  
 MANTISSA  
 5:213 04500 26 05613 06243 TF AMPQ, AZ101  
 5:214 04512 22 04530 05286 S \*+18, AFLG  
 5:215 04524 26 05613 06034 ASF2 TF AMPQ, AWK1,, SHIFT COMPLETE  
 5:216 04536 49 04824 00000 B EXADJ,,, GOTO EXPONENT ADJUST  
 5:217  
 5:218  
 5:219  
 5:220 \* ZERO CHECK GOTO MACHINE ZERO  
 5:221 04548 24 05613 06243 AZCK C AMPQ, AZ101,, ZERO MANTISSA CHECK  
 5:222 04560 47 04596 01200 BNE ACO  
 5:223 04572 16 05619  $\bar{0}0099$  AZRO TFM AEPQ, -99,, MAKE MACHINE ZERO  
 5:224 04584 49 05148 00000 B AMKFP,,, GOTO MAKE FP  
 5:225  
 5:226  
 5:227 \* NORMALIZE SHIFT RIGHT  
 5:228 \* - CARRY OUT- EXP ADJUST  
 5:229 04596 16 04710  $\bar{0}5397$  ACO TFM ACMF1+6, AMP,, INITIALIZE MF  
 INSTRUCTIONS  
 5:230 04608 16 04715  $\bar{0}5397$  TFM ACMF1+11, AMP  
 5:231 04620 16 04758  $\bar{0}5397$  TFM ACMF2+6, AMP,,  
 5:232 04632 16 04763  $\bar{0}5397$  TFM ACMF2+11, AMP  
 5:233 04644 43 04668 05621 BD \*+24, AOV  
 5:234 04656 49 04824 00000 B EXADJ,,, NO CARRY OUT GOTO EXP  
 ADJ  
 5:235 04668 22 04715 05276 S \*+47, AML  
 5:236 04680 11 04715  $\bar{0}0001$  AM \*+35, 00001  
 5:237 04692 22 04710 05276 S \*+18, AML  
 5:238 04704 71 05397 05397 ACMF1 MF AMP, AMP  
 5:239 04716 22 04763 05276 S \*+47, AML  
 5:240 04728 11 04763  $\bar{0}0001$  AM \*+35, 00001  
 5:241 04740 22 04758 05276 S \*+18, AML  
 5:242 04752 71 05505 05505 ACMF2 MF AMQ, AMQ  
 5:243 04764 26 05613 06243 TF AMPQ, AZ101,, CLEAR  
 5:244 04776 26 05613 05397 TF AMPQ, AMP  
 5:245 04788 21 05613 05505 FXAR2 A AMPQ, AMQ,, ARGs MAY REPLACE A  
 WITH S  
 5:246 04800 71 05612 05613 MF AMPQ-1, AMPQ  
 5:247 04812 26 05613 05612 TF AMPQ, AMPQ-1  
 5:248  
 5:249  
 5:250 \* ADJUST EXPONENT  
 5:251 \* ARITHMETIC OVERFLOW  
 5:252 \* MACHINE INFINITY  
 5:253 \* MANTISSA LEFT SHIFT FOR NORMALIZATION  
 5:254 04824 26 05619 06042 EXADJ TF AEPQ, AZ5  
 5:255 04836 26 05619 05403 TF AEPQ, AEP  
 5:256 04848 24 05403 05511 C AEP, AEQ  
 5:257 04860 46 04884 01300 BNL \*+24  
 5:258 04872 26 05619 05511 TF AEPQ, AEQ  
 5:259 04884 43 05088 05622 BD AEELS, ANRM,, NORMALIZE LEFT SHIFT  
 CHECK  
 5:260 04896 43 04920 05621 BD \*+24, AOV,,, ARITHMETIC OVERFLOW  
 CHECK  
 5:261 04908 49 05148 00000 B AMKFP

5:262

5:263 04920 14 05619 00099 CM AEPQ, 00099,, EXP 99 THEN MACH INF  
5:264 04932 46 04968 01300 BNL AINF  
  
5:265 04944 11 05619 00001 AM AEPQ, 1,, ARITH OV EXP ADJUST  
5:266 04956 49 05148 00000 B AMKFP  
  
5:267  
5:268 \* NORMALIZE SHIFT RIGHT-CARRY OUT  
5:269 \* EXPONENT OVERFLOW MACH INFINITY  
  
5:270 04968 16 05070 05613 AINF TFM AINF2+6, AMPQ,, INITIALIZE SF  
5:271 04980 44 05028 05613 BNF AINF1, AMPQ  
5:272 04992 26 05613 05929 TF AMPQ, A9-3,, MOVE NINES  
5:273 05004 32 05613 00000 SF AMPQ,,, REPLACE SIGN FLAG  
5:274 05016 49 05040 00000 B \*+24  
5:275 05028 26 05613 05929 AINF1 TF AMPQ, A9-3,, MOVE NINES  
5:276 05040 22 05070 05276 S \*+30, AML  
  
5:277 05052 11 05070 00001 AM \*+18, 00001  
5:278 05064 32 05613 00000 AINF2 SF AMPQ  
5:279 05076 49 05148 00000 B AMKFP  
  
5:280  
5:281 \* NORMALIZING SHIFT LEFT  
5:282 \* CHECK FOR EXP OVERFLOW  
5:283 \* SET TO MACHINE ZERO  
5:284 05088 22 05619 05291 AELS S AEPQ, AZCNT,, ADJ EXP FOR LEFT SHIFT  
  
5:285 05100 14 05619 00100 CM AEPQ, -100  
5:286 05112 47 05148 01200 BNE AMKFP  
  
5:287 05124 16 05619 00099 TFM AEPQ, -99  
5:288 05136 26 05613 06243 TF AMPQ, AZ101  
  
5:289  
5:290  
5:291 \* PUT SUM AND ADJUSTED EXPONENT  
5:292 \* INTO FLOATING POINT MM...MM EE  
5:293 05148 71 05618 05615 AMKFP MF AEPQ-1, AEPQ-4  
5:294 05160 26 08153 05619 TF PQFP, AEPQ  
5:295 05172 26 08151 05613 TF PQFP-2, AMPQ  
  
5:296  
5:297  
5:298 \* COMPARE FADD SUM TO A21 SUM  
5:299 \* A21RC EQ TRUE IF EQUAL OTW FALSE  
  
5:300 05184 17 09922 05212 BTM CF, \*+28,, COMPARE FLOATING SUBROUTINE  
  
5:301 05200 063600..306366 DSA A21D1, PQFP, A21RC  
  
5:302  
5:303  
5:304 \* SEND RETURN CODE TO CALLING PROGRAM  
5:305 05212 26 05247 03215 TF \*+35, A21-1,,  
  
5:306 05224 12 05247 00002 SM \*+23, 2,,  
5:307 05236 26 05254 00000 TF \*+18, 0,,  
5:308 05248 25 00000 06366 TD 0, A21RC,,  
  
5:309  
5:310  
5:311 \* RETURN  
  
5:312 05260 49 03215 00000 FACR B A21-1,,6, RETURN TO CALLING  
PROGRAM  
5:313

5:314  
 5:315  
 5:316  
 5:317  
 5:318 \* ----- WORK AREAS FOR A (21) INSTRUCTION

|                         |                                   |           |   |                              |
|-------------------------|-----------------------------------|-----------|---|------------------------------|
| 5:319                   | 05276 <del>0</del> 00000          | AML DC    | 5, 0,,,                                 | MANTISSA LENGTH              |
| 5:320<br>EQ)            | 05281 <del>0</del> 00000          | AED DC    | 5, 0,,,                                 | EXP DIFFERENCE D = ABS (EP-  |
| 5:321                   |                                   |           |   |                              |
| 5:322                   | 05286 <del>0</del> 00000          | AFLG DC   | 5, 0,,,                                 | MANTISSA FLAG ADDRESS        |
| 5:323<br>5:324          | 05291 <del>0</del> 00000          | AZCNT DC  | 5, 0,,,                                 | MANTISSA LEADING ZEROS COUNT |
| 5:325<br>5:326          | 05296 <del>0</del> 00000          | AMPA DC   | 5, 0,,,                                 | POINTER TO AMP               |
| 5:327                   | 05346 <del>0</del> 000000..000000 | DC        | 50, 0,,,                                | MP MANTISSA FIELD            |
| 5:328<br>CARRY/OVERFLOW | 05347 000000..000000              | DSC       | 50, 0,,,                                | SIZE IS 101 FOR              |
| 5:329                   | 05397 0                           | AMP DSC   | 1, 0                                    |                              |
| 5:330                   | 05398 @                           | DC        | 1, @                                    |                              |
| 5:331                   |                                   |           |   |                              |
| 5:332                   | 05403 <del>0</del> 00000          | AEP DC    | 5, 0,,,                                 | P EXPONENT                   |
| 5:333<br>5:334          | 05404 @                           | DC        | 1, @                                    |                              |
| 5:335                   | 05454 <del>0</del> 000000..000000 | DC        | 50, 0,,,                                | MQ MANTISSA FIELD            |
| 5:336<br>CARRY/OVERFLOW | 05455 000000..000000              | DSC       | 50, 0,,,                                | SIZE IS 101 FOR              |
| 5:337                   | 05505 0                           | AMQ DSC   | 1, 0                                    |                              |
| 5:338                   | 05506 @                           | DC        | 1, @                                    |                              |
| 5:339                   |                                   |           |   |                              |
| 5:340                   | 05511 <del>0</del> 00000          | AEQ DC    | 5, 0,,,                                 | Q EXPONENT                   |
| 5:341<br>5:342          | 05512 @                           | DC        | 1, @                                    |                              |
| 5:343                   | 05562 <del>0</del> 000000..000000 | DC        | 50, 0,,,                                | MP + MQ SUM MANTISSA FIELD   |
| 5:344                   | 05563 000000..000000              | DSC       | 50, 0,,,                                |                              |
| 5:345                   | 05613 0                           | AMPQ DSC  | 1, 0                                    |                              |
| 5:346                   | 05614 @                           | DC        | 1, @                                    |                              |
| 5:347                   |                                   |           |   |                              |
| 5:348                   | 05619 <del>0</del> 00000          | AEPQ DC   | 5, 0,,,                                 | FINAL EXPONENT               |
| 5:349<br>5:350          | 05620 @                           | DC        | 1, @                                    |                              |
| 5:351                   | 05621 <del>0</del>                | AOV DC    | 1, 0,,,                                 | OVERFLOW FLAG FOR CARRY OUT  |
| 5:352                   | 05622 <del>0</del>                | ANRM DC   | 1, 0,,,                                 | NORMALIZE FLAG               |
| 5:353<br>5:354          | *                                 |           | 123456789 123456789 123456789 123456789 |                              |
| 1234567890              |                                   |           |   |                              |
| 5:355                   | 05625 <del>4</del> 17271..47450@  | AOVM DAC  | 21,A21                                  | OVERFLOW MESSAGE@            |
| 5:356                   | 05667 <del>4</del> 17271..45000@  | AEQVM DAC | 31,A21                                  | EXponent OVERFLOW MESSAGE@   |

----- 6: fp40-fmul.sps -----

6:1 \* =====

6:2 \* FMUL TEST  
 6:3 \*  
 6:4 \*FMUL  
 6:5 \* ======  
 6:6  
 6:7 06371 00005 DS 5,,, RETURN ADDRESS FROM BTM  
 6:8 06372 41 00000 00000 FMTST NOP 00000, 00000  
 6:9  
 6:10 06384 34 00000 00102 RCTY  
 6:11 06396 34 00000 00102 RCTY  
 6:12 06408 39 13551 00100 WATY FMULT,,, MAIN FMUL TEST TITLE  
 6:13 06420 34 00000 00102 RCTY  
 6:14  
 6:15  
 6:16 \* INITIALIZE TABLE POINTER  
 6:17  
 6:18 06432 16 13644 00000 TFM FMINC, 0,, TABLE POINTER  
 6:19  
 6:20 \* POINT TO TEST DATA TABLES  
 6:21 \* RESET  
 6:22 06444 16 13664 13694 TFM FMTBL, FMTBI  
 6:23 06456 16 13669 13734 TFM FMTBL+5, FMTBP  
 6:24 06468 16 13674 13774 TFM FMTBL+10, FMTBQ  
 6:25 06480 26 13659 13664 TF FMTP, FMTBL  
 6:26 06492 26 13664 13669 TF FMTP+5, FMTBL+5  
 6:27 06504 26 13669 13674 TF FMTP+10, FMTBL+10  
 6:28  
 6:29 06516 41 00000 00000 FMNXT NOP  
 6:30  
 6:31 06528 21 13659 13644 A FMTP, FMINC,, ID MESSAGE TABLE  
 6:32 06540 14 13659 00000 CM FMTP, 00000, 6, RETURN ON ZERO ADDRESS  
 6:33 06552 46 06371 01200 BE FMTST-1,,,6,  
 6:34 RETURN  
 6:35 06564 21 13664 13644 A FMTP+5, FMINC,, MULTIPLICAND TABLE  
 6:36 06576 21 13669 13644 A FMTP+10, FMINC,, MULTIPLIERS TABLE  
 6:37  
 6:38 06588 16 13644 00005 TFM FMINC, 5  
 6:39  
 6:40 06600 26 13679 13659 TF FMI, FMTP,11  
 6:41 06612 26 13684 13664 TF FMP, FMTP+5,11  
 6:42 06624 26 13689 13669 TF FMQ, FMTP+10,11  
 6:43  
 6:44 \* START OF CURRENT FMUL TEST  
 6:45 06636 41 00000 00000 FMRPT NOP  
 6:46 06648 34 00000 00102 RCTY  
 6:47 06660 39 13679 00100 WATY FMI,,6, TEST TITLE  
 6:48 06672 34 00000 00101 SPTY  
 6:49  
 6:50 \*--- NEED TO PRESERVE MULTIPLICAND - MOVE TO FMPRD FIRST  
 6:51 \*--- AVOID TFL FOR FLOATING POINT TESTS  
 6:52

|             |                             |       |   |
|-------------|-----------------------------|-------|---|
| 6:53        | 06684 26 13911 13684        | TF    | FMPRD, FMP, 11, FMP POINTS TO EXPONENT            |
| 6:54        | 06696 12 13684 <u>00002</u> | SM    | FMP, 00002,, FMP NOW POINTS TO MANTISSA           |
| 6:55        | 06708 26 13909 13684        | TF    | FMPRD-2, FMP, 11,                                 |
| 6:56        | 06720 11 13684 <u>00002</u> | AM    | FMP, 00002,, FMA AGAIN POINTS TO EXPONENT         |
| 6:57        |                             |       |   |
| 6:58        | 06732 03 13911 13689        | FMUL  | FMPRD, FMQ, 11                                    |
| 6:59        |                             |       |   |
| 6:60        |                             | *     | INDICATOR CHECK                                   |
| 6:61        | 06744 47 06768 01400        | BNV   | *+24  |
| 6:62        | 06756 39 15015 00100        | WATY  | OVM1,,, OVERFLOW MESSAGE                          |
| 6:63        | 06768 47 06792 01500        | BNXV  | *+24  |
| 6:64        | 06780 39 15037 00100        | WATY  | XCKM1,,, EXPONENT OVERFLOW MESSAGE                |
| 6:65        |                             |       |   |
| 6:66        |                             | *     | CALL SUBROUTINE M23                               |
| 6:67        |                             | *     | M (23) MANTASSAS AND COMPUTE EXPONENTS            |
| 6:68        | 06792 17 06900 <u>06824</u> | BTM   | M23, *+32,, TRANSMIT RETURN ADDRESS               |
| 6:69        | 06808 <u>136841..114955</u> | DSA   | -FMP, -FMQ, FMPRD, STAT                           |
| 6:70        |                             |       |   |
| 6:71        |                             | *     | CHECK COMPARE STATUS                              |
| 6:72        |                             | *     | CALL ERROR ROUTINE AND RETURN ITS STATUS IN ESTAT |
| 6:73        |                             |       |   |
| 6:74        | 06824 17 09518 <u>06846</u> | BTM   | ERTN, *+22,, TRANSMIT ADDRESS OF NEXT             |
| INSTRUCTION |                             |       |   |
| 6:75        | 06840 <u>1495514954</u>     | DSA   | STAT, ESTAT                                       |
| 6:76        |                             |       |   |
| 6:77        | 06846 43 06870 14954        | BD    | FMEND, ESTAT                                      |
| 6:78        | 06858 49 06636 00000        | B     | FMRPT,,, RERUN TEST                               |
| 6:79        |                             |       |   |
| 6:80        | 06870 41 00000 00000        | FMEND | NOP 00000, 00000                                  |
| 6:81        | 06882 49 06516 00000        | B     | FMNXT,,, GOTO NEXT FMUL TEST                      |
| 6:82        |                             |       |   |

----- 7: fp41-fixmul.sps -----

|             |   |   |
|-------------|---|---|
| 7:1         | * | -----   |
| 7:2         | * | SUBROUTINE STATUS = M23(FP1, FP2, FP-PRODUCT)           |
| 7:3         | * | COMPARES FMUL PRODUCT WITH M(23)/EX-SUM                 |
| 7:4         | * | REF (1) 227-5630-1 IBM 1620 FLOATING POINT FEATURE CE   |
| MANUAL 1962 |   |   |
| 7:5         | * |   |
| 7:6         | * | VERIFIES FMUL RESULT BY USING M(23) TO MULTIPLY         |
| MANTISSAS   |   |   |
| 7:7         | * | AND SEPARATELY ADDS EXPONENTS.                          |
| 7:8         | * | FLOATING POINT NUMBER IS CREATED FROM M(23) PRODUCT AND |
| 7:9         | * | (ADJUSTED) SUM OF EXPONENTS                             |
| 7:10        | * |   |
| 7:11        | * | HANDLES CASES DESCRIBED IN REF (1) FLOATING MULTIPLY    |
| EXAMPLES    |   |   |
| 7:12        | * |   |
| 7:13        | * | FMUL EXAMPLE 1. NO EXPONENT MODIFY REQUIRED             |
| 7:14        | * | FMUL EXAMPLE 2. EXPONENT MODIFY REQUIRED                |
| 7:15        | * | FMUL EXAMPLE 3. DIGIT FORCE -- MACHINE INFINITY         |
| 7:16        | * | FMUL EXAMPLE 4. EXPONENT OVERFLOW -- MODIFY PE TO 99    |
| 7:17        | * | FMUL EXAMPLE 5. SPECIAL CASE 999 X 199                  |
| 7:18        | * |   |

7:19 \*  
 7:20 \* USAGE  
 7:21 \* BTM M23, \*+32,, TRANSMIT RETURN ADDRESS  
 7:22 \* DSA -FMP, -FMQ, FMPRD, STAT  
 7:23 \* NOP 00000, 00000,, RETURN TO HERE  
 7:24 \*  
 7:25 \* M23A1 = -FMP (INDIRECT ADDRESS) FLOATING POINT NUMBER  
 7:26 \* M23A2 = -FMQ (INDIRECT ADDRESS) FLOATING POINT NUMBER  
 7:27 \* M23D1 = FMPRD (DATA FIELD) FLOATING POINT FMUL PRODUCT  
 7:28 \* M23RC = STAT ( DATA, RETURN CODE )  
 7:29 \* RETURNS STATUS OF COMPARE  
 7:30 \*  
 7:31 \*  
 7:32 \*M23  
 7:33 \* -----  
 7:34 06898 00005 DS 5,, RETURN ADDRESS  
 7:35 06900 41 00000 00000 M23 NOP 00000, 00000  
 7:36  
 7:37 \* GET FIRST ARGUMENT (INDIRECT)  
 7:38 06912 26 06947 06899 TF \*+35, M23-1,,  
 7:39 06924 12 06947 00016 SM \*+23, 00016,,  
 7:40 06936 26 06971 00000 TF \*+35, 0,,  
 7:41 06948 33 06971 00000 CF \*+23  
 7:42 06960 26 08498 00000 TF M23A1, 0,,  
 7:43  
 7:44  
 7:45 \* GET SECOND ARGUMENT (INDIRECT)  
 7:46 06972 26 07007 06899 TF \*+35, M23-1,,  
 7:47 06984 12 07007 00011 SM \*+23, 00011,,  
 7:48 06996 26 07031 00000 TF \*+35, 0,,  
 7:49 07008 33 07031 00000 CF \*+23  
 7:50 07020 26 08503 00000 TF M23A2, 0,,  
 7:51  
 7:52  
 7:53 \* GET THIRD ARGUMENT  
 7:54 07032 26 07067 06899 TF \*+35, M23-1,,  
 7:55 07044 12 07067 00006 SM \*+23, 00006,,  
 7:56 07056 26 07079 00000 TF \*+23, 0,,  
 7:57 07068 26 08605 00000 TF M23D1, 0,, -- GETS EXP  
 7:58  
 7:59 07080 26 07115 07079 TF \*+35, \*-1,,  
 7:60 07092 12 07115 00002 SM \*+23, 00002,  
 7:61 07104 26 08603 00000 TF M23D1-2, 0,, -- GETS MANTISSA  
 7:62  
 7:63  
 7:64 \* ADD MP AND MQ EXPONENTS  
 7:65 07116 26 08159 08373 TF SUMEX, MZ5,, CLEAR  
 7:66 07128 21 08159 08498 A SUMEX, M23A1, 11, EXPONENT 1  
 7:67 07140 21 08159 08503 A SUMEX, M23A2, 11, EXPONENT 2  
 7:68  
 7:69 \* MANTISSA  
 7:70 07152 12 08498 00002 SM M23A1, 00002  
 7:71 07164 12 08503 00002 SM M23A2, 00002  
 7:72 07176 26 07848 08498 TF MPMA, M23A1, 11, MANTISSA 1

7:73 07188 26 07949 08503 TF MQMA, M23A2, 11, MANTISSA 2  
 7:74  
 7:75 \* MANTISSA LENGTH OF FIRST ARG  
 7:76 \* L REPRESENTS MANTISSA LENGTH

7:77 07200 16 07748 00001 TFM FML, 00001  
 7:78 07212 26 08493 08498 TF MPMAA, M23A1  
 7:79

7:80 07224 12 08493 00001 ML SM MPMAA, 1

7:81 07236 11 07748 00001 AM FML, 1

7:82 07248 44 07224 08493 BNF ML, MPMAA, 11

7:83  
 7:84 \* IF EXP SUM GT 100 THEN RESULT IS MACHINE INFINITY 99...9  
 99  
 7:85 \* IF EXP SUM EQ 100 ONLY SET EXP TO 99

7:86 07260 14 08159 00100 CM SUMEX, 100  
 7:87 07272 47 07392 01300 BL MUL,,, SUM EXP LT 100  
 7:88 07284 46 07380 01200 BE ME100,,, SUM EXP EQ 100  
 7:89  
 7:90 07296 26 08159 08262 TF SUMEX, M9,,, SUM EXP GT 100 SET SUM  
 EXP TO 99

7:91 07308 26 08363 08260 TF MWK1-2, M9-2,,, COPY 9S TO WORK AREA  
 7:92 07320 22 07350 07748 S \*+30, FML

7:93 07332 11 07350 00001 AM \*+18, 00001,  
 7:94 07344 32 08363 00000 SF MWK1-2  
 7:95 07356 26 08050 08363 TF PQMA, MWK1-2,,, 9S IN MANTISSA PRODUCT  
 FIELD

7:96 07368 49 07596 00000 B MKFP,,, GOTO MAKE FP NUM FOR  
 COMPARE

7:97  
 7:98 07380 26 08159 08262 ME100 TF SUMEX, M9,,, SUM EXP EQ 100 SET SUM  
 EXP TO 99

7:99  
 7:100 \* MULTIPLY MANTISSAS (P,Q) USING M (23)

7:101 07392 26 08478 08424 MUL TF PAREA, MZ100,6, 100 ZEROS TO PRODUCT  
 AREA (99)

7:102 07404 23 07848 07949 M MPMA, MQMA,, P MANTISSA X Q

MANTISSA

7:103  
 7:104 \* CHECK FOR EXPONENT CASE - PRODUCT LENGTH LT 2L  
 7:105 \* HIGH ORDER 0  
 7:106 \* PROD-HIGH = 100 -2L

7:107 07416 16 08483 00100 TFM PAR1, 00100,,, PRODUCT AREA (99) + 1  
 7:108 07428 22 08483 07748 S PAR1, FML,,, 100 - L  
 7:109 07440 22 08483 07748 S PAR1, FML,,, 100 - L

MOVE FLAG

7:110 07452 43 07548 08483 BD PRSH, PAR1,11, IF HIGH ORDER 0 THEN

7:111 07464 26 08488 08483 TF PARW, PAR1

7:112 07476 11 08488 00001 AM PARW, 00001,

7:113 07488 71 08488 08483 MF PARW, PAR1,611

7:114 07500 12 07748 00001 SM FML, 00001,

7:115

7:116 07512 14 08159 00099 CM SUMEX, 00099,, IF OV KEEP 99  
7:117 07524 46 07548 01200 BE PRSH

7:118 07536 12 08159 00001 SM SUMEX, 00001,, MODIFY EXP IF HI ORD  
DIGIT EQ 0

7:119 \* SHIFT PRODUCT L (MANTISSA LENGTH) AND MOVE SIGN FLAG

7:120 07548 26 08488 08478 PRSH TF PARW, PAREA  
7:122 07560 22 08488 07748 S PARW, FML,,

7:123 07572 71 08488 08478 MF PARW, PAREA,611

7:124

7:125 \* MOVE PRODUCT TO RESULT AREA

7:126 07584 26 08050 08488 TF PQMA, PARW , 11,

7:127

7:128 \* PUT PRODUCT AND EXPONENT SUM INTO FLOATING POINT  
MM...MM EE

7:129 07596 41 00000 00000 MKFP NOP 0000,0000  
7:130 07608 71 08158 08155 MF SUMEX-1, SUMEX-4  
7:131 07620 26 08153 08159 TF PQFP, SUMEX  
7:132 07632 26 08151 08050 TF PQFP-2, PQMA

7:133

7:134 \* COMPARE FMUL PRODUCT TO M23 PRODUCT

7:135 \* M23RC EQ TRUE IF EQUAL OTW FALSE

7:136 07644 17 09922 07672 BTM CF, \*+28,, TRANSMIT RETURN ADDRESS

7:137 07660 086050..308607 DSA M23D1, PQFP, M23RC

7:138

7:139 \* SEND RETURN CODE TO CALLING PROGRAM

7:140 07672 26 07707 06899 TF \*+35, M23-1,,

7:141 07684 12 07707 00001 SM \*+23, 1,,  
7:142 07696 26 07714 00000 TF \*+18, 0,,  
7:143 07708 25 00000 08607 TD 0, M23RC,,

7:144

7:145 07720 41 00000 00000 FMCR NOP 00000, 00000

7:146

7:147 \* RETURN

7:148 07732 49 06899 00000 B M23-1,,6, RETURN TO CALLING  
PROGRAM

7:149

7:150 \* ----- WORK AREAS FOR M (23) INSTRUCTION

7:151 07748 00000 FML DC 5, 0,,, MANTISSA LENGTH  
7:152

7:153 07798 000000..000000 DC 50, 0,,, MP MANTISSA FIELD  
7:154 07799 000000..000000 DSC 49, 0,,,  
7:155 07848 0 MPMA DSC 1, 0,,,  
7:156 07849 @ DC 1, @

7:157

7:158 07899 000000..000000 DC 50, 0,,, MQ MANTISSA FIELD  
7:159 07900 000000..000000 DSC 49, 0,,,  
7:160 07949 0 MQMA DSC 1, 0,,,  
7:161 07950 @ DC 1, @

7:162



7:204 08605 00 M23D1 DC 2, 0,,, FMUL CALLING PROGRAM PRODUCT  
 7:205 08606 @ DC 1, @  
 7:206

7:207 08607 0 M23RC DC 1, 0,,, RETURN CODE

----- 8: fp50-subroutines.sps -----

```

8:1          *
=====
8:2          *      SET SENSE SWITCHES SUBROUTINE
8:3          *
=====
8:4
8:5 08612 00005 DS 5,,, RETURN ADDRESS FROM BTM
8:6 08614 41 00000 00000 SETS1 NOP
8:7          * CALL SUBROUTINE PRINT SENSE SWITCH STATUS
8:8 08626 17 08704 08638 BTM SWSTA, *+12,, TRANSMIT RETURN ADDRESS
8:9 08638 34 00000 00102 RCTY
8:10
8:11          * SET SENSE SWITCHES AND CONTINUE
8:12 08650 39 09341 00100 WATY SWMS5
8:13 08662 34 00000 00102 RCTY
8:14 08674 48 00000 00000 H
8:15

8:16 08686 49 08613 00000 B SETS1-1,,6, RETURN
8:17
8:18
8:19          * -----
8:20          * SUBROUTINE PRINT SENSE SWITCH STATUS
8:21          *
8:22          *SWSTA
8:23          * -----
8:24
8:25 08702 00005 DS 5,, SWATA RETURN ADDRESS
8:26 08704 41 00000 00000 SWSTA NOP
8:27 08716 34 00000 00102 RCTY
8:28 08728 39 09185 00100 WATY SWMS2
8:29 08740 34 00000 00102 RCTY
8:30
8:31 08752 39 09245 00100 WATY SWMS3
8:32 08764 34 00000 00102 RCTY
8:33
8:34 08776 39 09291 00100 WATY SWMS4
8:35 08788 34 00000 00102 RCTY
8:36
8:37 08800 39 09065 00100 WATY SWST,,, SENSE SWITCH STATUS
8:38 08812 34 00000 00102 RCTY
8:39 08824 39 09105 00100 WATY SWMS1
8:40 08836 34 00000 00102 RCTY
8:41
8:42 08848 46 08884 00100 BC1 *+36,,, SW1
8:43 08860 39 09169 00100 WATY OFF
8:44 08872 49 08896 00000 B *+24
8:45 08884 39 09153 00100 WATY ON
8:46
8:47 08896 46 08932 00200 BC2 *+36,,, SW2
8:48 08908 39 09169 00100 WATY OFF
8:49 08920 49 08944 00000 B *+24
8:50 08932 39 09153 00100 WATY ON
8:51

```

8:52 08944 46 08980 00300 BC3 \*+36,,, SW3  
 8:53 08956 39 09169 00100 WATY OFF  
 8:54 08968 49 08992 00000 B \*+24  
 8:55 08980 39 09153 00100 WATY ON  
 8:56  
 8:57 08992 46 09028 00400 BC4 \*+36,,, SW4  
 8:58 09004 39 09169 00100 WATY OFF  
 8:59 09016 49 09040 00000 B \*+24  
 8:60 09028 39 09153 00100 WATY ON  
 8:61  
 8:62 09040 34 00000 00102 RCTY  
 8:63  
 8:64 09052 49 08703 00000 B SWSTA-1,,6, RETURN TO CALLING PROGRAM  
 8:65  
 8:66  
 8:67 09065 624555..64620@ SWST DAC 20,SENSE SWITCH STATUS@  
 8:68  
 8:69 09105 007100..00740@ SWMS1 DAC 24, 1 2 3 4@  
 8:70 09153 565500..00000@ ON DAC 8,ON @  
 8:71 09169 564646..00000@ OFF DAC 8,OFF @  
 8:72  
 8:73 09185 006266..56590@ SWMS2 DAC 30, SW1 ON = DO NOT PRINT ERROR@  
 8:74 09245 006266..62630@ SWMS3 DAC 23, SW2 ON = REPEAT TEST@  
 8:75 09291 006266..56590@ SWMS4 DAC 25, SW3 ON = HALT ON ERROR@  
 8:76 09341 624563..00000@ SWMS5 DAC 43,SET SENSE SWITCHES THEN CONTINUE@  
 8:77 09427 594559..00000@ SWMS6 DAC 43,RERUN MODE. SW2 OFF = EXIT RERUN@  
 8:78  
 8:79  
 8:80  
 8:81  
 8:82 \* -----  
 8:83 \* SUBROUTINE FL COMMAND TESTS ERROR ROUTINE  
 8:84 \* ERRC = ERTN(FL-CMD-TEST-STAT)  
 8:85 \*  
 8:86 \* CALLING  
 8:87 \* BTM ERTN, \*+23,, TRANSMIT ADDRESS OF NEXT  
**INSTRUCTION**  
 8:88 \* DSA FL-CMD-TEST-STAT, ESTAT  
 8:89 \* NEXT INSTRUCTION  
 8:90 \*  
 8:91 \* ARGS  
 8:92 \* FL-CMD-TEST-STAT IS EA1  
 8:93 \*  
 8:94 \* RETURN CODE  
 8:95 \* ERRC 0 = RERUN TEST 1 = GOTO NEXT TEST  
 8:96 \*  
 8:97 \* ERROR ROUTINE  
 8:98 \* SW1 ON = DO NOT PRINT ERROR  
 8:99 \* SW2 ON = REPEAT TEST  
 8:100 \* SW3 ON = HALT ON ERROR  
 8:101 \*  
 8:102 \*ERTN  
 8:103 \* -----

8:104  
 8:105 09516 00005 DS 5,, ERTN RETURN ADDRESS  
 8:106 09518 41 00000 00000 ERTN NOP  
 8:107  
 8:108  
 8:109 \* GET FIRST ARGUMENT  
 8:110 09530 26 09565 09517 TF \*+35, ERTN-1,,  
 8:111 09542 12 09565 00006 SM \*+23, 6,,  
 8:112 09554 26 09577 00000 TF \*+23, 0,,  
 8:113 09566 26 09914 00000 TF EA1, 0,, FL-CMD-TEST-STAT 1=PASS  
 0=FAIL  
 8:114  
 8:115 09578 25 09915 14953 TD ERRC, FALSE,, RET CD DEFAULT IS RERUN TEST  
 8:116  
 8:117 09590 43 09662 09914 BD ERPAS, EA1,, CHECK PASS OR FAIL  
 8:118  
 8:119 09602 46 09626 00100 BC1 ERSW3  
 8:120 09614 39 14957 00100 WATY FAIL  
 8:121  
 8:122 09626 47 09686 00300 ERSW3 BNC3 ERSW2  
 8:123 09638 48 00000 00000 H 00000, 00000  
 8:124 09650 49 09686 00000 B ERSW2  
 8:125  
 8:126 09662 41 00000 00000 ERPAS NOP 00000, 00000  
 8:127 09674 39 14991 00100 WATY PASS  
 8:128  
 8:129 09686 41 00000 00000 ERSW2 NOP  
 8:130 09698 46 09734 00200 BC2 ERPSW,,, IF SW2 ON REPEAT TEST  
 8:131 09710 25 09915 14952 TD ERRC, TRUE,, GOTO NEXT TEST  
 8:132 09722 49 09842 00000 B ERRT,,, RETURN  
 8:133  
 8:134 \* CALL SUBROUTINE PRINT SENSE SWITCH STATUS  
 8:135 09734 17 08704 09746 ERPSW BTM SWSTA, \*+12,, TRANSMIT RETURN ADDRESS  
 8:136 09746 34 00000 00102 RCTY  
 8:137  
 8:138 \* SET SENSE SWITCHES AND CONTINUE  
 8:139 09758 34 00000 00102 RCTY  
 8:140 09770 34 00000 00102 RCTY  
 8:141 09782 39 09427 00100 WATY SWMS6  
 8:142 09794 34 00000 00102 RCTY  
 8:143 09806 39 09341 00100 WATY SWMS5  
 8:144 09818 34 00000 00102 RCTY  
 8:145 09830 48 00000 00000 H  
 8:146  
 8:147  
 8:148 09842 41 00000 00000 ERRT NOP  
 8:149 \* MOVE RETURN CODE TO THIRD ARGUMENT  
 8:150 09854 26 09889 09517 TF \*+35, ERTN-1,,  
 8:151 09866 12 09889 00001 SM \*+23, 1,,  
 8:152 09878 26 09896 00000 TF \*+18, 0,,  
 8:153 09890 25 00000 09915 TD 0, ERRC,,  
 8:154  
 8:155 \* RETURN  
 8:156 09902 49 09517 00000 B ERTN-1,,6, RETURN TO CALLING  
 PROGRAM  
 8:157  
 8:158 \* ======  
 8:159 09914 0 EA1 DC 1, 0,,, FL-CMD-TEST-STAT

8:160 09915 0 ERRC DC 1, 0,,, ERROR RTN RETURN CODE 0 = RERUN  
 TEST 1 = GOTO NEXT TEST  
 8:161  
 8:162  
 8:163 \* -----  
 8:164 \* SUBROUTINE STATUS = CF(FP1, FP2)  
 8:165 \* COMPARE FLOATING  
 8:166 \*  
 8:167 \* COMPARES TWO FLOATING POINT NUMBERS BY  
 8:168 \* COMPARING THE MANTISSA FIELDS AND EXPONENT FIELDS  
 8:169 \*  
 8:170 \* CALLING  
 8:171 \* BTM CF, \*+28,, TRANSMIT ADDRESS OF NEXT  
 INSTRUCTION  
 8:172 \* DSA FP1, FP2, STATUS  
 8:173 \* NEXT INSTRUCTION  
 8:174 \*  
 8:175 \* CFA1 ADDRESS OF FLOATING POINT NUMBER 1  
 8:176 \*  
 8:177 \* CFA2 ADDRESS OF FLOATING POINT NUMBER 2  
 8:178 \*  
 8:179 \* CFRC ADDRESS OF RETURN CODE (STATUS)  
 8:180 \* TRUE = EQ, FALSE = NE  
 8:181 \*  
 8:182 \* RETURN ADDRESS (BTM) CF-1  
 8:183 \*  
 8:184 \*CF  
 8:185 \* -----  
 8:186  
 8:187 09920 00005 DS 5,, CF RETURN ADDRESS  
 8:188 09922 41 00000 00000 CF NOP 00000, 00000  
 8:189  
 8:190 \* GET FIRST ARGUMENT  
 8:191 09934 26 09969 09921 TF \*+35, CF-1,,  
 8:192 09946 12 09969 00012 SM \*+23, 12,,  
 8:193 09958 26 09981 00000 TF \*+23, 0,,  
 8:194 09970 16 10310 000000 TFM CFA1, 0,,  
 8:195 09982 44 10030 09981 BNF CFSEC, \*-1,, IF NOT INDIRECT GET 2ND ARG  
 8:196 09994 26 10029 09981 TF \*+35, \*-13  
 8:197 10006 33 10029 00000 CF \*+23  
 8:198 10018 26 10310 00000 TF CFA1, 0  
 8:199  
 8:200 \* GET SECOND ARGUMENT  
 8:201 10030 26 10065 09921 CFSEC TF \*+35, CF-1,,  
 8:202 10042 12 10065 00007 SM \*+23, 7,,  
 8:203 10054 26 10077 00000 TF \*+23, 0,,  
 8:204 10066 16 10315 000000 TFM CFA2, 0,,  
 8:205 10078 44 10126 10077 BNF CFINI, \*-1,, IF NOT INDIRECT GOTO INIT RC  
 8:206 10090 26 10125 10077 TF \*+35, \*-13  
 8:207 10102 33 10125 00000 CF \*+23  
 8:208 10114 26 10315 00000 TF CFA2, 0  
 8:209  
 8:210  
 8:211 \* INITIALIZATION  
 8:212 10126 25 10316 14952 CFINI TD CFRC, TRUE,, SET RETURN CODE  
 8:213  
 8:214 \* COMPARE EXPONENTS

8:215 10138 24 10310 10315 C CFA1, CFA2, 611, COMPARE EXPs  
 8:216 10150 46 10174 01200 BE MANT,,, EXPs ARE EQUAL GOTO  
 MANTISSA  
 8:217 10162 25 10316 14953 TD CFRC, FALSE,, EXPs ARE NE SET RETURN  
 CODE  
 8:218  
 8:219 \* GET MANTISSA ADDRESSES  
 8:220 10174 12 10310 00002 MANT SM CFA1, 00002,, BACKUP 2 TO GET  
 MANTISSA OF A  
 8:221 10186 12 10315 00002 SM CFA2, 00002,, BACKUP 2 TO GET  
 MANTISSA OF B  
 8:222  
 8:223 \* COMPARE MANTASSAS  
 8:224 10198 24 10310 10315 C CFA1, CFA2, 611 RETURN IF EQ  
 8:225 10210 46 10234 01200 BE CFRT,,, SET RETURN CODE  
 8:226 10222 25 10316 14953 TD CFRC, FALSE,,  
 8:227  
 8:228 10234 41 00000 00000 CFRT NOP  
 8:229 \* MOVE RETURN CODE (CFRC) TO THIRD ARGUMENT  
 8:230 10246 26 10281 09921 TF \*+35, CF-1,,  
 8:231 10258 12 10281 00002 SM \*+23, 2,,  
 8:232 10270 26 10288 00000 TF \*+18, 0,,  
 8:233 10282 25 00000 10316 TD 0, CFRC,,  
 8:234  
 8:235 \* RETURN  
 8:236 10294 49 09921 00000 B CF-1,, 6, RETURN TO CALLING  
 PROGRAM  
 8:237  
 8:238 \* ======  
 8:239 10310 00000 CFA1 DC 5, 0  
 8:240 10315 00000 CFA2 DC 5, 0  
 8:241 10316 0 CFRC DC 1, 0,,, RETURN CODE 1=TRUE  
 0=FALSE  
 8:242  
 8:243

----- 9: fp60-symbols-dend.sps -----

9:1 \* ======  
 9:2 \* ======  
 9:3 \* -----  
 9:4 \* SYMBOLS  
 9:5 \* -----  
 9:6 \* ======  
 9:7  
 9:8 10319 465356..59630@ TITLE DAC 35, FLOATING POINT DIAGNOSTICS - START@  
 9:9 10389 465356..55440@ DONE DAC 33, FLOATING POINT DIAGNOSTICS - END@  
 9:10  
 9:11  
 9:12 \* WORK AREAS  
 9:13  
 9:14 10503 000000..000000 DC 50, 0





9:110 \* TABLE POINTER  
 9:111 11728 00015 ASTBL DSA 15  
 9:112  
 9:113 \* LIST OF FADD DATA TABLES  
 9:114 11733 117781..311888 FATBL DSA FATBI, FATBP, FATBQ  
 9:115  
 9:116 \* LIST OF FSUB DATA TABLES  
 9:117 11748 119431..812053 FSTBL DSA FSTBI, FSTBP, FSTBQ  
 9:118  
 9:119  
 9:120 11763 00005 FAI DS 5  
 9:121 11768 00005 FAP DS 5  
 9:122 11773 00005 FAQ DS 5  
 9:123  
 9:124 \* FADD TEST IDENTIFICATION MESSAGES  
 9:125 11778 122091..713439 FATBI DSA FAI1, FAI2, FAI3, FAI4, FAI5, FAI7, FAI8,  
 FAI9, FAI10, FAI11  
 9:126 11828 00000 DSA 00000  
 9:127  
 9:128 \* P DATA  
 9:129 11833 123121..013542 FATBP DSA FAP1, FAP2, FAP3, FAP4, FAP5, FAP7, FAP8,  
 FAP9, FAP10, FAP11  
 9:130 11883 00000 DSA 00000  
 9:131  
 9:132 \* Q DATA  
 9:133 11888 123181..613548 FATBQ DSA FAQ1, FAQ2, FAQ3, FAQ4, FAQ5, FAQ7, FAQ8,  
 FAQ9, FAQ10, FAQ11  
 9:134 11938 00000 DSA 00000  
 9:135  
 9:136  
 9:137 \*\*\*\*\* FSUB TEST DATA 7 AND 8 DIFFER -- P NEGATIVE  
 9:138 \* FSUB TEST IDENTIFICATION MESSAGES  
 9:139 11943 122091..713439 FSTBI DSA FAI1, FAI2, FAI3, FAI4, FAI5, FSI7, FSI8,  
 FAI9, FAI10, FAI11  
 9:140 11993 00000 DSA 00000  
 9:141  
 9:142 \* P DATA  
 9:143 11998 123121..013542 FSTBP DSA FAP1, FAP2, FAP3, FAP4, FAP5, FSP7, FSP8,  
 FAP9, FAP10, FAP11  
 9:144 12048 00000 DSA 00000  
 9:145  
 9:146 \* Q DATA  
 9:147 12053 123181..613548 FSTBQ DSA FAQ1, FAQ2, FAQ3, FAQ4, FAQ5, FSQ7, FSQ8,  
 FAQ9, FAQ10, FAQ11  
 9:148 12103 00000 DSA 00000  
 9:149  
 9:150  
 9:151  
 9:152 \* FADD DATA SYMBOLS

9:153

9:154 12153  $\bar{0}00000..000000$  DC 50, 0  
 9:155 12154 000000..000000 DSC 50, 0

9:156 12205  $\bar{0}0$  FASUM DC 2, 0  
 9:157 12206 @ DC 1, @

9:158

9:159 \* REF 1. 227-5630-1 IBM 1620 FLOATING POINT FEATURE CE

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9:160 \* EXAMPLES 1-5 EXPONENT CONFIGURATION  
 9:161 \* EXAMPLES 6-11 FRACTION (MANTISSA) CONFIGURATION  
 9:162 \* EXAMPLES 1 AND 6 SAME  
 9:163  
 9:164

9:165 12209  $\bar{4}56771..64630@$  FAI1 DAC 50, EX1 PE = QE / D = 0 NO NORMALIZING - NO CARRY OUT @  
 9:166

9:167 12310  $\bar{1}23$  DC 3, 123

9:168 12312  $\bar{0}4$  FAP1 DC 2, 04  
 9:169 12313 @ DC 1, @  
 9:170

9:171 12316  $\bar{2}46$  DC 3, 246

9:172 12318  $\bar{0}4$  FAQ1 DC 2, 04  
 9:173 12319 @ DC 1, @  
 9:174  
 9:175

9:176 12321  $\bar{4}56772..43490@$  FAI2 DAC 50, EX2 PE GT QE - D LT L QF SHIFTED RT TO ALIGN DECI @  
 9:177

9:178 12422  $\bar{1}23$  DC 3, 123

9:179 12424  $\bar{0}6$  FAP2 DC 2, 06  
 9:180 12425 @ DC 1, @  
 9:181

9:182 12428  $\bar{2}46$  DC 3, 246

9:183 12430  $\bar{0}4$  FAQ2 DC 2, 04  
 9:184 12431 @ DC 1, @  
 9:185  
 9:186

9:187 12433  $\bar{4}56773..00000@$  FAI3 DAC 50, EX3 PE GT QE - D GT L - Q DISCARDED-RESULT IS P @  
 9:188

9:189 12534  $\bar{1}23$  DC 3, 123

9:190 12536  $\bar{0}8$  FAP3 DC 2, 08  
 9:191 12537 @ DC 1, @  
 9:192

9:193 12540  $\bar{2}46$  DC 3, 246

9:194 12542  $\bar{0}3$  FAQ3 DC 2, 03

9:195 12543 @ DC 1, @  
 9:196  
 9:197  
 9:198 12545  $\bar{4}56774..49540$ @ FAI4 DAC 50, EX4 PE LT QE- D LT L PF SHIFTED RT TO ALIGN  
 DECIM@  
 9:199  
 9:200 12646  $\bar{1}23$  DC 3, 123  
 9:201 12648  $\bar{0}2$  FAP4 DC 2, 02  
 9:202 12649 @ DC 1, @  
 9:203  
 9:204 12652  $\bar{2}46$  DC 3, 246  
 9:205 12654  $\bar{0}4$  FAQ4 DC 2, 04  
 9:206 12655 @ DC 1, @  
 9:207  
 9:208  
 9:209 12657  $\bar{4}56775..00000$ @ FAI5 DAC 50, EX5 PE LT QE - D GT L P DISCARDED-RESULT IS  
 Q @  
 9:210  
 9:211 12758  $\bar{1}23$  DC 3, 123  
 9:212 12760  $\bar{0}3$  FAP5 DC 2, 03  
 9:213 12761 @ DC 1, @  
 9:214  
 9:215 12764  $\bar{2}46$  DC 3, 246  
 9:216 12766  $\bar{0}8$  FAQ5 DC 2, 08  
 9:217 12767 @ DC 1, @  
 9:218  
 9:219  
 9:220 \* EX 6 NO NORMALIZING REQUIRED---NO CARRY OUT -- SAME AS  
 EX1  
 9:221  
 9:222 12769  $\bar{4}56777..63000$ @ FAI7 DAC 50, EX7 NORMALIZING SHIFT RT - CARRY OUT- EXP  
 ADJUST @  
 9:223  
 9:224 12870  $\bar{4}23$  DC 3, 423  
 9:225 12872  $\bar{0}4$  FAP7 DC 2, 04  
 9:226 12873 @ DC 1, @  
 9:227  
 9:228 12876  $\bar{7}45$  DC 3, 745  
 9:229 12878  $\bar{0}4$  FAQ7 DC 2, 04  
 9:230 12879 @ DC 1, @  
 9:231  
 9:232  
 9:233 12881  $\bar{4}56777..63000$ @ FSI7 DAC 49, EX7 (SUB) NORM SHIFT RT - CARRY OUT- EXP  
 ADJUST @  
 9:234  
 9:235 \* FSUB TEST - P IS NEGATIVE  
 9:236

|       |       |                       |      |                           |   |
|-------|-------|-----------------------|------|---------------------------|---|
| 9:237 | 12980 | <u>423</u>            |      | DC                        | 3, -423   |
| 9:238 | 12982 | <u>04</u>             | FSP7 | DC                        | 2, 04   |
| 9:239 | 12983 | <u>@</u>              |      | DC                        | 1, @  |
| 9:240 |       |                       |      |                           |   |
| 9:241 | 12986 | <u>745</u>            |      | DC                        | 3, 745  |
| 9:242 | 12988 | <u>04</u>             | FSQ7 | DC                        | 2, 04   |
| 9:243 | 12989 | <u>@</u>              |      | DC                        | 1, @  |
| 9:244 |       |                       |      |                           |   |
| 9:245 |       |                       |      |                           |   |
| 9:246 | 12991 | <u>456778..55460@</u> | FAI8 | DAC                       | 50, EX8 NORM SHIFT RT-CARRY OT CAUSES EXP OV<br>MACH INF@ |
| 9:247 |       |                       |      |                           |   |
| 9:248 | 13092 | <u>423</u>            |      | DC                        | 3, 423  |
| 9:249 | 13094 | <u>99</u>             | FAP8 | DC                        | 2, 99   |
| 9:250 | 13095 | <u>@</u>              |      | DC                        | 1, @  |
| 9:251 |       |                       |      |                           |   |
| 9:252 | 13098 | <u>745</u>            |      | DC                        | 3, 745  |
| 9:253 | 13100 | <u>99</u>             | FAQ8 | DC                        | 2, 99   |
| 9:254 | 13101 | <u>@</u>              |      | DC                        | 1, @  |
| 9:255 |       |                       |      |                           |   |
| 9:256 | 13103 | <u>456778..55460@</u> | FSI8 | DAC                       | 50, EX8 (SUB) NORM SHIFT RT-CARRY OT- EXP OV<br>MACH INF@ |
| 9:257 |       |                       |      |                           |   |
| 9:258 |       |                       | *    | FSUB TEST - P IS NEGATIVE |   |
| 9:259 |       |                       |      |                           |   |
| 9:260 | 13204 | <u>423</u>            |      | DC                        | 3, -423   |
| 9:261 | 13206 | <u>99</u>             | FSP8 | DC                        | 2, 99   |
| 9:262 | 13207 | <u>@</u>              |      | DC                        | 1, @  |
| 9:263 |       |                       |      |                           |   |
| 9:264 | 13210 | <u>745</u>            |      | DC                        | 3, 745  |
| 9:265 | 13212 | <u>99</u>             | FSQ8 | DC                        | 2, 99   |
| 9:266 | 13213 | <u>@</u>              |      | DC                        | 1, @  |
| 9:267 |       |                       |      |                           |   |
| 9:268 | 13215 | <u>456779..79790@</u> | FAI9 | DAC                       | 50, EX9 ZERO FRACTION RESULT - MACHINE ZERO<br>0...0 -99@ |
| 9:269 |       |                       |      |                           |   |
| 9:270 | 13316 | <u>345</u>            |      | DC                        | 3, 345  |
| 9:271 | 13318 | <u>04</u>             | FAP9 | DC                        | 2, 04   |
| 9:272 | 13319 | <u>@</u>              |      | DC                        | 1, @  |
| 9:273 |       |                       |      |                           |   |
| 9:274 | 13322 | <u>345</u>            |      | DC                        | 3, -345   |
| 9:275 | 13324 | <u>04</u>             | FAQ9 | DC                        | 2, 04   |
| 9:276 | 13325 | <u>@</u>              |      | DC                        | 1, @  |
| 9:277 |       |                       |      |                           |   |

9:278

9:279 13327 456771..44510@ FAI10 DAC 50,EX10 NORMALIZING SHIFT LEFT - SHIFT LEFT-  
EXP ADJ@  
9:280

9:281 13428 345 DC 3, 345

9:282 13430 04 FAP10 DC 2, 04  
9:283 13431 @ DC 1, @  
9:284

9:285 13434 321 DC 3, -321

9:286 13436 04 FAQ10 DC 2, 04  
9:287 13437 @ DC 1, @  
9:288  
9:289

9:290 13439 456771..56000@ FAI11 DAC 50,EX11 NORMALIZING SHIFT LEFT- EXP OV MACHINE  
ZERO @  
9:291

9:292 13540 345 DC 3, 345

9:293 13542 99 FAP11 DC 2, -99  
9:294 13543 @ DC 1, @  
9:295

9:296 13546 321 DC 3, -321

9:297 13548 99 FAQ11 DC 2, -99  
9:298 13549 @ DC 1, @  
9:299

9:300 \*

9:301 \*FADD TEST DATA END -----

9:303

9:304 \*FMUL TEST DATA START  
9:305  
9:306

9:307 13551 333333..33330@ FMULT DAC 45,===== FLOATING MULTIPLY (FMUL) TESTS  
=====@

9:308  
9:309 \* FMUL TESTS TABLE  
9:310

9:311 13644 00000 FMINC DC 5, 0,, TABLE POINTER

9:312  
9:313 \* TABLE POINTER

9:314 13659 00015 FMTP DS 15

9:315  
9:316 \* LIST OF TABLES

9:317 13664 136941..413774 FMTBL DSA FMTBI, FMTBP, FMTBQ

9:318

9:319 13679 00005 FMI DS 5

9:320 13684 00005 FMP DS 5

9:321 13689 00005 FMQ DS 5

9:322

9:323

9:324 \* FMUL TEST IDENTIFICATION MESSAGES



9:364 \* FMUL EXAMPLE 1. NO EXPONENT MODIFY REQUIRED  
 9:365  
 9:366 \* 123456789 123456789 123456789 123456789  
 1234567890

9:367 14215  $\bar{4}56771..04000@$  FMI1 DAC 50,EX1A NO EXP MOD REQUIRED +MP,+MQ, +EP,+EQ  
 (FMUL) @  
 9:368

9:369 14316  $\bar{3}45$  DC 3, 345

9:370 14318  $\bar{0}7$  FMP1 DC 2, 07  
 9:371 14319 @ DC 1, @  
 9:372

9:373 14322  $\bar{4}32$  DC 3, 432

9:374 14324  $\bar{0}3$  FMQ1 DC 2, 03  
 9:375 14325 @ DC 1, @  
 9:376

9:377

9:378 14327  $\bar{4}56771..04000@$  FMI10 DAC 50,EX1B NO EXP MOD REQUIRED -MP,+MQ, -EP,+EQ  
 (FMUL) @  
 9:379

9:380 14428  $\bar{3}4\bar{5}$  DC 3, -345

9:381 14430  $\bar{0}7$  FMP10 DC 2, -07  
 9:382 14431 @ DC 1, @  
 9:383

9:384 14434  $\bar{4}32$  DC 3, 432

9:385 14436  $\bar{0}3$  FMQ10 DC 2, 03  
 9:386 14437 @ DC 1, @  
 9:387

9:388

9:389 14439  $\bar{4}56771..04000@$  FMI11 DAC 50,EX1C NO EXP MOD REQUIRED -MP,-MQ, -EP,-EQ  
 (FMUL) @  
 9:390

9:391 14540  $\bar{3}4\bar{5}$  DC 3, -345

9:392 14542  $\bar{0}7$  FMP11 DC 2, -07  
 9:393 14543 @ DC 1, @  
 9:394

9:395 14546  $\bar{4}3\bar{2}$  DC 3, -432

9:396 14548  $\bar{0}3$  FMQ11 DC 2, -03  
 9:397 14549 @ DC 1, @  
 9:398

9:399

9:400 \* FMUL EXAMPLE 2. EXPONENT MODIFY REQUIRED  
 9:401

9:402 \* 123456789 123456789 123456789 123456789  
 1234567890

9:403 14551  $\bar{4}56772..04000@$  FMI2 DAC 49,EX2 EXPONENT MOD REQ-ED +MP,+MQ, +EP,+EQ  
 (FMUL) @  
 9:404

9:405 14650  $\bar{1}23$  DC 3, 123  
 9:406 14652  $\bar{0}2$  FMP2 DC 2, 02  
 9:407 14653 @ DC 1, @  
 9:408  
 9:409 14656  $\bar{2}46$  DC 3, 246  
 9:410 14658  $\bar{0}4$  FMQ2 DC 2, 04  
 9:411 14659 @ DC 1, @  
 9:412  
 9:413  
 9:414 \* FMUL EXAMPLE 3. DIGIT FORCE -- MACHINE INFINITY  
 9:415  
 9:416 \* 123456789 123456789 123456789 123456789 123456789 1234  
 9:417 14661  $\bar{4}56773..04000@$  FMI3 DAC 44,EX3 DIGIT FORCE -- MACHINE INFINITY (FMUL) @  
 9:418  
 9:419 14750  $\bar{3}45$  DC 3, 345  
 9:420 14752  $\bar{4}3$  FMP3 DC 2, 43  
 9:421 14753 @ DC 1, @  
 9:422  
 9:423 14756  $\bar{4}32$  DC 3, 432  
 9:424 14758  $\bar{6}4$  FMQ3 DC 2, 64  
 9:425 14759 @ DC 1, @  
 9:426  
 9:427  
 9:428 \* FMUL EXAMPLE 4. EXPONENT OVERFLOW -- MODIFY PE TO 99  
 9:429  
 9:430 \* 123456789 123456789 123456789 123456789 123456789  
 123456789  
 9:431 14761  $\bar{4}56774..04000@$  FMI4 DAC 49,EX4 EXPONENT OVERFLOW -- MODIFY PE TO 99  
 (FMUL) @  
 9:432  
 9:433 14860  $\bar{1}23$  DC 3, 123  
 9:434 14862  $\bar{3}8$  FMP4 DC 2, 38  
 9:435 14863 @ DC 1, @  
 9:436  
 9:437 14866  $\bar{2}46$  DC 3, 246  
 9:438 14868  $\bar{6}2$  FMQ4 DC 2, 62  
 9:439 14869 @ DC 1, @  
 9:440  
 9:441  
 9:442 \* FMUL EXAMPLE 5. SPECIAL CASE 999 X 199  
 9:443  
 9:444 \* 123456789 123456789 123456789 123456789  
 12345  
 9:445 14871  $\bar{4}56775..04000@$  FMI5 DAC 35,EX5 SPECIAL CASE 999 X 199 (FMUL) @  
 9:446  
 9:447 14942  $\bar{9}99$  DC 3, 999

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9:448 14944 01          FMP5  DC      2, 01
9:449 14945 @           DC      1, @
9:450

9:451 14948 199         DC      3, 199

9:452 14950 01          FMQ5  DC      2, 01
9:453 14951 @           DC      1, @
9:454
9:455
9:456          *FMUL TEST DATA END -----
9:457
9:458          * CONSTANTS AND STATUS CODES

9:459 14952 1           TRUE   DC      1,1

9:460 14953 0           FALSE  DC      1,0
9:461

9:462 14954 0           ESTAT  DC      1,0,,, FL COMMAND TEST ERR RTN STATUS
9:463 14955 0           STAT    DC      1,0,,, FL COMMAND TEST STATUS
9:464

9:465 14957 333333..33330@ FAIL   DAC    17,==== FAILED ====@
9:466 14991 202057..202000@ PASS   DAC    11,--PASSED--@
9:467
9:468

9:469 15012 0           OV     DC      1,0,,,      OVERFLOW FLAG
9:470 15013 0           XCK   DC      1,0,,,      EXPONENT OVERFLOW FLAG
9:471

9:472 15015 005665..660000@ OVM1   DAC    11, OVERFLOW @
9:473 15037 004567..660000@ XCKM1  DAC    20, EXPONENT OVERFLOW @
9:474
9:475
9:476          * -----
9:477          * -----
9:478          * -----
9:479 00402             DEND   FPMAIN

```

Symbol Cross-Reference Table  
=====

| Id | Source File           |
|----|-----------------------|
| -- | -----                 |
| 1  | fp10-main.sps         |
| 2  | fp20-tftest.sps       |
| 3  | fp21-tftest.sps       |
| 4  | fp30-fadd.sps         |
| 5  | fp31-fixadd.sps       |
| 6  | fp40-fmul.sps         |
| 7  | fp41-fixmul.sps       |
| 8  | fp50-subroutines.sps  |
| 9  | fp60-symbols-dend.sps |

| Symbol | Addr. | Type   | Defined | References |       |       |       |       |       |
|--------|-------|--------|---------|------------|-------|-------|-------|-------|-------|
| <hr/>  |       |        |         |            |       |       |       |       |       |
| A21    | 03216 | <inst> | 5:45    | 4:101      | 5:49  | 5:58  | 5:66  | 5:74  | 5:305 |
| 5:312  |       |        |         |            |       |       |       |       |       |
| A21A1  | 06253 | DC     | 5:388   | 5:62       | 5:90  | 5:102 | 5:106 | 5:113 |       |
| A21A2  | 06258 | DC     | 5:389   | 5:70       | 5:91  | 5:103 | 5:107 |       |       |
| A21D1  | 06360 | DC     | 5:393   | 5:77       | 5:81  | 5:301 |       |       |       |
| A21RC  | 06366 | DC     | 5:396   | 5:301      | 5:308 |       |       |       |       |
| A9     | 05932 | DC     | 5:366   | 5:272      | 5:275 |       |       |       |       |
| ACMF1  | 04704 | <inst> | 5:238   | 5:229      | 5:230 |       |       |       |       |
| ACMF2  | 04752 | <inst> | 5:242   | 5:231      | 5:232 |       |       |       |       |
| ACO    | 04596 | <inst> | 5:229   | 5:222      |       |       |       |       |       |
| ADDM   | 04104 | <inst> | 5:165   | 5:122      | 5:142 | 5:161 |       |       |       |
| ADIGT  | 04404 | <inst> | 5:204   | 5:208      |       |       |       |       |       |
| ADJP   | 03780 | <inst> | 5:129   | 5:123      |       |       |       |       |       |
| ADJP1  | 03840 | <inst> | 5:135   | 5:130      |       |       |       |       |       |
| ADJQ   | 03936 | <inst> | 5:147   | 5:124      |       |       |       |       |       |
| ADJQ1  | 04008 | <inst> | 5:154   | 5:149      |       |       |       |       |       |
| ADSA   | 03118 | DSA    | 4:102   | 4:16       |       |       |       |       |       |
| AED    | 05281 | DC     | 5:320   | 5:95       | 5:96  | 5:97  | 5:98  | 5:129 | 5:136 |
| 5:148  |       |        |         | 5:155      |       |       |       |       |       |
| AEELS  | 05088 | <inst> | 5:284   | 5:259      |       |       |       |       |       |
| AEOVVM | 05667 | DAC    | 5:356   |            |       |       |       |       |       |
| AEP    | 05403 | DC     | 5:332   | 5:88       | 5:90  | 5:96  | 5:121 | 5:151 | 5:255 |
| 5:256  |       |        |         |            |       |       |       |       |       |
| AEHQ   | 05619 | DC     | 5:348   | 5:132      | 5:151 | 5:223 | 5:254 | 5:255 | 5:258 |
| 5:263  |       |        |         | 5:265      | 5:284 | 5:285 | 5:287 | 5:293 | 5:293 |
| 5:294  |       |        |         |            |       |       |       |       |       |
| AEQ    | 05511 | DC     | 5:340   | 5:89       | 5:91  | 5:97  | 5:121 | 5:132 | 5:256 |
| 5:258  |       |        |         |            |       |       |       |       |       |
| AFLAG  | 04368 | <inst> | 5:200   | 5:201      |       |       |       |       |       |
| AFLG   | 05286 | DC     | 5:322   | 5:197      | 5:206 | 5:214 |       |       |       |
| AINF   | 04968 | <inst> | 5:270   | 5:264      |       |       |       |       |       |
| AINF1  | 05028 | <inst> | 5:275   | 5:271      |       |       |       |       |       |
| AINF2  | 05064 | <inst> | 5:278   | 5:270      |       |       |       |       |       |
| AL     | 03696 | <inst> | 5:115   | 5:117      |       |       |       |       |       |
| ALDON  | 01146 | <inst> | 1:154   |            |       |       |       |       |       |
| AMKFP  | 05148 | <inst> | 5:293   | 5:133      | 5:152 | 5:224 | 5:261 | 5:266 | 5:279 |
| 5:286  |       |        |         |            |       |       |       |       |       |
| AML    | 05276 | DC     | 5:319   | 5:112      | 5:116 | 5:129 | 5:139 | 5:148 | 5:158 |
| 5:191  |       |        |         |            |       |       |       |       |       |
| AMP    | 05397 | DSC    | 5:329   | 5:235      | 5:237 | 5:239 | 5:241 | 5:276 |       |
| 5:141  |       |        |         | 5:104      | 5:106 | 5:135 | 5:137 | 5:137 | 5:138 |
| 5:232  |       |        |         | 5:141      | 5:150 | 5:169 | 5:229 | 5:230 | 5:231 |
| AMPA   | 05296 | DC     | 5:325   | 5:238      | 5:238 | 5:244 |       |       |       |
| 5:202  |       |        |         | 5:113      | 5:115 | 5:117 | 5:198 | 5:200 | 5:201 |
| 5:204  |       |        |         | 5:204      | 5:207 | 5:211 |       |       |       |
| AMPAAP | 06248 | DC     | 5:386   |            |       |       |       |       |       |
| AMPQ   | 05613 | DSC    | 5:345   | 5:131      | 5:150 | 5:168 | 5:169 | 5:170 | 5:184 |
| 5:190  |       |        |         |            |       |       |       |       |       |
| 5:221  |       |        |         | 5:193      | 5:198 | 5:210 | 5:212 | 5:213 | 5:215 |
| 5:247  |       |        |         | 5:243      | 5:244 | 5:245 | 5:246 | 5:246 | 5:247 |
| 5:288  |       |        |         | 5:270      | 5:271 | 5:272 | 5:273 | 5:275 | 5:278 |
|        |       |        |         | 5:295      |       |       |       |       |       |

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|-------|-------|--------|-------|-------|-------|-------|-------|-------|-------|
| AMQ   | 05505 | DSC    | 5:337 | 5:105 | 5:107 | 5:131 | 5:154 | 5:156 | 5:156 |
| 5:157 |       |        |       | 5:160 | 5:160 | 5:170 | 5:242 | 5:242 | 5:245 |
| ANRM  | 05622 | DC     | 5:352 | 5:166 | 5:187 | 5:196 | 5:259 |       |       |
| AOV   | 05621 | DC     | 5:351 | 5:167 | 5:175 | 5:233 | 5:260 |       |       |
| AOVM  | 05625 | DAC    | 5:355 |       |       |       |       |       |       |
| APQFP | 05829 | DC     | 5:359 |       |       |       |       |       |       |
| ASF   | 04464 | <inst> | 5:210 | 5:204 |       |       |       |       |       |
| ASF2  | 04524 | <inst> | 5:215 | 5:210 |       |       |       |       |       |
| ASHFT | 04212 | <inst> | 5:183 | 5:174 |       |       |       |       |       |
| ASTBL | 11728 | DS     | 9:111 | 4:42  | 4:43  | 4:44  | 4:52  | 4:53  | 4:54  |
| 4:60  |       |        |       | 4:61  | 4:64  | 4:65  | 4:69  | 4:70  | 4:71  |
| AWK1  | 06034 | DC     | 5:371 | 5:195 | 5:212 | 5:215 |       |       |       |
| AZ100 | 06142 | DSC    | 5:379 |       |       |       |       |       |       |
| AZ101 | 06243 | DSC    | 5:383 | 5:104 | 5:105 | 5:168 | 5:184 | 5:195 | 5:213 |
| 5:221 |       |        |       | 5:243 | 5:288 |       |       |       |       |
| AZ2   | 06037 | DC     | 5:374 |       |       |       |       |       |       |
| AZ5   | 06042 | DC     | 5:375 | 5:88  | 5:89  | 5:95  | 5:254 |       |       |
| AZCK  | 04548 | <inst> | 5:221 | 5:176 | 5:193 |       |       |       |       |
| AZCNT | 05291 | DC     | 5:323 | 5:188 | 5:205 | 5:284 |       |       |       |
| AZRO  | 04572 | <inst> | 5:223 | 5:185 |       |       |       |       |       |
| BTSUB | 02392 | <inst> | 3:18  | 2:131 | 3:24  |       |       |       |       |
| CF    | 09922 | <inst> | 8:188 | 3:23  | 5:300 | 7:136 | 8:191 | 8:201 | 8:230 |
| 8:236 |       |        |       |       |       |       |       |       |       |
| CFA1  | 10310 | DC     | 8:239 | 8:194 | 8:198 | 8:215 | 8:220 | 8:224 |       |
| CFA2  | 10315 | DC     | 8:240 | 8:204 | 8:208 | 8:215 | 8:221 | 8:224 |       |
| CFINI | 10126 | <inst> | 8:212 | 8:205 |       |       |       |       |       |
| CFRC  | 10316 | DC     | 8:241 | 8:212 | 8:217 | 8:226 | 8:233 |       |       |
| CFRT  | 10234 | <inst> | 8:228 | 8:225 |       |       |       |       |       |
| CFSEC | 10030 | <inst> | 8:201 | 8:195 |       |       |       |       |       |
| DONE  | 10389 | DAC    | 9:9   | 1:157 |       |       |       |       |       |
| EA1   | 09914 | DC     | 8:159 | 8:113 | 8:117 |       |       |       |       |
| ERPAS | 09662 | <inst> | 8:126 | 8:117 |       |       |       |       |       |
| ERPSW | 09734 | <inst> | 8:135 | 8:130 |       |       |       |       |       |
| ERRC  | 09915 | DC     | 8:160 | 8:115 | 8:131 | 8:153 |       |       |       |
| ERRT  | 09842 | <inst> | 8:148 | 8:132 |       |       |       |       |       |
| ERSW2 | 09686 | <inst> | 8:129 | 8:122 | 8:124 |       |       |       |       |
| ERSW3 | 09626 | <inst> | 8:122 | 8:119 |       |       |       |       |       |
| ERTN  | 09518 | <inst> | 8:106 | 2:141 | 4:107 | 6:74  | 8:110 | 8:150 | 8:156 |
| ESTAT | 14954 | DC     | 9:462 | 2:142 | 2:144 | 4:108 | 4:110 | 6:75  | 6:77  |
| EXADJ | 04824 | <inst> | 5:254 | 5:216 | 5:234 |       |       |       |       |
| FACR  | 05260 | <inst> | 5:312 |       |       |       |       |       |       |
| FAEND | 03186 | <inst> | 4:113 | 4:110 |       |       |       |       |       |
| FAI   | 11763 | DS     | 9:120 | 4:69  | 4:76  |       |       |       |       |
| FAI1  | 12209 | DAC    | 9:165 | 9:125 | 9:139 |       |       |       |       |
| FAI10 | 13327 | DAC    | 9:279 | 9:125 | 9:139 |       |       |       |       |
| FAI11 | 13439 | DAC    | 9:290 | 9:125 | 9:139 |       |       |       |       |
| FAI2  | 12321 | DAC    | 9:176 | 9:125 | 9:139 |       |       |       |       |
| FAI3  | 12433 | DAC    | 9:187 | 9:125 | 9:139 |       |       |       |       |
| FAI4  | 12545 | DAC    | 9:198 | 9:125 | 9:139 |       |       |       |       |
| FAI5  | 12657 | DAC    | 9:209 | 9:125 | 9:139 |       |       |       |       |
| FAI7  | 12769 | DAC    | 9:222 | 9:125 |       |       |       |       |       |
| FAI8  | 12991 | DAC    | 9:246 | 9:125 |       |       |       |       |       |
| FAI9  | 13215 | DAC    | 9:268 | 9:125 | 9:139 |       |       |       |       |
| FAIL  | 14957 | DAC    | 9:465 | 8:120 |       |       |       |       |       |
| FAINC | 11713 | DC     | 9:108 | 4:32  | 4:60  | 4:64  | 4:65  | 4:67  |       |
| FALSE | 14953 | DC     | 9:460 | 2:65  | 5:166 | 5:167 | 5:187 | 8:115 | 8:217 |
| 8:226 |       |        |       |       |       |       |       |       |       |
| FANXT | 02826 | <inst> | 4:57  | 4:45  | 4:115 |       |       |       |       |
| FAP   | 11768 | DS     | 9:121 | 4:70  | 4:82  | 4:83  | 4:84  | 4:85  | 4:102 |
| FAP1  | 12312 | DC     | 9:168 | 9:129 | 9:143 |       |       |       |       |

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|-------|-------|--------|-------|-------|-------|-------|-------|-------|
| FAP10 | 13430 | DC     | 9:282 | 9:129 | 9:143 |       |       |       |
| FAP11 | 13542 | DC     | 9:293 | 9:129 | 9:143 |       |       |       |
| FAP2  | 12424 | DC     | 9:179 | 9:129 | 9:143 |       |       |       |
| FAP3  | 12536 | DC     | 9:190 | 9:129 | 9:143 |       |       |       |
| FAP4  | 12648 | DC     | 9:201 | 9:129 | 9:143 |       |       |       |
| FAP5  | 12760 | DC     | 9:212 | 9:129 | 9:143 |       |       |       |
| FAP7  | 12872 | DC     | 9:225 | 9:129 |       |       |       |       |
| FAP8  | 13094 | DC     | 9:249 | 9:129 |       |       |       |       |
| FAP9  | 13318 | DC     | 9:271 | 9:129 | 9:143 |       |       |       |
| FAQ   | 11773 | DS     | 9:122 | 4:71  | 4:89  | 4:102 |       |       |
| FAQ1  | 12318 | DC     | 9:172 | 9:133 | 9:147 |       |       |       |
| FAQ10 | 13436 | DC     | 9:286 | 9:133 | 9:147 |       |       |       |
| FAQ11 | 13548 | DC     | 9:297 | 9:133 | 9:147 |       |       |       |
| FAQ2  | 12430 | DC     | 9:183 | 9:133 | 9:147 |       |       |       |
| FAQ3  | 12542 | DC     | 9:194 | 9:133 | 9:147 |       |       |       |
| FAQ4  | 12654 | DC     | 9:205 | 9:133 | 9:147 |       |       |       |
| FAQ5  | 12766 | DC     | 9:216 | 9:133 | 9:147 |       |       |       |
| FAQ7  | 12878 | DC     | 9:229 | 9:133 |       |       |       |       |
| FAQ8  | 13100 | DC     | 9:253 | 9:133 |       |       |       |       |
| FAQ9  | 13324 | DC     | 9:275 | 9:133 | 9:147 |       |       |       |
| FARIT | 03042 | <inst> | 4:89  | 4:12  | 4:34  |       |       |       |
| FARPT | 02946 | <inst> | 4:74  | 4:111 |       |       |       |       |
| FASUM | 12205 | DC     | 9:156 | 4:82  | 4:84  | 4:89  | 4:102 |       |
| FATBI | 11778 | DSA    | 9:125 | 4:39  | 9:114 |       |       |       |
| FATBL | 11733 | DSA    | 9:114 | 4:39  | 4:40  | 4:41  | 4:42  | 4:43  |
| FATBP | 11833 | DSA    | 9:129 | 4:40  | 9:114 |       |       | 4:44  |
| FATBQ | 11888 | DSA    | 9:133 | 4:41  | 9:114 |       |       |       |
| FATST | 02466 | <inst> | 4:7   | 1:137 | 1:144 | 4:10  | 4:14  | 4:18  |
| FIRST | 00462 | <inst> | 1:111 |       |       |       |       |       |
| FMCR  | 07720 | <inst> | 7:145 |       |       |       |       |       |
| FMEND | 06870 | <inst> | 6:80  | 6:77  |       |       |       |       |
| FMI   | 13679 | DS     | 9:319 | 6:40  | 6:47  |       |       |       |
| FMI0  | 13915 | DAC    | 9:349 |       |       |       |       |       |
| FMI1  | 14215 | DAC    | 9:367 | 9:325 |       |       |       |       |
| FMI10 | 14327 | DAC    | 9:378 | 9:325 |       |       |       |       |
| FMI11 | 14439 | DAC    | 9:389 | 9:325 |       |       |       |       |
| FMI2  | 14551 | DAC    | 9:403 | 9:325 |       |       |       |       |
| FMI3  | 14661 | DAC    | 9:417 | 9:325 |       |       |       |       |
| FMI4  | 14761 | DAC    | 9:431 | 9:325 |       |       |       |       |
| FMI5  | 14871 | DAC    | 9:445 | 9:325 |       |       |       |       |
| FMINC | 13644 | DC     | 9:311 | 6:18  | 6:31  | 6:35  | 6:36  | 6:38  |
| FML   | 07748 | DC     | 7:151 | 7:77  | 7:81  | 7:92  | 7:108 | 7:109 |
| 7:122 |       |        |       |       |       |       |       |       |
| FMNXT | 06516 | <inst> | 6:29  | 6:81  |       |       |       |       |
| FMP   | 13684 | DS     | 9:320 | 6:41  | 6:53  | 6:54  | 6:55  | 6:56  |
| FMP0  | 14109 | DC     | 9:353 |       |       |       |       |       |
| FMP1  | 14318 | DC     | 9:370 | 9:329 |       |       |       |       |
| FMP10 | 14430 | DC     | 9:381 | 9:329 |       |       |       |       |
| FMP11 | 14542 | DC     | 9:392 | 9:329 |       |       |       |       |
| FMP2  | 14652 | DC     | 9:406 | 9:329 |       |       |       |       |
| FMP3  | 14752 | DC     | 9:420 | 9:329 |       |       |       |       |
| FMP4  | 14862 | DC     | 9:434 | 9:329 |       |       |       |       |
| FMP5  | 14944 | DC     | 9:448 | 9:329 |       |       |       |       |
| FMPRD | 13911 | DC     | 9:341 | 6:53  | 6:55  | 6:58  | 6:69  |       |
| FMQ   | 13689 | DS     | 9:321 | 6:42  | 6:58  | 6:69  |       |       |
| FMQ0  | 14212 | DC     | 9:360 |       |       |       |       |       |
| FMQ1  | 14324 | DC     | 9:374 | 9:333 |       |       |       |       |
| FMQ10 | 14436 | DC     | 9:385 | 9:333 |       |       |       |       |
| FMQ11 | 14548 | DC     | 9:396 | 9:333 |       |       |       |       |
| FMQ2  | 14658 | DC     | 9:410 | 9:333 |       |       |       |       |
| FMQ3  | 14758 | DC     | 9:424 | 9:333 |       |       |       |       |
| FMQ4  | 14868 | DC     | 9:438 | 9:333 |       |       |       |       |
| FMQ5  | 14950 | DC     | 9:452 | 9:333 |       |       |       |       |

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|--------|-------|--------|-------|-------|-------|-------|-------|-------|-------|
| FMRPT  | 06636 | <inst> | 6:45  | 6:78  |       |       |       |       |       |
| FMTBI  | 13694 | DSA    | 9:325 | 6:22  | 9:317 |       |       |       |       |
| FMTBL  | 13664 | DSA    | 9:317 | 6:22  | 6:23  | 6:24  | 6:25  | 6:26  | 6:27  |
| FMTBP  | 13734 | DSA    | 9:329 | 6:23  | 9:317 |       |       |       |       |
| FMTBQ  | 13774 | DSA    | 9:333 | 6:24  | 9:317 |       |       |       |       |
| FMTP   | 13659 | DS     | 9:314 | 6:25  | 6:26  | 6:27  | 6:31  | 6:32  | 6:35  |
| 6:36   |       |        |       |       |       |       |       |       |       |
|        |       |        |       | 6:40  | 6:41  | 6:42  |       |       |       |
| FMTST  | 06372 | <inst> | 6:8   | 1:150 | 6:33  |       |       |       |       |
| FMULT  | 13551 | DAC    | 9:307 | 6:12  |       |       |       |       |       |
| FPMAIN | 00402 | <inst> | 1:98  | 9:479 | 9:479 |       |       |       |       |
| FSI7   | 12881 | DAC    | 9:233 | 9:139 |       |       |       |       |       |
| FSI8   | 13103 | DAC    | 9:256 | 9:139 |       |       |       |       |       |
| FSP7   | 12982 | DC     | 9:238 | 9:143 |       |       |       |       |       |
| FSP8   | 13206 | DC     | 9:261 | 9:143 |       |       |       |       |       |
| FSQ7   | 12988 | DC     | 9:242 | 9:147 |       |       |       |       |       |
| FSQ8   | 13212 | DC     | 9:265 | 9:147 |       |       |       |       |       |
| FSTBI  | 11943 | DSA    | 9:139 | 4:49  | 9:117 |       |       |       |       |
| FSTBL  | 11748 | DSA    | 9:117 | 4:49  | 4:50  | 4:51  | 4:52  | 4:53  | 4:54  |
| FSTBP  | 11998 | DSA    | 9:143 | 4:50  | 9:117 |       |       |       |       |
| FSTBQ  | 12053 | DSA    | 9:147 | 4:51  | 9:117 |       |       |       |       |
| FXAR1  | 04164 | <inst> | 5:170 | 5:52  |       |       |       |       |       |
| FXAR2  | 04788 | <inst> | 5:245 | 5:54  |       |       |       |       |       |
| M23    | 06900 | <inst> | 7:35  | 6:68  | 7:38  | 7:46  | 7:54  | 7:140 | 7:148 |
| M23A1  | 08498 | DC     | 7:199 | 7:42  | 7:66  | 7:70  | 7:72  | 7:78  |       |
| M23A2  | 08503 | DC     | 7:200 | 7:50  | 7:67  | 7:71  | 7:73  |       |       |
| M23D1  | 08605 | DC     | 7:204 | 7:57  | 7:61  | 7:137 |       |       |       |
| M23RC  | 08607 | DC     | 7:207 | 7:137 | 7:143 |       |       |       |       |
| M9     | 08262 | DC     | 7:179 | 7:90  | 7:91  | 7:98  |       |       |       |
| MANT   | 10174 | <inst> | 8:220 | 8:216 |       |       |       |       |       |
| ME100  | 07380 | <inst> | 7:98  | 7:88  |       |       |       |       |       |
| MKFP   | 07596 | <inst> | 7:129 | 7:96  |       |       |       |       |       |
| ML     | 07224 | <inst> | 7:80  | 7:82  |       |       |       |       |       |
| MPMA   | 07848 | DSC    | 7:155 | 7:72  | 7:102 |       |       |       |       |
| MPMAA  | 08493 | DC     | 7:197 | 7:78  | 7:80  | 7:82  |       |       |       |
| MQMA   | 07949 | DSC    | 7:160 | 7:73  | 7:102 |       |       |       |       |
| MUL    | 07392 | <inst> | 7:101 | 7:87  |       |       |       |       |       |
| MWK1   | 08365 | DC     | 7:184 | 7:91  | 7:94  | 7:95  |       |       |       |
| MZ100  | 08424 | DSC    | 7:190 | 7:101 |       |       |       |       |       |
| MZ2    | 08368 | DC     | 7:187 |       |       |       |       |       |       |
| MZ5    | 08373 | DC     | 7:188 | 7:65  |       |       |       |       |       |
| OFF    | 09169 | DAC    | 8:71  | 8:43  | 8:48  | 8:53  | 8:58  |       |       |
| ON     | 09153 | DAC    | 8:70  | 8:45  | 8:50  | 8:55  | 8:60  |       |       |
| OV     | 15012 | DC     | 9:469 |       |       |       |       |       |       |
| OVM1   | 15015 | DAC    | 9:472 | 4:94  | 6:62  |       |       |       |       |
| PAR1   | 08483 | DC     | 7:194 | 7:107 | 7:108 | 7:109 | 7:110 | 7:111 | 7:113 |
| PAREA  | 08478 | DC     | 7:193 | 7:101 | 7:121 | 7:123 |       |       |       |
| PARW   | 08488 | DC     | 7:195 | 7:111 | 7:112 | 7:113 | 7:121 | 7:122 | 7:123 |
| 7:126  |       |        |       |       |       |       |       |       |       |
| PASS   | 14991 | DAC    | 9:466 | 8:127 |       |       |       |       |       |
| PQFP   | 08153 | DC     | 7:170 | 5:294 | 5:295 | 5:301 | 7:131 | 7:132 | 7:137 |
| PQMA   | 08050 | DSC    | 7:165 | 7:95  | 7:126 | 7:132 |       |       |       |
| PRSH   | 07548 | <inst> | 7:121 | 7:110 | 7:117 |       |       |       |       |
| RETAD  | 02460 | DS     | 3:35  | 2:130 | 3:31  |       |       |       |       |
| SETS1  | 08614 | <inst> | 8:6   | 1:113 | 8:16  |       |       |       |       |
| STAT   | 14955 | DC     | 9:463 | 2:65  | 2:135 | 2:142 | 3:24  | 4:102 | 4:108 |
| 6:69   |       |        |       |       |       |       |       |       |       |
|        |       |        |       | 6:75  |       |       |       |       |       |
| SUBTB  | 02754 | <inst> | 4:49  | 4:35  |       |       |       |       |       |
| SUMEX  | 08159 | DC     | 7:173 | 7:65  | 7:66  | 7:67  | 7:86  | 7:90  | 7:98  |
| 7:116  |       |        |       |       |       |       |       |       |       |
|        |       |        |       | 7:118 | 7:130 | 7:130 | 7:131 |       |       |
| SWMS1  | 09105 | DAC    | 8:69  | 8:39  |       |       |       |       |       |

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|-------|-------|--------|-------|-------|-------|-------|-------|-------|
| SWMS2 | 09185 | DAC    | 8:73  | 8:28  |       |       |       |       |
| SWMS3 | 09245 | DAC    | 8:74  | 8:31  |       |       |       |       |
| SWMS4 | 09291 | DAC    | 8:75  | 8:34  |       |       |       |       |
| SWMS5 | 09341 | DAC    | 8:76  | 8:12  | 8:143 |       |       |       |
| SWMS6 | 09427 | DAC    | 8:77  | 8:141 |       |       |       |       |
| SWST  | 09065 | DAC    | 8:67  | 8:37  |       |       |       |       |
| SWSTA | 08704 | <inst> | 8:26  | 8:8   | 8:64  | 8:135 |       |       |
| TBTFL | 02112 | <inst> | 2:126 | 2:106 |       |       |       |       |
| TER   | 02220 | <inst> | 2:141 | 2:81  | 2:101 | 2:122 | 2:134 |       |
| TEXCK | 02184 | <inst> | 2:133 | 2:71  | 2:80  | 2:100 | 2:121 |       |
| TFD   | 10797 | DS     | 9:42  | 2:53  | 2:71  | 2:76  | 2:77  | 2:91  |
|       |       |        |       |       |       |       |       | 2:95  |
| 2:107 |       |        |       | 2:110 | 2:112 | 2:118 | 2:126 | 2:127 |
| TFD1  | 11035 | DC     | 9:60  | 9:50  |       |       |       |       |
| TFD2  | 11237 | DC     | 9:67  | 9:50  |       |       |       |       |
| TFD3  | 11375 | DC     | 9:74  | 9:50  |       |       |       |       |
| TFD4  | 11537 | DC     | 9:82  | 9:50  |       |       |       |       |
| TFD5  | 11707 | DC     | 9:92  | 9:50  |       |       |       |       |
| TFEND | 02266 | <inst> | 2:147 | 2:144 |       |       |       |       |
| TFI   | 10792 | DS     | 9:41  | 2:52  | 2:57  |       |       |       |
| TFI1  | 10869 | DAC    | 9:56  | 9:46  |       |       |       |       |
| TFI2  | 11039 | DAC    | 9:63  | 9:46  |       |       |       |       |
| TFI3  | 11241 | DAC    | 9:70  | 9:46  |       |       |       |       |
| TFI4  | 11379 | DAC    | 9:78  | 9:46  |       |       |       |       |
| TFI5  | 11541 | DAC    | 9:88  | 9:46  |       |       |       |       |
| TFINC | 10767 | DC     | 9:32  | 2:30  | 2:44  | 2:48  | 2:50  |       |
| TFINS | 01284 | <inst> | 2:13  | 2:12  | 2:74  | 2:89  | 2:105 |       |
| TFNXT | 01440 | <inst> | 2:40  | 2:149 |       |       |       |       |
| TFRPT | 01536 | <inst> | 2:56  | 2:145 |       |       |       |       |
| TFSL  | 01740 | <inst> | 2:89  | 2:75  |       |       |       |       |
| TFSLC | 01860 | <inst> | 2:99  | 2:95  | 2:96  | 2:97  | 2:97  |       |
| TFSR  | 01896 | <inst> | 2:105 | 2:90  |       |       |       |       |
| TFSRC | 02076 | <inst> | 2:120 | 2:118 | 2:119 |       |       |       |
| TFSRF | 02040 | <inst> | 2:117 | 2:114 |       |       |       |       |
| TFTBD | 10837 | DSA    | 9:50  | 2:35  | 9:38  |       |       |       |
| TFTBI | 10802 | DSA    | 9:46  | 2:34  | 9:38  |       |       |       |
| TFTBL | 10782 | DSA    | 9:38  | 2:34  | 2:35  | 2:36  | 2:37  |       |
| TFTBP | 10777 | DS     | 9:35  | 2:36  | 2:37  | 2:44  | 2:45  | 2:48  |
|       |       |        |       |       |       |       |       | 2:52  |
| 2:53  |       |        |       |       |       |       |       |       |
| TFTST | 01236 | <inst> | 2:7   | 1:116 | 1:121 | 1:126 | 1:131 | 2:10  |
|       |       |        |       |       |       |       |       | 2:16  |
| 2:46  |       |        |       |       |       |       |       |       |
| TFWT  | 01356 | <inst> | 2:24  | 2:18  |       |       |       |       |
| TITLE | 10319 | DAC    | 9:8   | 1:102 |       |       |       |       |
| TRUE  | 14952 | DC     | 9:459 | 2:135 | 5:175 | 5:196 | 8:131 | 8:212 |
| WK1   | 10658 | DC     | 9:21  | 2:66  | 2:67  | 2:76  | 2:79  | 2:93  |
|       |       |        |       |       |       |       |       | 2:94  |
| 2:94  |       |        |       |       |       |       |       |       |
|       |       |        |       | 2:98  | 2:99  | 2:109 | 2:111 | 2:115 |
|       |       |        |       |       |       |       |       | 2:116 |
| 2:117 |       |        |       | 2:117 | 2:120 | 2:129 | 2:133 | 3:24  |
| WK1Z  | 10554 | DSC    | 9:16  | 2:66  | 2:68  |       |       |       |
| WK2   | 10761 | DC     | 9:26  | 2:68  | 2:69  |       |       |       |
| WTITL | 02610 | <inst> | 4:26  | 4:20  |       |       |       |       |
| XCK   | 15013 | DC     | 9:470 |       |       |       |       |       |
| XCKM1 | 15037 | DAC    | 9:473 | 4:96  | 6:64  |       |       |       |



## **CU03 - Indirect Addressing Diagnostic**



```
//=====
//  
// CU03 - Indirect Addressing Diagnostic  
//  
// Program Switch settings:  
//  
//    PS1:    ON - Bypass error type out  
//            OFF - Type out routine number on error  
//    PS2:    ON - Loop in routine  
//            OFF - Continue to next routine  
//    PS3:    ON - Stop on error  
//            OFF - Do not stop on error, continue  
//    PS4:    ON - Repeat test CU03  
//            OFF - Run test CU03 once  
//  
// Check switches settings:  
//  
//    DISK I/O - STOP  
//    PARITY   - STOP  
//    I/O       - STOP  
//    O'FLOW   - STOP  
//  
// Start addresses:  
//  
//    00828 - Full test  
//  
// Directions:  
//  
//    1. Load CU03 diagnostic  
//    2. Press START  
//    3. Press START  
//=====
```



## Sample Output – CU03

SW 1 OFF SW 2 OFF SW 3 OFF SW 4 OFF SET SWS FOR INDIRECT ADDRESSING TEST. THEN START.

START ROUTINES. ETOS FOLLOW.

TEST ROUTINES COMPLETED. IF SW1 OFF, NO ROUTINE NOS TYPED OUT, AND NO HANG-UPS, MACHINE PERFORMED TESTS PROPERLY.



NO. 2125574  
SHEET 0  
OF 27

# DIAGNOSTIC TEST

QITLE 1620 INDIRECT ADDRESSING DIAGNOSTIC TEST - CU03  
MACH.TYPE 1620 BY J.H.M. APPR. GIA DATE 4-11-62

## ENGINEERING CHANGE HISTORY

| E/C NO. | DATE     | SHEETS AFFECTED                           |
|---------|----------|---|
| 404568  | 12-15-60 | 1-27                                      |
| 404618  | 5-15-61  | 1, 1A, 4, 5A, 10, 14, 16, 20,<br>27       |
| 404675  | 4-11-62  | 2, 3, 4, 5A, 8, 13, 14, 16,<br>23, 26, 27 |
|         |          |   |
|         |          |   |
|         |          |   |
|         |          |   |
|         |          |   |
|         |          |   |
|         |          |   |

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

INDIRECT ADDRESSING**A. SCOPE:**

This test is essentially a fault detection test designed to check the indirect addressing circuits. Both the P and Q fields are used as indirect addresses and specify data fields in both even and odd memory positions. Chaining of indirect addresses in both the P and Q fields is checked for two addresses.

All immediate operation codes, write alphabetic, branch, branch indicate, and branch no indicate codes are checked to determine that a flag in the low order position of the Q field will not indicate an indirect address.

The control code is checked to determine that the P field is not indirect addressable, and both the P and Q fields for branch back, NOP, and halt are checked for being non-indirect addressable.

**B. SET UP:**

Data Switches should normally be set to STOP. This will cause the program to stop at the end of the cycle on which a parity error occurs.

The four console switches should be set as desired. The normal setting is, all switches OFF. These switches have the following functions in this test:

|                  |  |
|------------------|--|
| <b>SWITCH #1</b> | ON - Bypass error type out<br>OFF - Type out routine number on error |
| <b>SWITCH #2</b> | ON - Loop in routine<br>OFF - Continue to next routine               |
| <b>SWITCH #3</b> | ON - Stop on error<br>OFF - Do not stop on error; continue           |
| <b>SWITCH #4</b> | ON - Repeat test CU03  |

NORMAL LOAD FROM PAPER TAPE READER:

To run the entire test, load the tape in the reader, put in REEL mode, and READY the reader. Reset the 1620. Insert, key in the instructions:  
 360009600300  
 4900828. (MAR should read 00018) Release and start, then follow instructions typed out.

**NORMAL LOAD FROM CARD I/O:**

**Place card deck in the reader. Reset 1620. Depress load key located on the card reader. The first card is read into the buffer and its data automatically transferred into the first 80 positions of core storage. Following the transfer of data into the 80 low order positions of core storage, the computer will simulate a release and program start at location 00000.**

**TO PRODUCE A NEW PAPER TAPE:**

To regenerate, or produce another tape for input, read the Master tape into the last part of memory and then dump memory to the paper tape punch. The instructions required to load and dump memory to produce another paper tape are:

36 14444 00300  
35 14444 00200  
48

**C. TEST METHOD:**

The test is composed of sub-routines, each of which is designed to check some aspect of the Indirect Addressing feature.

A failure of a sub-routine to perform the indirect addressing properly will initiate an error routine. There are three different formats for the error routines; timeouts, halts, and "hang-ups" in indirect addressing cycles.

The normal run of this test performs each routine 100 times before testing sense switch #4. If sense switch #4 is off, the test completed routine is executed and the halt operation code is tested to determine that the P and Q fields are not indirect addressable.

The first sub-routine executed types the setting of the sense switches, the name of the test, and instructions to follow.

Routines 002-005 check for P field indirect addressing on the immediate operation codes add and subtract. If the indirect address defines the field of the augend or minuend, a certain answer is obtained. The result of the arithmetic operation is compared against the predetermined answer and equal comparison indicates that the indirect address operation was correct. If the augend or minuend is not defined by the indirect address, a different answer results. If the first comparison is unequal, the results of the arithmetic operation is compared against the predetermined error result. (The result if indirect addressing is not executed). If this comparison is equal, an error routine is executed and the routine number typed out. If the comparison is unequal, the program halts. Displaying IR-1 will indicate the routine number in which the program halts.

Routines 006-008 check for the chaining of two indirect addresses in the Q field of a multiply operation. The product is compared against a predetermined answer. An equal comparison indicates that the chaining of indirect addresses functioned properly. If this comparison is unequal, another comparison is made against a predetermined answer that would result in the first indirect address was not recognized. An equal comparison on this second compare initiates the execution of an error routine that types the routine number;

while an unequal comparison on the second compare causes the program to halt.

Routines 009 and 010 check for the chaining of two indirect addresses in the P field of a transmit field operation. The transmitted field is compared against predetermined results. An equal comparison indicates that the chaining operation was performed correctly, and the program branches to the next routine. An unequal comparison on the first compare initiates a second compare against a result that would occur if the first indirect address was ignored. An equal comparison branches to an error routine that types out the routine number; while an unequal comparison halts the program.

Routines 011-016 check that a flag bit on the low order position of the Q field of the immediate operations add, subtract, multiply, compare, transmit digit, and transmit field does not define an indirect address. The routine numbers will type out as an error indication if the Q field is recognized as an indirect address.

Routine 017 checks that the Q field of the write alphabetic operation will not recognize an indirect address. A T should be typed for each routine pass. If the Q field is recognized as an indirect address, the program will "hang-up".

Routine 018 checks that the Q field of a transmit record can be an indirect address. A comparison is made to determine if the indirect address was used or ignored. An equal comparison advances the program to the next routine. An unequal comparison advances the program to the error routine that types out the routine number and the record transmitted.

Routines 019 and 519 check that the Q field of the branch and transmit immediate operation and both the P and Q field of the branch back operation will not recognize an indirect address. The routine number is typed out if the incorrect field is transmitted on the branch and transmit immediate operation. If the P and Q fields of the branch back instruction recognize indirect addresses, the program will "hang-up" in indirect addressing cycles on the branch back instruction.

Routines 020-022 check that the Q field of a branch indicate, branch no indicate, and branch operation will not recognize an indirect address. If the Q fields of these operations recognize an indirect address, the addresses are such that the program will "hang-up" in indirect address cycles on the "op code" being checked.

Routine 023 checks that on NOP the P and Q fields will not recognize indirect addresses. The indirect address in the P field is the Q field address, and the indirect address in the Q field is the P field address. If an indirect address is recognized, a loop will be set up and the program will "hang-up" in indirect address cycles.

Routine 024 checks that the P field of a control operation does not recognize an indirect address. A "hang-up" in indirect address cycles will result if an indirect address is recognized.

Routine 025 is the times 100 routine, and routine 026 is the test completed routine and also checks that on a halt operation neither the P nor the Q fields will recognize an indirect address.

The complete normal typeout information will be as follows:

SW 1 OFF SW 2 OFF SW 3 OFF SW 4 OFF SET SWS FOR INDIRECT  
ADDRESSING TEST. THEN START.  
START ROUTINES. ETOS FOLLOW.

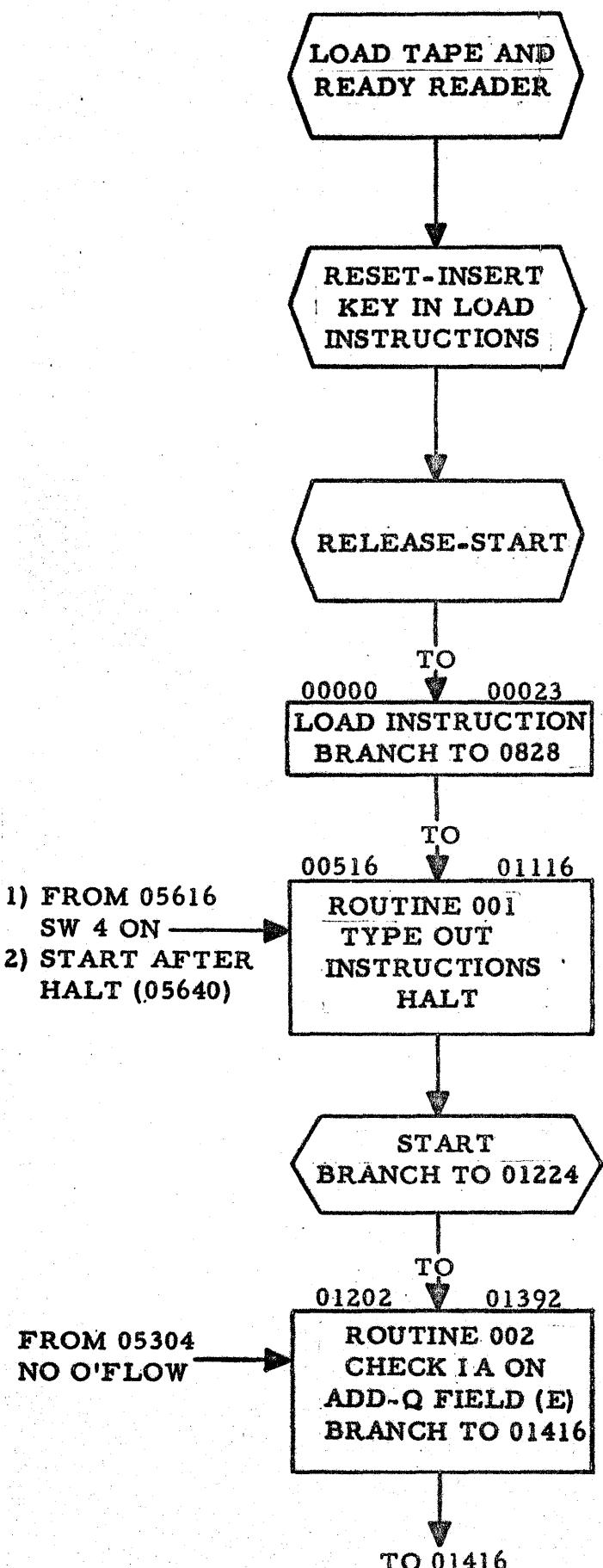
START ROUTINES. ETCOS FOLLOW.

TEST ROUTINES COMPLETED. IF SW1 OFF, NO ROUTINE NOS TYPED OUT, AND NO HANG-UPS, MACHINE PERFORMED TESTS PROPERLY.

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**EC 404675**

## INDIRECT ADDRESSING

FLOW CHART



LOAD INSTRUCTIONS ARE  
36 0009600300  
4900828

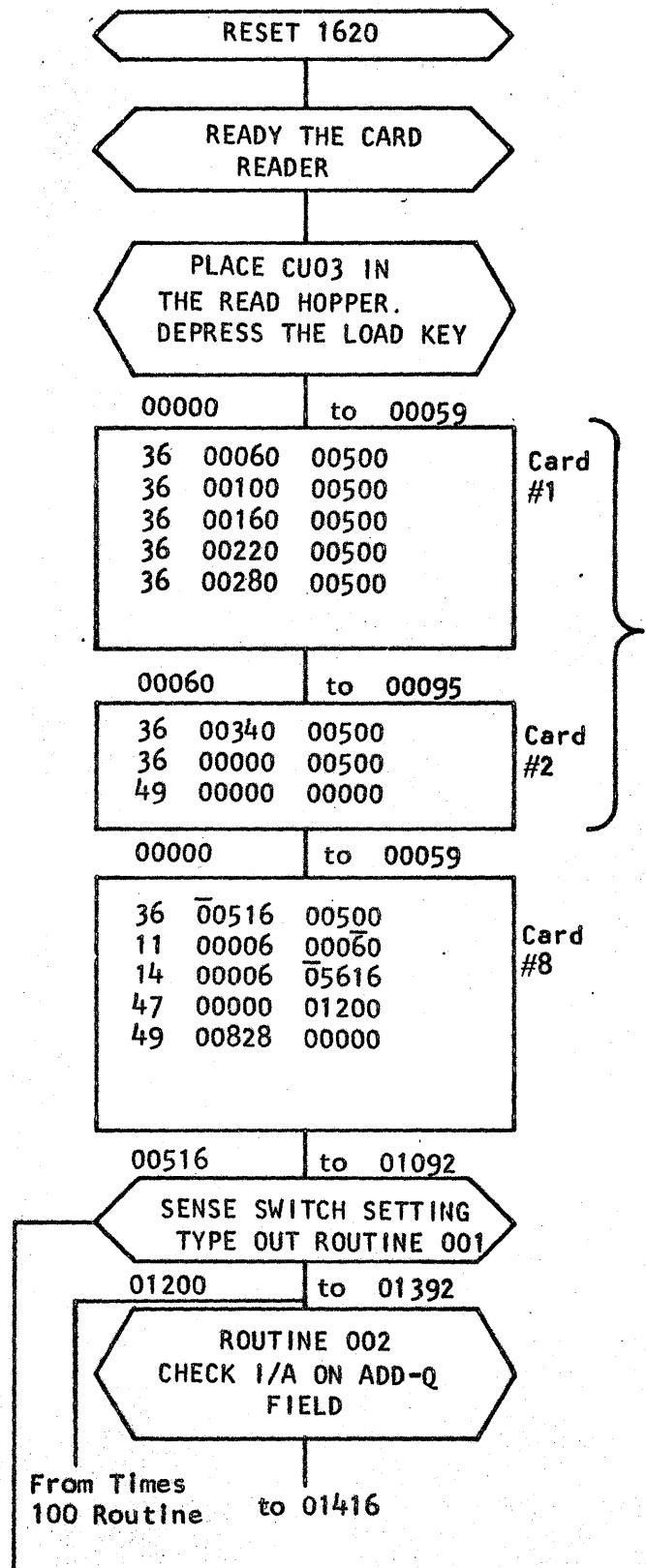
IF THE ADD IS 077 THE I/A WAS  
077 CORRECT.

154

IF THE ADD IS 077 THE I/A WAS NOT  
210 INITIATED  
287

CU03 FLOW CHART  
WITH 1622 I/O

Page 5A



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

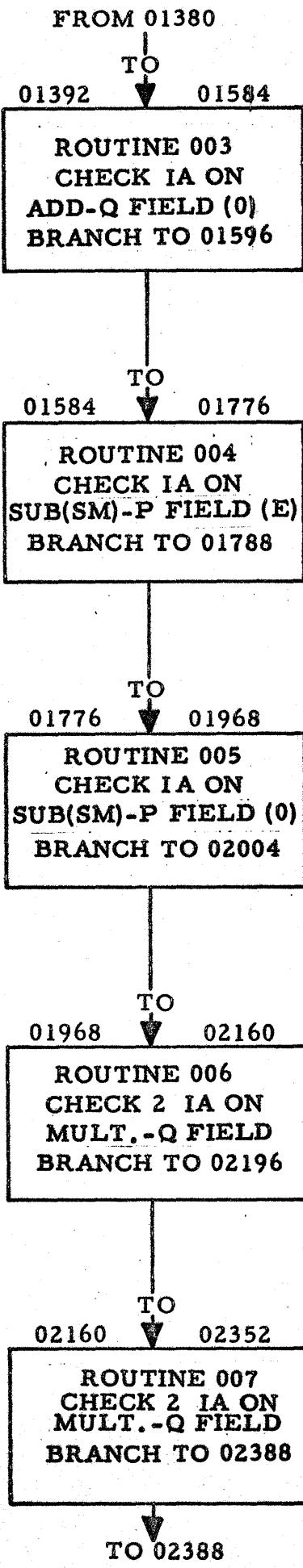
Eighth Load Card contains instructions for loading core storage.

This routine will indicate if B1 and/or BN1 are working. The 1620 will halt with 01091 in MAR

If Add is {  
 077  
 077  
 154  
 077  
 210  
 287 } the I/A was correct  
 If Add is {  
 077  
 077  
 154  
 077  
 210  
 287 } the I/A was not initiated

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- 1) SW 4 On (05616)
- 2) Start After Halt (05640)



IF THE ADD IS 099 THE I/A  
099 WAS CORRECT

198

IF THE ADD IS 403 THE I/A WAS  
099 NOT INITIATED

502

IF THE SUBT. IS 099 THE I/A WAS  
-066 CORRECT

033

IF THE SUBT. IS 592 THE I/A WAS  
-066 NOT INITIATED

526

IF THE SUBT. IS 099 THE I/A WAS  
-077 CORRECT

022

IF THE SUBT. IS 783 THE I/A WAS  
-077 NOT INITIATED

706

IF THE MULTIPLY IS 666 THE I/A WAS  
x99 CORRECT

65934

IF THE MULTIPLY IS 666 THE FIRST I/A  
x72 WAS NOT  
47952 INITIATED

IF PRODUCT IS 50616, 2ND I/A WAS NOT  
INITIATED

IF THE MULTIPLY IS 888 THE I/A WAS  
x67 CORRECT

68376

IF PRODUCT IS 57720, THE I/A WAS NOT  
INITIATED

IF PRODUCT IS 59496, THE 2ND I/A WAS  
NOT INITIATED

FROM 02340

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02352

02544

ROUTINE 008  
CHECK 2 IA ON  
MULT-Q FIELD  
BRANCH TO 02580

IF MULTIPLY IS  $\bar{4}44$  THE IA WAS  
 $\times \bar{3}3$  CORRECT

$\bar{1}4652$

IF THE PRODUCT IS  $\bar{2}530\bar{8}$ , THE I/A  
WAS NOT INITIATED. IF THE PRODUCT  
IS  $\bar{2}6640$ , THE 2ND I/A WAS NOT  
INITIATED.

TO

02544

02772

ROUTINE 009  
CHECK 2 IA ON  
TF - P FIELD  
BRANCH TO 02808

IF FIELD 02562-02566 IS  $\bar{7}0248$ , I/A WAS  
CORRECT. IF FIELD 02556-02560 IS  
 $\bar{7}0248$ , FIRST I/A WAS NOT INITIATED.  
IF FIELD 02544-02548 IS  $\bar{7}0248$ , 2ND I/A  
WAS NOT INITIATED.

TO

02772

03000

ROUTINE 010  
CHECK 2 IA ON  
TF - P FIELD  
BRANCH TO 03036

IF FIELD 02791-02795 IS  $\bar{8}2047$ , I/A  
WAS CORRECT. IF FIELD 02785-02789  
IS  $\bar{8}2047$ , I/A WAS NOT INITIATED. IF  
FIELD 02773-02777 IS  $\bar{8}2047$ , 2ND I/A  
WAS NOT INITIATED.

TO

03000

03216

ROUTINE 011  
CHECK FOR NO IA  
ON AM-Q FIELD  
BRANCH TO 03240

I/A SHOULD BE INHIBITED. IF SUM IS  
 $\bar{5}877$ , NO I/A. IF SUM IS  $\bar{9}110$ , I/A WAS  
NOT INHIBITED.

TO

03216

03420

ROUTINE 012  
CHECK FOR NO IA  
ON SM-Q FIELD  
BRANCH TO 03444

I/A SHOULD BE INHIBITED. IF REMAINDER  
IS  $\bar{8}004$ , NO I/A. IF REMAINDER IS  
 $\bar{7}333$ , I/A WAS NOT INHIBITED.

TO 03444

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EC 404568

FROM 03408

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TO

03420

↓ 03612

ROUTINE 013  
CHECK FOR NO IA  
ON MM-Q FIELD  
BRANCH TO 03672

TO

03660

↓ 03804

ROUTINE 014  
CHECK FOR NO IA  
ON CM-Q FIELD  
BRANCH TO 03816

TO

03804

↓ 03960

ROUTINE 015  
CHECK FOR NO IA  
ON TDM-Q FIELD  
BRANCH TO 03984

TO

03960

↓ 04116

ROUTINE 016  
CHECK FOR NO IA  
ON TFM-Q FIELD  
BRANCH TO 04272  
I

TO

04116

↓ 04332

ROUTINE 017  
CHECK FOR NO IA  
ON WA-Q FIELD  
BRANCH TO 04356

↓  
TO 04356

IF PRODUCT IS 3441, I/A WAS  
INHIBITED. IF PRODUCT IS 3442,  
I/A WAS NOT INHIBITED.

IF E/Z AFTER COMPARE, I/A WAS  
INHIBITED. IF ERROR TYPE OUT,  
COMPARE UNEQUAL.

IF TRANSMITTED DIGIT IS 5, NO I/A.  
IF TRANSMITTED DIGIT IS 9, I/A WAS  
NOT INHIBITED.

IF TRANSMITTED FIELD IS 03971,  
NO I/A. IF TRANSMITTED FIELD IS  
1287, I/A WAS NOT INHIBITED.

A "T" SHOULD BE TYPED FOR EACH ROUTINE  
PASS. A "HANG-UP" INDICATES I/A IS NOT  
BEING INHIBITED.

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FROM 04296

TO

04332 ▼ 04500

ROUTINE 018  
CHECK FOR IA  
ON TR - Q FIELD  
BRANCH TO 04512

TO

04500 ▼ 04632

ROUTINE 019  
CHECK FOR NO IA  
ON BTM - Q FIELD  
BRANCH TO 04740

04632 TO 04716

ROUTINE 519  
CHECK FOR NO IA  
ON BB

04716 ▼ 04896

ROUTINE 020  
CHECK FOR NO IA  
ON B1 - Q FIELD  
BRANCH TO 04908

04896 ▼ 05064

ROUTINE 021  
CHECK FOR NO IA  
ON BN1 - Q FIELD  
BRANCH TO 05064

TO 05064

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IF TRANSMITTED RECORD IS 968,  
I/A WAS EXECUTED. IF TRANSMITTED  
RECORD IS 128, NO I/A.

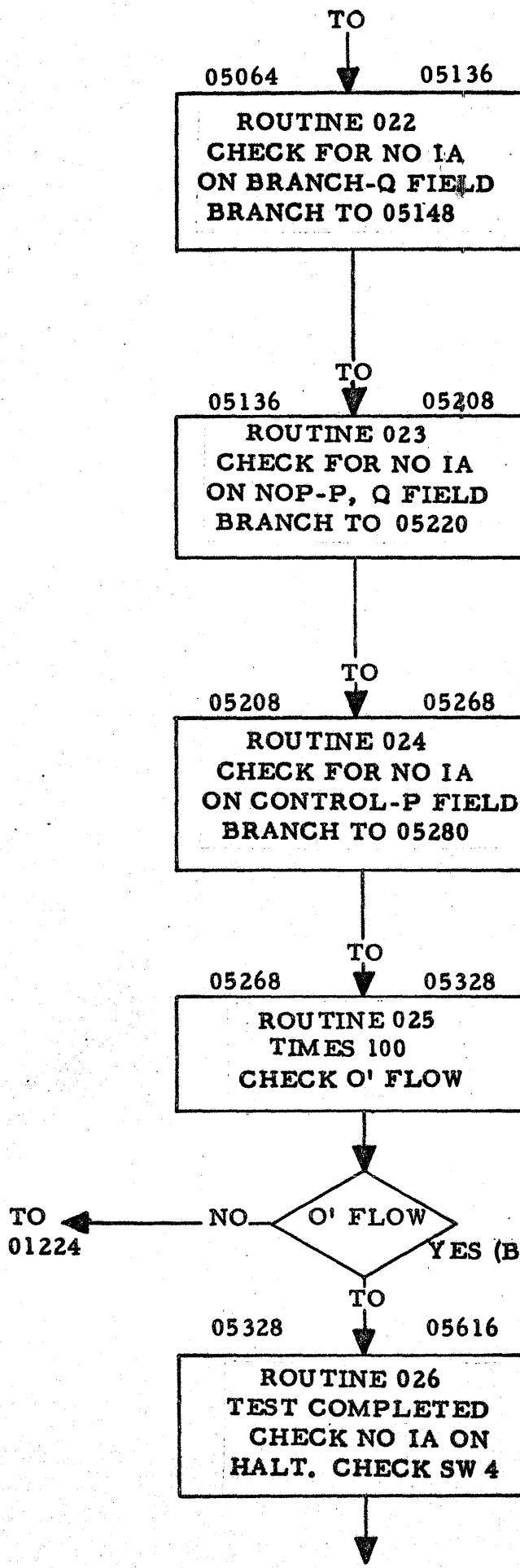
IF TRANSMITTED FIELD IS 04511,  
NO I/A. IF TRANSMITTED FIELD IS  
98765, I/A WAS EXECUTED.

A "HANG-UP" IN 1 TIME WITH A 42  
OP CODE AT INSTRUCTION 04680  
INDICATES IA IS NOT BEING  
INHIBITED.

A "HANG-UP" IN 1 TIME WITH A 46  
OP CODE AT INSTRUCTION 04764  
INDICATES IA IS NOT BEING  
INHIBITED.

A "HANG-UP" IN 1 TIME WITH A 47  
OP CODE AT INSTRUCTION 04932  
INDICATES IA IS NOT BEING  
INHIBITED.

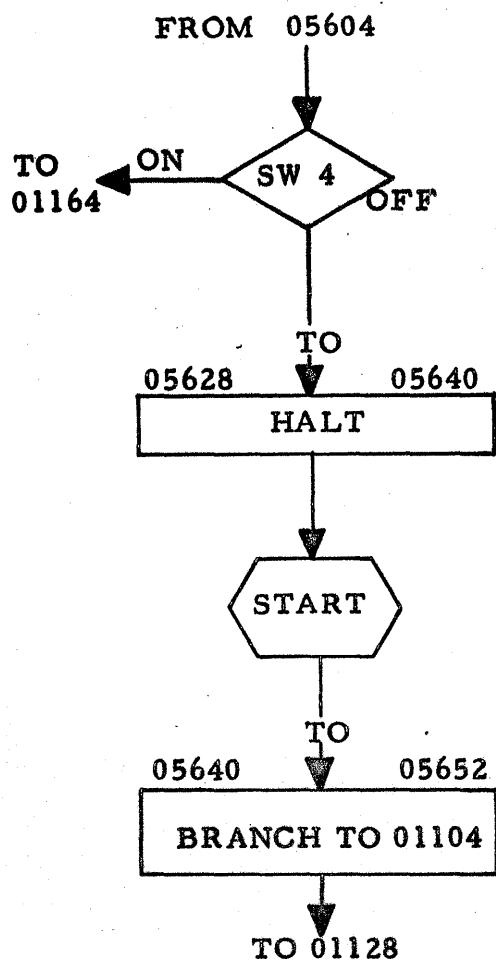
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A "HANG-UP" IN 1 TIME WITH A 47  
OP CODE AT INSTRUCTION 05076  
INDICATES IA IS NOT BEING  
INHIBITED.

A "HANG-UP" IN 1 TIME WITH A 41  
OP CODE AT INSTRUCTION ON  
05148 INDICATES IA IS NOT BEING  
INHIBITED.

A "HANG-UP" IN 1 TIME WITH A 34  
OP CODE AT INSTRUCTION 05232  
INDICATES IA IS NOT BEING INHIBITED.



A "HANG-UP" INDICATES IA IS NOT BEING INHIBITED.

#### TO PRODUCE A NEW TAPE:

1. LOAD MASTER TAPE INTO MEMORY STARTING 14444
2. DUMP NUMERIC TO PAPER TAPE PUNCH.
3. WHEN PROGRAM HALTS, NEW TAPE HAS BEEN GENERATED.

RESET

INSERT

KEY IN 3 6 1 4 4 4 4 0 0 3 0 0  
3 5 1 4 4 4 4 4 0 0 2 0 0  
4 8

RELEASE

START

PN 2125574  
EC 404568

## 1620 DIAGNOSTICS

## CU03 INDIRECT ADDRESSING TEST

| MEM<br>LOC | 00<br>01 | DESCRIPTION    |                |     |
|------------|----------|----------------|----------------|-----|
|            |          | PPPPP<br>23456 | QQQQQ<br>78901 | TYP |
| 096        |          | 000            | 00000          | MT  |
| 108        | 00       | 00102          | 03040          | MT  |
| 120        | 00       | 20406          | 08000          | MT  |
| 132        | 30       | 60902          | 10040          | MT  |
| 144        | 80       | 21610          | 05001          | MT  |
| 156        | 51       | 02006          | 02181          | MT  |
| 168        | 42       | 00704          | 11282          | MT  |
| 180        | 00       | 80614          | 22300          | MT  |
| 192        | 90       | 81726          | 30000          | MT  |
| 204        | 00       | 00005          | 06070          | MT  |
| 216        | 80       | 90012          | 14161          | MT  |
| 228        | 81       | 51811          | 24272          | MT  |
| 240        | 02       | 42822          | 36352          | MT  |
| 252        | 03       | 53045          | 40363          | MT  |
| 264        | 24       | 84455          | 32494          | MT  |
| 276        | 65       | 36048          | 46546          | MT  |
| 288        | 27       | 54453          | 62718          | MT  |
| 300        | 01       | 23456          | 78912          | AT  |
| 312        | 34       | 56789          | 02345          | AT  |
| 324        | 67       | 89013          | 45678          | AT  |
| 336        | 90       | 12456          | 78901          | AT  |
| 348        | 23       | 56789          | 01234          | AT  |
| 360        | 67       | 89012          | 34578          | AT  |
| 372        | 90       | 12345          | 68901          | AT  |
| 384        | 23       | 45679          | 01234          | AT  |
| 396        | 56       | 78 #           |                | AT  |
| 408        |          |                |                | X   |
| 420        |          |                |                | X   |
| 432        |          |                |                | X   |
| 444        |          |                |                | X   |
| 456        |          |                |                | X   |
| 468        |          |                |                | X   |
| 480        |          |                |                | X   |
| 492        |          |                |                | X   |
| 504        |          |                |                | X   |

## ROUTINE 001

TYPE OUT SENSE SWITCH SETTING  
AND NAME OF TEST

|     |    |        |       |     |                   |
|-----|----|--------|-------|-----|-------------------|
| 516 | 62 | 66 7   | 1 56  | X   | SW 1 0            |
| 528 | 55 | 0#6    | 266   | X   | N# SW             |
| 540 | 71 | 564    | 646   | X   | 1 OFF             |
| 552 | 0# | 6266   | 72    | X   | #SW 2             |
| 564 | 56 | 55 0   | #6266 | X   | ON #SW            |
| 576 |    | 72 5   | 64646 | X   | 2 OFF             |
| 588 |    | 0# 626 | 6 73  | X   | #SW 3             |
| 600 |    | 5655   | 0# 62 | X   | ON #S             |
| 612 | 66 | 73     | 5646  | X   | W 3 OF            |
| 624 | 46 | 0#6    | 266   | X   | F #SW             |
| 636 | 74 | 565    | 5 0#  | X   | 4 ON #            |
| 648 | 62 | 66 7   | 4 56  | X   | SW 4 0            |
| 660 | 46 | 46 0   | #6245 | X   | FF #SE            |
| 672 | 63 | 626    | 662   | X   | T SWS             |
| 684 | 46 | 5659   | 4955  | X   | FOR IN            |
| 696 | 44 | 49594  | 54363 | X   | DIRECT            |
| 708 |    | 41444  | 45945 | X   | ADDRE             |
| 720 | 62 | 62495  | 547   | X   | SSING             |
| 732 | 63 | 45626  | 303   | X   | TEST.             |
| 744 | 63 | 48455  | 5 62  | X   | THEN S            |
| 756 | 63 | 41596  | 303   | X   | TART              |
| 768 | 0# | 62634  | 15963 |     | # START           |
| 780 | 00 | 59566  | 46349 |     | ROUTI             |
| 792 | 55 | 45620  | 30045 |     | NES. E            |
| 804 | 63 | 56620  | 04656 |     | TOS FO            |
| 816 | 53 | 53566  | 6030# |     | LLOW.#            |
| 828 | 46 | 00852  | 00100 | BI  | CHECK FOR SW1 ON  |
| 840 | 47 | 00876  | 00100 | BNI | CHECK FOR SW1 OFF |
| 852 | 39 | 00517  | 00100 | WA  | SW 1 ON           |
| 864 | 49 | 00888  |       | B   |                   |

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|      |    |       |       |     |                           |
|------|----|-------|-------|-----|---------------------------|
| 876  | 39 | 00535 | 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 | 00555 | 00100 | WA  | SW 2 ON                   |
| 924  | 49 | 00948 |       | B   |                           |
| 936  | 39 | 00573 | 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 | 00593 | 00100 | WA  | SW 3 ON                   |
| 984  | 49 | 01008 |       | B   |                           |
| 996  | 39 | 00611 | 00100 | WA  | SW 3 OFF                  |
| 1008 | 46 | 01032 | 00400 | BI  | CHECK FOR 4 ON            |
| 1020 | 47 | 01056 | 00400 | BNI | CHECK FOR SW 4 OFF        |
| 1032 | 39 | 00631 | 00100 | WA  | SW 4 ON                   |
| 1044 | 49 | 01068 |       | B   |                           |
| 1056 | 39 | 00649 | 00100 | WA  | SW 4 OFF                  |
| 1068 | 39 | 00669 | 00100 | WA  | SET SWS FOR IA THEN START |
| 1080 | 48 |       |       | H   |                           |
| 1092 | 34 |       | 00102 | K   | CARRIAGE RETURN           |
| 1104 | 39 | 00771 | 00100 | WA  | ETOS FOLLOW               |
| 1116 | 34 |       | 00102 | K   |                           |
| 1140 | 49 | 01224 |       | B   |                           |
| 1152 |    |       |       | X   |                           |
| 1164 |    |       |       | X   |                           |
| 1176 |    |       |       | X   |                           |
| 1188 |    |       |       | X   |                           |

## ROUTINE 002

CHECK FOR I/A Q. FIELD, EVEN POSITION,  
ON ADD OPERATION

|      |    |       |       |    |                            |
|------|----|-------|-------|----|----------------------------|
| 1200 | 01 | 210   | 077   | X  | CONSTANTS AND WORKING AREA |
| 1212 |    |       |       | X  | WORKING AREA               |
| 1224 | 26 | 01207 | 01210 | TF | SET AUGEND                 |
| 1236 | 21 | 01207 | 01204 | A  | ADD WITH INDIRECT ADDRESS  |
| 1248 | 14 | 01207 | 154   | C  | CHECK FOR CORRECT ANSWER   |
| 1260 | 46 | 01368 | 01200 | BI | CHECK E/Z FOR E/Z          |
| 1272 | 14 | 01207 | 287   | C  | CHECK FOR ERROR ANSWER     |
| 1284 | 46 | 01320 | 01200 | BI | CHECK FOR E/Z FOR E/Z      |
| 1296 | 48 | 00002 |       | H  |                            |
| 1308 | 49 | 01368 |       | X  |                            |

## ERROR ROUTINE

|      |    |       |       |     |
|------|----|-------|-------|-----|
| 1320 | 46 | 01344 | 00100 | BI  |
| 1332 | 39 | 01357 | 00100 | WA  |
| 1344 | 47 | 01368 | 00300 | BNI |
| 1356 | 48 | 70707 | 2 0*  | H   |
| 1368 | 46 | 01224 | 00200 | BI  |
| 1380 | 49 | 01416 |       | B   |

## ROUTINE 003

CHECK FOR I/A Q FIELD, ODD POSITION,  
ON ADD OPERATION

|      |    |       |       |    |                            |
|------|----|-------|-------|----|----------------------------|
| 1392 | 0  | 1403  | 099   | X  | CONSTANTS AND WORKING AREA |
| 1404 |    |       |       | X  | WORKING AREA               |
| 1416 | 26 | 01400 | 01403 | TF | SET AUGEND                 |
| 1428 | 21 | 01400 | 01397 | A  | ADD WITH INDIRECT ADDRESS  |
| 1440 | 14 | 01400 | 198   | CM | CHECK FOR CORRECT ANSWER   |
| 1452 | 46 | 01560 | 01200 | BI | CHECK E/Z FOR E/Z          |
| 1464 | 14 | 01400 | 502   | CM | CHECK FOR ERROR ANSWER     |
| 1476 | 46 | 01512 | 01200 | BI | CHECK E/Z FOR E/Z          |
| 1488 | 48 | 00003 |       | H  |                            |
| 1500 | 49 | 01560 | 00100 | BI |                            |

## ERROR ROUTINE

|      |    |       |       |     |
|------|----|-------|-------|-----|
| 1512 | 46 | 01536 | 00100 | BI  |
| 1524 | 39 | 01549 | 00100 | WA  |
| 1536 | 47 | 01560 | 00300 | BNI |
| 1548 | 48 | 70707 | 3 0*  | H   |
| 1560 | 46 | 01416 | 00200 | BI  |
| 1572 | 49 | 01596 |       | B   |

## ROUTINE 004

CHECK FOR I/A P FIELD, EVEN POSITION  
ON SUBTRACT OPERATION

|      |    |       |       |    |                                |
|------|----|-------|-------|----|--------------------------------|
| 1584 | 01 | 592   | 099   | X  | CONSTANTS AND WORKING AREA     |
| 1596 | 26 | 01592 | 01595 | TF | SET MINUEND                    |
| 1608 | 12 | 01588 | 066   | SM | SUBTRACT WITH INDIRECT ADDRESS |
| 1620 | 14 | 01592 | 033   | CM | CHECK FOR CORRECT ANSWER       |
| 1632 | 46 | 01752 | 01200 | BI | CHECK E/Z FOR E/Z              |
| 1644 | 14 | 01588 | 00526 | CM | CHECK FOR ERROR ANSWER         |
| 1656 | 46 | 01692 | 01200 | BI | CHECK E/Z FOR E/Z              |
| 1668 | 48 | 00004 |       | H  |                                |
| 1680 | 49 | 01692 |       | B  |                                |

## ERROR ROUTINE

|      |    |       |       |     |                   |
|------|----|-------|-------|-----|-------------------|
| 1692 | 16 | 01588 | 592   | TFM | RESTORE CONSTANTS |
| 1704 | 46 | 01728 | 00100 | BI  |                   |
| 1716 | 39 | 01741 | 00100 | WA  |                   |
| 1728 | 47 | 01752 | 00300 | BNI |                   |
| 1740 | 48 | 70707 | 4 0*  | H   |                   |
| 1752 | 46 | 01596 | 00200 | BI  |                   |
| 1764 | 49 | 01788 | 0     | B   |                   |

## ROUTINE 005

CHECK FOR I/A P FIELD, ODD POSITION  
ON SUBTRACT OPERATION

|      |    |       |       |    |                                |
|------|----|-------|-------|----|--------------------------------|
| 1776 | 17 | 83 0  | 099   | X  | CONSTANTS AND WORKING AREA     |
| 1788 | 26 | 01783 | 01786 | TF | SET MINUEND                    |
| 1800 | 12 | 01779 | 077   | SM | SUBTRACT WITH INDIRECT ADDRESS |
| 1812 | 14 | 01783 | 022   | CM | CHECK FOR CORRECT ANSWER       |
| 1824 | 46 | 01944 | 01200 | BI | CHECK E/Z FOR E/Z              |
| 1836 | 14 | 01779 | 706   | CM | CHECK FOR ERROR ANSWER         |
| 1848 | 46 | 01884 | 01200 | BI | CHECK E/Z FOR E/Z              |
| 1860 | 48 | 00005 |       | H  |                                |
| 1872 | 49 | 01884 |       | B  |                                |

## ERROR ROUTINE

|      |    |       |       |     |                   |
|------|----|-------|-------|-----|-------------------|
| 1884 | 16 | 01779 | 783   | TFM | RESTORE CONSTANTS |
| 1896 | 46 | 01920 | 00100 | BI  |                   |
| 1908 | 39 | 01933 | 00100 | WA  |                   |
| 1920 | 47 | 01944 | 00300 | BNI |                   |
| 1932 | 48 | 70707 | 5 0*  | H   |                   |
| 1944 | 46 | 01788 | 00200 | BI  |                   |
| 1956 | 49 | 02004 |       | B   |                   |

## ROUTINE 006

CHECK FOR TWO I/A'S, Q FIELD, TWO EVEN  
POSITION, ON A MULTIPLY OPERATION

|      |    |       |       |   |                                    |
|------|----|-------|-------|---|------------------------------------|
| 1968 | 01 | 976   | 59666 | X | CONSTANTS                          |
| 1980 | 01 | 972   |       | X | CONSTANTS                          |
| 1992 |    |       |       | X | WORKING AREA                       |
| 2004 | 23 | 01979 | 01984 | M | MULTIPLY WITH 2 INDIRECT ADDRESSES |

|      |    |       |       |    |                          |
|------|----|-------|-------|----|--------------------------|
| 2016 | 14 | 00099 | 65934 | CM | CHECK FOR CORRECT ANSWER |
| 2028 | 46 | 02136 | 01200 | BI | CHECK E/Z FOR E/Z        |
| 2040 | 14 | 00099 | 47952 | CM | CHECK FOR ERROR ANSWER   |
| 2052 | 46 | 02088 | 01200 | BI | CHECK E/Z FOR E/Z        |
| 2064 | 48 | 00006 |       | H  |                          |
| 2076 | 49 | 02136 |       | B  |                          |

#### ERROR ROUTINE

|      |    |       |       |     |  |
|------|----|-------|-------|-----|--|
| 2088 | 46 | 02112 | 00100 | BI  |  |
| 2100 | 39 | 02125 | 00100 | WA  |  |
| 2112 | 47 | 02136 | 00300 | BNI |  |
| 2124 | 48 | 70707 | 6 0‡  | H   |  |
| 2136 | 46 | 02004 | 00200 | BI  |  |
| 2148 | 49 | 02196 |       | B   |  |

#### ROUTINE 007

##### CHECK FOR TWO I/A'S, Q FIELD, TWO ODD POSITION, ON A MULTIPLY OPERATION

|      |    |       |       |    |                                    |
|------|----|-------|-------|----|------------------------------------|
| 2160 | 0  | 21677 | 7 888 | X  | CONSTANTS                          |
| 2172 | 0  | 2165  |       | X  | CONSTANTS                          |
| 2184 |    |       |       | X  | WORKING AREA                       |
| 2196 | 23 | 02171 | 02177 | M  | MULTIPLY WITH 2 INDIRECT ADDRESSES |
| 2208 | 14 | 00099 | 68376 | CM | CHECK FOR CORRECT ANSWER           |
| 2220 | 46 | 02328 | 01200 | BI | CHECK E/Z FOR E/Z                  |
| 2232 | 14 | 00099 | 57720 | CM | CHECK FOR ERROR ANSWER             |
| 2244 | 46 | 02280 | 01200 | BI | CHECK E/Z FOR E/Z                  |
| 2256 | 48 | 00007 |       | H  |                                    |
| 2268 | 49 | 02328 |       | B  |                                    |

#### ERROR ROUTINE

|      |    |       |       |     |  |
|------|----|-------|-------|-----|--|
| 2280 | 46 | 02304 | 00100 | BI  |  |
| 2292 | 39 | 02317 | 00100 | WA  |  |
| 2304 | 47 | 02328 | 00300 | BNI |  |
| 2316 | 48 | 70707 | 7 0‡  | H   |  |
| 2328 | 46 | 02196 | 00200 | BI  |  |
| 2340 | 49 | 02388 |       | B   |  |

## ROUTINE 008

CHECK FOR TWO I/A'S, Q FIELD, ODD-EVEN  
POSITION, ON A MULTIPLY OPERATION

|      |    |       |       |    |                                    |
|------|----|-------|-------|----|------------------------------------|
| 2352 | 0  | 2360  | 33444 | X  | CONSTANTS                          |
| 2364 | 02 | 357   |       | X  | CONSTANTS                          |
| 2376 |    |       |       | X  | WORKING AREA                       |
| 2388 | 23 | 02363 | 02368 | M  | MULTIPLY WITH 2 INDIRECT ADDRESSES |
| 2400 | 14 | 00099 | 14652 | CM | CHECK FOR CORRECT ANSWER           |
| 2412 | 46 | 02520 | 01200 | BI | CHECK E/Z FOR E/Z                  |
| 2424 | 14 | 00099 | 25308 | CM | CHECK FOR ERROR ANSWER             |
| 2436 | 46 | 02472 | 01200 | BI | CHECK E/Z FOR E/Z                  |
| 2448 | 48 | 00008 |       | H  |                                    |
| 2460 | 49 | 02520 |       | B  |                                    |

## ERROR ROUTINE

|      |    |       |       |     |  |
|------|----|-------|-------|-----|--|
| 2472 | 46 | 02496 | 00100 | BI  |  |
| 2484 | 39 | 02509 | 00100 | WA  |  |
| 2496 | 47 | 02520 | 00300 | BNI |  |
| 2508 | 48 | 70707 | 8 0‡  | H   |  |
| 2520 | 46 | 02388 | 00200 | BI  |  |
| 2532 | 49 | 02580 |       | B   |  |

## ROUTINE 009

CHECK FOR TWO I/A'S, P FIELD, EVEN POSITION  
ON A TRANSMIT FIELD OPERATION

|      |    |       |       |     |   |
|------|----|-------|-------|-----|---|
| 2544 | 02 | 566‡  | 70248 | X   | CONSTANTS                                   |
| 2556 | 02 | 548‡0 |       | X   | CONSTANTS                                   |
| 2568 |    |       |       | X   | WORKING AREA                                |
| 2580 | 26 | 02560 | 02555 | TF  | TRANSMIT FIELD WITH 2 INDIRECT<br>ADDRESSES |
| 2592 | 14 | 02566 | 70248 | CM  | CHECK FOR CORRECT ANSWER                    |
| 2604 | 47 | 02652 | 01200 | BNI | CHECK E/Z FOR E/Z                           |
| 2616 | 16 | 02566 | 00000 | TFM | RESTORE WORKING AREA TO ZERO                |
| 2628 | 16 | 02560 | 02548 | TFM | RESTORE WORKING AREA                        |
| 2640 | 49 | 02748 |       | B   |   |

## ERROR ROUTINE

|      |    |       |       |     |  |
|------|----|-------|-------|-----|--|
| 2652 | 46 | 02700 | 00100 | BI  |  |
| 2664 | 39 | 02713 | 00100 | WA  |  |
| 2676 | 38 | 02556 | 00100 | WN  |  |
| 2688 | 38 | 02544 | 00100 | WN  |  |
| 2700 | 47 | 02724 | 00300 | BNI |  |

|      |    |       |       |     |
|------|----|-------|-------|-----|
| 2712 | 48 | 70707 | 9 0‡  | H   |
| 2724 | 16 | 02560 | 02548 | TFM |
| 2736 | 16 | 02548 | 02566 | TFM |
| 2748 | 46 | 02580 | 00200 | BI  |
| 2760 | 49 | 02808 |       | B   |

## ROUTINE 010

CHECK FOR TWO I/A'S, P FIELD ODD POSITION,  
ON A TRANSMIT FIELD OPERATION

|      |    |       |       |     |  |
|------|----|-------|-------|-----|--|
| 2772 | 0  | 2795‡ | 82047 | X   | CONSTANTS                                |
| 2784 | 0  | 2777‡ | 0     | X   | CONSTANTS                                |
| 2796 |    |       |       | X   | WORKING AREA                             |
| 2808 | 26 | 02789 | 02783 | TF  | TRANSMIT FIELD WITH 2 INDIRECT ADDRESSES |
| 2820 | 14 | 02795 | 82047 | CM  | CHECK FOR CORRECT ANSWER                 |
| 2832 | 47 | 02880 | 01200 | BNI | CHECK E/Z FOR E/Z                        |
| 2844 | 16 | 02795 | 00000 | TFM | RESTORE WORKING AREA TO ZERO             |
| 2856 | 49 | 02976 |       | B   |  |
| 2868 |    |       |       | X   |  |

## ERROR ROUTINE

|      |    |       |       |     |
|------|----|-------|-------|-----|
| 2880 | 46 | 02928 | 00100 | BI  |
| 2892 | 39 | 02941 | 00100 | WA  |
| 2904 | 38 | 02785 | 00100 | WN  |
| 2916 | 38 | 02773 | 00100 | WN  |
| 2928 | 47 | 02952 | 00300 | BNI |
| 2940 | 48 | 70717 | 0 0‡  | H   |
| 2952 | 16 | 02789 | 02777 | TFM |
| 2964 | 16 | 02777 | 02795 | TFM |
| 2976 | 46 | 02808 | 00200 | BI  |
| 2988 | 49 | 03036 |       | B   |

## ROUTINE 011

CHECK FOR NO I/A ON ADD IMMEDIATE,  
Q FIELD

|      |    |       |       |     |                                   |
|------|----|-------|-------|-----|-----------------------------------|
| 3000 | 88 | 88‡   | 03011 | X   | CONSTANTS                         |
| 3012 |    |       | 0222  | X   | CONSTANTS                         |
| 3024 |    |       |       | X   | WORKING AREA                      |
| 3036 | 16 | 03003 | 8888  | TFM | SET AUGEND                        |
| 3048 | 11 | 03003 | 03011 | AM  | CHECK FOR NO I/A ON ADD IMMEDIATE |
| 3060 | 14 | 03003 | 5877  | CM  | CHECK FOR CORRECT ANSWER          |
| 3072 | 46 | 03192 | 01200 | BI  | CHECK E/Z FOR E/Z                 |

|      |    |       |       |     |                        |
|------|----|-------|-------|-----|------------------------|
| 3084 | 14 | 03003 | 9110  | CM  | CHECK FOR ERROR ANSWER |
| 3096 | 46 | 03144 | 01200 | BI  | CHECK E/Z FOR E/Z      |
| 3108 | 38 | 03000 | 00100 | WN  | TYPE ANSWER            |
| 3120 | 48 | 00011 |       | H   | HALT                   |
| 3132 | 41 |       |       | NOP |                        |

### ERROR ROUTINE

|      |    |       |       |     |  |
|------|----|-------|-------|-----|--|
| 3144 | 46 | 03168 | 00100 | BI  |  |
| 3156 | 39 | 03181 | 00100 | WA  |  |
| 3168 | 47 | 03192 | 00300 | BNI |  |
| 3180 | 48 | 70717 | 1 0#  | H   |  |
| 3192 | 46 | 03036 | 00200 | BI  |  |
| 3204 | 49 | 03240 |       | B   |  |

### ROUTINE 012

#### CHECK FOR NO I/A ON SUBTRACT IMMEDIATE, Q FIELD

|      |     |       |       |              |  |
|------|-----|-------|-------|--------------|--|
| 3216 | 444 | 03222 | X     | CONSTANTS    |  |
| 3228 |     |       | X     | WORKING AREA |  |
| 3240 | 16  | 03219 | 7777  | TFM          | SET MINUEND                            |
| 3252 | 12  | 03219 | 03227 | SM           | CHECK FOR NO I/A SUBTRACT<br>IMMEDIATE |
| 3264 | 14  | 03219 | 8004  | CM           | CHECK FOR CORRECT ANSWER               |
| 3276 | 46  | 03396 | 01200 | BI           | CHECK E/Z FOR E/Z                      |
| 3288 | 14  | 03219 | 7333  | CM           | CHECK FOR ERROR ANSWER                 |
| 3300 | 46  | 03348 | 01200 | BI           | CHECK E/Z FOR E/Z                      |
| 3312 | 38  | 03216 | 00100 | WN           | TYPE ANSWER                            |
| 3324 | 48  | 00012 |       | H            | HALT                                   |
| 3336 | 41  |       |       | NOP          |  |

### ERROR ROUTINE

|      |    |       |       |     |  |
|------|----|-------|-------|-----|--|
| 3348 | 46 | 03372 | 00100 | BI  |  |
| 3360 | 39 | 03385 | 00100 | WA  |  |
| 3372 | 47 | 03396 | 00300 | BNI |  |
| 3384 | 48 | 70717 | 2 0#  | H   |  |
| 3396 | 46 | 03240 | 00200 | BI  |  |
| 3408 | 49 | 03444 |       | B   |  |

### ROUTINE 013

#### CHECK FOR NO I/A ON MULTIPLY IMMEDIATE, Q FIELD

|      |    |     |       |   |              |
|------|----|-----|-------|---|--------------|
| 3420 | 11 | 122 | 03424 | X | CONSTANTS    |
| 3432 |    |     |       | X | WORKING AREA |

|      |    |       |       |    |                          |
|------|----|-------|-------|----|--------------------------|
| 3444 | 13 | 03422 | 03431 | MM | MULTIPLY IMMEDIATE       |
| 3456 | 14 | 00099 | 3441  | CM | CHECK FOR CORRECT ANSWER |
| 3468 | 46 | 03588 | 01200 | BI | CHECK E/Z FOR E/Z        |
| 3480 | 14 | 00099 | 2442  | CM | CHECK FOR ERROR ANSWER   |
| 3492 | 46 | 03540 | 01200 | BI | CHECK E/Z FOR E/Z        |
| 3504 | 48 | 00013 |       | H  | HALT                     |
| 3516 | 49 | 03540 |       | B  |                          |
| 3528 |    |       |       | X  |                          |

#### ERROR ROUTINE

|      |    |       |       |     |  |
|------|----|-------|-------|-----|--|
| 3540 | 46 | 03564 | 00100 | BI  |  |
| 3552 | 39 | 03577 | 00100 | WA  |  |
| 3564 | 47 | 03588 | 00300 | BNI |  |
| 3576 | 48 | 70717 | 3 07  | H   |  |
| 3588 | 46 | 03444 | 00200 | BI  |  |
| 3600 | 49 | 03672 |       | B   |  |
| 3612 |    |       |       | X   |  |
| 3624 |    |       |       | X   |  |
| 3636 |    |       |       | X   |  |
| 3648 |    |       |       | X   |  |

#### ROUTINE 014

CHECK NO I/A ON COMPATE IMMEDIATE,  
Q FIELD

|      |    |       |       |     |                                |
|------|----|-------|-------|-----|--------------------------------|
| 3660 | 03 | 671   | 55555 | X   | CONSTANTS AND WORKING AREA     |
| 3672 | 14 | 03664 | 03671 | CM  | CHECK FOR NO I/A ON COMP IMMED |
|      |    |       |       |     | Q FIELD                        |
| 3684 | 47 | 03732 | 01200 | BNI | CHECK E/Z FOR E/Z              |
| 3696 | 49 | 03780 |       | B   |                                |
| 3708 |    |       |       | X   |                                |
| 3720 |    |       |       | X   |                                |

#### ERROR ROUTINE

|      |    |       |       |     |  |
|------|----|-------|-------|-----|--|
| 3732 | 46 | 03756 | 00100 | BI  |  |
| 3744 | 39 | 03769 | 00100 | WA  |  |
| 3756 | 47 | 03780 | 00300 | BNI |  |
| 3768 | 48 | 70717 | 4 07  | H   |  |
| 3780 | 46 | 03672 | 00200 | BI  |  |
| 3792 | 49 | 03816 |       | B   |  |

PN 2125574  
EC 404568

## ROUTINE 015

CHECK FOR NO I/A ON TRANSMIT DIGIT  
IMMEDIATE, Q FIELD

|      |    |       |       |     |                                 |
|------|----|-------|-------|-----|---------------------------------|
| 3804 | 65 | 9 6   | 03806 | X   | WORKING AREA                    |
| 3816 | 15 | 03809 | 03815 | TDM | CHECK FOR NO IA ON TDM Q        |
| 3828 | 24 | 03809 | 03805 | C   | CHECK CORRECT DIGIT TRANSFERRED |
| 3840 | 47 | 03888 | 01200 | BNI | CHECK E/Z FOR E/Z               |
| 3852 | 15 | 03809 | 0     | TDM | RESTORE WORKING AREA            |
| 3864 | 49 | 03936 |       | B   |                                 |
| 3876 |    |       |       | X   |                                 |

## ERROR ROUTINE

|      |    |       |       |     |  |
|------|----|-------|-------|-----|--|
| 3888 | 46 | 03912 | 00100 | BI  |  |
| 3900 | 39 | 03925 | 00100 | WA  |  |
| 3912 | 47 | 03936 | 00300 | BNI |  |
| 3924 | 48 | 70717 | 5 0‡  | H   |  |
| 3936 | 46 | 03816 | 00200 | BI  |  |
| 3948 | 49 | 03984 |       | B   |  |

## ROUTINE 016

CHECK FOR NO I/A ON TRANSMIT FIELD  
IMMEDIATE, Q FIELD

|      |    |       |       |              |                                |
|------|----|-------|-------|--------------|--------------------------------|
| 3960 |    | 1287  | X     | WORKING AREA |                                |
| 3972 |    | 03971 | X     | CONSTANTS    |                                |
| 3984 | 16 | 03966 | 03971 | TFM          | CHECK FOR NO IA ON TFM Q FIELD |
| 3996 | 24 | 03966 | 03983 | C            | CHECK CORRECT DATA TRANSFERRED |
| 4008 | 47 | 04044 | 01200 | BNI          | CHECK E/Z FOR E/Z              |
| 4020 | 16 | 03966 | 00000 | TFM          | RESTORE WORKING AREA           |
| 4032 | 49 | 04092 |       | X            |                                |

## ERROR ROUTINE

|      |    |       |       |     |  |
|------|----|-------|-------|-----|--|
| 4044 | 46 | 04068 | 00100 | BI  |  |
| 4056 | 39 | 04081 | 00100 | WA  |  |
| 4068 | 47 | 04092 | 00300 | BNI |  |
| 4080 | 48 | 70717 | 6 0‡  | H   |  |
| 4092 | 46 | 03984 | 00200 | BI  |  |
| 4104 | 49 | 04272 |       | B   |  |

PN 2125574  
EC 404568

## ROUTINE 017

CHECK FOR NO I/A ON WRITE  
ALPHABETIC, Q FIELD

|      |    |       |       |                               |
|------|----|-------|-------|-------------------------------|
| 4116 | 63 | 0#    | X     | T                             |
| 4128 |    |       | X     |                               |
| 4140 |    |       | X     |                               |
| 4152 |    |       | X     |                               |
| 4164 |    |       | X     |                               |
| 4176 |    |       | X     |                               |
| 4188 |    |       | X     |                               |
| 4200 |    |       | X     |                               |
| 4212 |    |       | X     |                               |
| 4224 |    |       | X     |                               |
| 4236 |    |       | X     |                               |
| 4248 |    |       | X     |                               |
| 4260 |    |       | X     |                               |
| 4272 | 16 | 10100 | 04295 | TFM SET DATA IN IA FIELD      |
| 4284 | 39 | 04117 | 10100 | WA CHECK FOR NO IA IN Q ON WA |
| 4296 | 49 | 04356 |       | B                             |
| 4308 |    |       |       | X                             |
| 4320 |    |       |       | X                             |

## ROUTINE 018

CHECK FOR I/A ON TRANSMIT  
RECORD, Q FIELD

|      |    |       |       |     |                               |
|------|----|-------|-------|-----|-------------------------------|
| 4332 |    |       | 04351 | X   | CONSTANTS AND WORKING AREA    |
| 4344 | 28 | #     | 968#  | X   | CONSTANTS AND WORKING AREA    |
| 4356 | 31 | 04332 | 04343 | TR  | CHECK FOR IA IN Q FIELD ON TR |
| 4368 | 14 | 04334 | 968   | CM  | CHECK FOR CORRECT TRANSFER    |
| 4380 | 47 | 04428 | 01200 | BNI | CHECK E/Z FOR E/Z             |
| 4392 | 49 | 04476 |       | B   |                               |
| 4404 |    |       |       | X   |                               |
| 4416 |    |       |       | X   |                               |

## ERROR ROUTINE

|      |    |       |       |     |
|------|----|-------|-------|-----|
| 4428 | 46 | 04452 | 00100 | BI  |
| 4440 | 39 | 04465 | 00100 | WA  |
| 4452 | 47 | 04476 | 00300 | BNI |
| 4464 | 48 | 70717 | 8 0#  | H   |
| 4476 | 46 | 04356 | 00200 | BI  |
| 4488 | 49 | 04512 |       | B   |

## ROUTINE 019

CHECK FOR NO I/A ON BRANCH AND  
TRANSMIT IMMEDIATE, Q FIELD

|      |    |       |       |     |   |
|------|----|-------|-------|-----|---|
| 4500 |    | 98765 | 04506 | X   | CONSTANTS AND WORKING AREA                    |
| 4512 | 17 | 04644 | 04511 | BTM | CHECK NO IA ON BTM                            |
| 4524 | 48 | 04643 | 00000 | X   | OP CODE 48 OR 16 IF HALT 519 NOT<br>PERFORMED |
| 4536 | 16 | 04525 | 48    | TFM | SET P CODE 48 IN                              |
| 4548 | 49 | 04608 |       | B   |   |

## ERROR ROUTINE

|      |    |       |       |     |
|------|----|-------|-------|-----|
| 4560 | 46 | 04584 | 00100 | BI  |
| 4572 | 39 | 04597 | 00100 | WA  |
| 4584 | 47 | 04608 | 00300 | BNI |
| 4596 | 48 | 70717 | 9 0#  | H   |
| 4608 | 46 | 04512 | 00200 | BI  |
| 4620 | 49 | 04740 |       | B   |

## ROUTINE 519

THIS IS ROUTINE BRANCHED TO IN 019  
CHECKS FOR NO I/A ON BRANCH BACK

|      |    |       |       |              |                                   |
|------|----|-------|-------|--------------|-----------------------------------|
| 4632 |    |       | X     | WORKING AREA |                                   |
| 4644 | 14 | 04643 | 04511 | CM           | CHECK TF OF ROUTINE 019 CORRECT   |
| 4656 | 47 | 04560 | 01200 | BNI          | CHECK E/Z TRIG FOR E/Z            |
| 4668 | 16 | 04525 | 16    | TFM          | SET OP CODE 16 IN 04524           |
| 4680 | 42 | 04691 | 04686 | BB           | IF HANGS UP IN THIS STEP IA ON BB |
| 4692 |    |       | X     |              |                                   |
| 4704 |    |       | X     |              |                                   |

PN 2125574  
EC 404568

## ROUTINE 020

CHECK FOR NO I/A ON BRANCH  
INDICATE, Q FIELD

|      |    |       |       |                              |
|------|----|-------|-------|------------------------------|
| 4716 |    | 000   | X     | WORKING AREA                 |
| 4728 |    |       | X     | WORKING AREA                 |
| 4740 | 11 | 04727 | 01    | AM SET H/P TRIG H/P          |
| 4752 | 16 | 11104 | 04775 | TFM SET UP IA AT 11104       |
| 4764 | 46 | 04788 | 11104 | BI CHECK NO IA ON BI Q FIELD |
| 4776 | 49 | 04824 |       | B ENTER ERROR ROUTINE        |
| 4788 | 16 | 04727 | 000   | TFM CLEAR ADD FIELD          |
| 4800 | 49 | 04872 |       | B                            |
| 4812 |    |       | X     |                              |

## ERROR ROUTINE

|      |    |       |       |     |
|------|----|-------|-------|-----|
| 4824 | 46 | 04848 | 00100 | BI  |
| 4836 | 39 | 04861 | 00100 | WA  |
| 4848 | 47 | 04872 | 00300 | BNI |
| 4860 | 48 | 70727 | 0 0%  | H   |
| 4872 | 46 | 04740 | 00200 | BI  |
| 4884 | 49 | 04908 |       | B   |

## ROUTINE 021

CHECK FOR NO I/A ON BRANCH NO  
INDICATE, Q FIELD

|      |    |       |       |                        |
|------|----|-------|-------|------------------------|
| 4896 |    | 00    | X     | WORKING AREA           |
| 4908 | 11 | 04907 | 22    | AM SET H/P TRIG H/P    |
| 4920 | 16 | 11109 | 04943 | TFM SET UP IA AT 11109 |
| 4932 | 47 | 04992 | 11109 | BNI CHECK NO IA ON BNI |
| 4944 | 16 | 04907 | 000   | TFM CLEAR ADD FIELD    |
| 4956 | 49 | 05040 |       | B                      |
| 4968 |    |       | X     |                        |
| 4980 |    |       | X     |                        |

## ERROR ROUTINE

|      |    |       |       |     |
|------|----|-------|-------|-----|
| 4992 | 46 | 05016 | 00100 | BI  |
| 5004 | 39 | 05029 | 00100 | WA  |
| 5016 | 47 | 05040 | 00300 | BNI |
| 5028 | 48 | 70727 | 1 0#  | H   |
| 5040 | 46 | 04908 | 00200 | BI  |
| 5052 | 49 | 05064 |       | B   |

## ROUTINE 022

CHECK FOR NO I/A ON BRANCH,  
Q FIELD

|      |    |       |       |     |                       |
|------|----|-------|-------|-----|-----------------------|
| 5064 | 16 | 11114 | 05087 | TFM | SET UP IA AT 11114    |
| 5076 | 49 | 05112 | 11114 | B   | CHECK NO IA ON BRANCH |
| 5088 |    |       |       | X   |                       |
| 5100 |    |       |       | X   |                       |
| 5112 | 46 | 05064 | 00200 | BI  |                       |
| 5124 | 49 | 05148 |       | B   |                       |

## ROUTINE 023

CHECK FOR NO I/A ON NO OPOSITION  
P AND Q FIELDS

|      |    |       |       |     |                        |
|------|----|-------|-------|-----|------------------------|
| 5136 |    |       |       | X   |                        |
| 5148 | 41 | 05159 | 05154 | NOP | CHECK FOR NO IA ON NOP |
| 5160 | 49 | 05184 |       | B   |                        |
| 5172 |    |       |       | X   |                        |
| 5184 | 46 | 05148 | 00200 | BI  |                        |
| 5196 | 49 | 05220 |       | B   |                        |

## ROUTINE 024

CHECK FOR NO I/A ON CONTROL,  
P FIELD

|      |    |       |       |     |                                |
|------|----|-------|-------|-----|--------------------------------|
| 5208 |    |       |       | X   |                                |
| 5220 | 16 | 10101 | 05238 | TFM | SET 05238 AT 10101             |
| 5232 | 34 | 10101 | 10101 | K   | CHECK NO IA ON CONTROL P FIELD |
| 5244 | 49 | 05280 |       | B   |                                |
| 5256 |    |       |       | X   |                                |

## ROUTINE 025

## TIMES 100 ROUTINE

|      |    |       | 000   | X   | WORKING AREA       |
|------|----|-------|-------|-----|--------------------|
| 5268 |    |       | 01400 | BI  | TURN OFF OVERFLOW  |
| 5280 | 46 | 05292 | 10    | AM  | ADD ONE            |
| 5292 | 11 | 05279 | 01400 | BNI | CHECK FOR OVERFLOW |
| 5304 | 47 | 01224 |       | B   |                    |
| 5316 | 49 | 05592 |       |     |                    |

## ROUTINE 026

## TEST COMPLETED ROUTINE

|      |    |       |       |    |                     |
|------|----|-------|-------|----|---------------------|
| 5328 |    |       |       | X  |                     |
| 5340 |    |       |       | X  |                     |
| 5352 | 63 | 45626 | 3 59  | X  | TEST R              |
| 5364 | 56 | 64634 | 95545 | X  | OUTINE              |
| 5376 | 62 | 435   | 65457 | X  | S COMP              |
| 5388 | 53 | 45634 | 54403 | X  | LETED               |
| 5400 |    | 4946  | 6266  | X  | IF SW               |
| 5412 | 71 | 564   | 64623 | X  | I OFE,              |
| 5424 |    | 5556  | 5956  | X  | NO RO               |
| 5436 | 64 | 63495 | 545   | X  | UTINE               |
| 5448 | 55 | 5662  | 6368  | X  | NOS TY              |
| 5460 | 57 | 4544  | 5664  | X  | PED OU              |
| 5472 | 63 | 23 4  | 15544 | X  | T, AND              |
| 5484 |    | 5556  | 4841  | X  | NO HA               |
| 5496 | 55 | 47206 | 45762 | X  | NG-UPS              |
| 5508 | 23 | 544   | 14348 | X  | , MACH              |
| 5520 | 49 | 5545  | 5745  | X  | INE PE              |
| 5532 | 59 | 46565 | 95445 | X  | RFORME              |
| 5544 | 44 | 634   | 56263 | X  | TEST                |
| 5556 | 62 | 575   | 95657 | X  | S PROP              |
| 5568 | 45 | 59536 | 803   | X  | ERLY.               |
| 5580 | #  |       |       | X  | #                   |
| 5592 | 34 |       | 00102 | K  | CARRIAGE RETURN     |
| 5604 | 39 | 05353 | 00100 | WA | TYPE TEST COMPLETED |
| 5616 | 46 | 01092 | 00400 | BI |                     |
| 5628 | 48 | 05634 | 05639 | H  |                     |
| 5640 | 49 | 01104 | E     | B  |                     |

## **CS01 - Check Stops Diagnostic**



```
//=====
//  
// CS01 - Check Stops Diagnostic  
//  
// Program Switch settings:  
//  
//    PS1:  not used  
//    PS2:  not used  
//    PS3:  not used  
//    PS4:  not used  
//  
// Check switches settings:  
//  
//    DISK I/O - STOP  
//    PARITY   - STOP  
//    I/O      - STOP  
//    O'FLOW   - STOP  
//  
// Start addresses:  
//  
//    00402 - Full test  
//  
// Directions:  
//  
//    1. Load CS01 diagnostic  
//    2. Press START  
//    3. Verify CHECK STOP & MAR CHK are on and MAR = C/C/C/C/C-8-2  
//    4. Press RESET  
//    5. Press START  
//    6. Verify CHECK STOP & MAR CHK are on and MAR = C/C/C/C-8-2/C  
//    7. Press RESET  
//    8. Press START  
//    9. Verify CHECK STOP & MAR CHK are on and MAR = C/C/C-8-2/C/C  
//    10. Press RESET  
//    11. Press START  
//    12. Verify CHECK STOP & MAR CHK are on and MAR = C/C-8-2/C/C/C  
//    13. Press RESET  
//    14. Press START  
//    15. Verify CHECK STOP & MAR CHK are on and MAR = C-8-2/C/C/C/C  
//    16. Press RESET  
//    17. Press START  
//    18. Verify CHECK STOP & MAR CHK are on and MAR = C/C/C/C/8-2-1  
//    19. Press RESET  
//    20. Press START  
//    21. Verify CHECK STOP & MAR CHK are on and MAR = C/C/C/8-2-1/C  
//    22. Press RESET  
//    23. Press START  
//    24. Verify CHECK STOP & MAR CHK are on and MAR = C/C/8-2-1/C/C  
//    25. Press RESET  
//    26. Press START  
//    27. Verify CHECK STOP & MAR CHK are on and MAR = C/8-2-1/C/C/C  
//    28. Press RESET  
//    29. Press START  
//    30. Verify CHECK STOP & MAR CHK are on and MAR = 8-2-1/C/C/C/C  
//    31. Press RESET  
//    32. Press START  
//    33. Verify CHECK STOP & MAR CHK are on and MAR = C/C/C/C/C-8-4  
//    34. Press RESET  
//    35. Press START  
//    36. Verify CHECK STOP & MAR CHK are on and MAR = C/C/C/C-8-4/C  
//    37. Press RESET  
//    38. Press START  
//    39. Verify CHECK STOP & MAR CHK are on and MAR = C/C/C-8-4/C/C
```

```
// 40. Press RESET
// 41. Press START
// 42. Verify CHECK STOP & MAR CHK are on and MAR = C/C-8-4/C/C/C
// 43. Press RESET
// 44. Press START
// 45. Verify CHECK STOP & MAR CHK are on and MAR = C-8-4/C/C/C/C
// 46. Press RESET
// 47. Press START
// 48. Verify CHECK STOP & MAR CHK are on and MAR = C/C/C/C/8-4-1
// 49. Press RESET
// 50. Press START
// 51. Verify CHECK STOP & MAR CHK are on and MAR = C/C/C/8-4-1/C
// 52. Press RESET
// 53. Press START
// 54. Verify CHECK STOP & MAR CHK are on and MAR = C/C/8-4-1/C/C
// 55. Press RESET
// 56. Press START
// 57. Verify CHECK STOP & MAR CHK are on and MAR = C/8-4-1/C/C/C
// 58. Press RESET
// 59. Press START
// 60. Verify CHECK STOP & MAR CHK are on and MAR = 8-4-1/C/C/C/C
// 61. Press RESET
// 62. Press START
// 63. Verify CHECK STOP & MAR CHK are on and MAR = C/C/C/C/8-4-2
// 64. Press RESET
// 65. Press START
// 66. Verify CHECK STOP & MAR CHK are on and MAR = C/C/C/8-4-2/C
// 67. Press RESET
// 68. Press START
// 69. Verify CHECK STOP & MAR CHK are on and MAR = C/C/8-4-2/C/C
// 70. Press RESET
// 71. Press START
// 72. Verify CHECK STOP & MAR CHK are on and MAR = C/8-4-2/C/C/C
// 73. Press RESET
// 74. Press START
// 75. Verify CHECK STOP & MAR CHK are on and MAR = 8-4-2/C/C/C/C
// 76. Press RESET
// 77. Press START
// 78. Verify CHECK STOP & MAR CHK are on and MAR = C/C/C/C/C-8-4-2-1
// 79. Press RESET
// 80. Press START
// 81. Verify CHECK STOP & MAR CHK are on and MAR = C/C/C/C-8-4-2-1/C
// 82. Press RESET
// 83. Press START
// 84. Verify CHECK STOP & MAR CHK are on and MAR = C/C/C-8-4-2-1/C/C
// 85. Press RESET
// 86. Press START
// 87. Verify CHECK STOP & MAR CHK are on and MAR = C/C-8-4-2-1/C/C/C
// 88. Press RESET
// 89. Press START
// 90. Verify CHECK STOP & MAR CHK are on and MAR = C-8-4-2-1/C/C/C/C
// 91. Press RESET
// 92. Press START
// 93. Verify CHECK STOP is on and OPERATION REGISTER = 7/7
// 94. Press RESET
// 95. Press START
// 96. Verify CHECK STOP is on and OPERATION REGISTER = C/C-8-4-2-1
// 97. Press RESET
// 98. Press START
// 99. Verify CHECK STOP is on and OPERATION REGISTER = C-8-4-2-1/C
// 100. Press RESET
// 101. Press START
// 102. Verify CHECK STOP & MAR CHK are on and MAR = C/8/4/2/1
```

```
// 103. Press RESET
// 104. Press INSERT
// 105. Press RELEASE
// 106. Press START
// 107. Verify CHECK STOP & MAR CHK are on and MAR = C-4-2/C/C/C/C
// 108. Press RESET
// 109. Press START
// 110. Verify CHECK STOP & MAR CHK are on and MAR = C-8-1/C-8-1/C-8-1/C-8-1/C-8-1
// 111. Press RESET
// 112. Press START
// 113. Type A
// 114. Verify CHECK STOP & MAR CHK are on and MAR = 1/C/C/C/C
// 115. Press RESET
// 116. Press START
// 117. Verify CHECK STOP & MAR CHK are on and MAR = 1/C/C/C/C
// 118. Press RESET
// 119. Press START
// =====
```



## Sample Output – CS01

```
CHECK STOP TEST (CS01)

MAR CHECKS - NON-NUMERIC DIGITS IN EVERY POSITION
- DIGIT 8-2 (5)
- DIGIT 8-2-1 (5)
- DIGIT 8-4 (5)
- DIGIT 8-4-1 (5)
- DIGIT 8-4-2 (5)
- DIGIT 8-4-2-1 (5)
OPCODE CHECKS - BAD INSTRUCTIONS
- UNDEFINED OPCODE (1)
- NON-NUMERIC OPCODES (2)
- UNALIGNED INSTRUCTION (1)
MEMORY CHECKS - BAD ADDRESSES
- OUT-OF-RANGE (2)
IO CHECK - UNALIGNED READ/WRITE
- READ ALPHAMERIC (1)
  A
- WRITE ALPHAMERIC (1)

END OF TESTS
```



IBM 1620 Jr. SPS Assembler (v0.99)  
8/26/2020 @ 08:05

Source: CS01 Check Stops.sps      Assembled:

IBM 1620 Jr. SPS Assembler (v0.99)      Source: CS01\_Check\_Stops.sps      Assembled:  
8/26/2020 @ 08:05

53 00537 @ DSC 1,@  
 54 00538 00000000 DSC 8,00000000  
 55  
 56 00546 33 DSC 2,33  
 57 00548 @ DSC 1,@  
 58 00549 000000000 DSC 9,000000000  
 59  
 60 \* RECORD GROUP MARK (0XB) IN ALL POSITIONS  
 61 00558 39 01629 00100 WATY MAR11  
 62 00570 34 00000 00102 RCTY  
 63  
 64 00582 33 00001 00000 CF 00001  
 65 00594 33 00010 00000 CF 00010  
 66 00606 33 00100 00000 CF 00100  
 67 00618 33 01000 00000 CF 01000  
 68 00630 33 10000 00000 CF 10000  
 69  
 70 \* NUMERIC BLANK (0XC) IN ALL POSITIONS  
 71 00642 39 01669 00100 WATY MAR12  
 72 00654 34 00000 00102 RCTY  
 73  
 74 00666 330000 DSC 6,330000  
 75 00672 ~ DNB 1  
 76 00673 00000 DSC 5,00000  
 77  
 78 00678 33000 DSC 5,33000  
 79 00683 ~ DNB 1  
 80 00684 000000 DSC 6,000000  
 81  
 82 00690 3300 DSC 4,3300  
 83 00694 ~ DNB 1  
 84 00695 0000000 DSC 7,0000000  
 85  
 86 00702 330 DSC 3,330  
 87 00705 ~ DNB 1  
 88 00706 00000000 DSC 8,00000000  
 89  
 90 00714 33 DSC 2,33  
 91 00716 ~ DNB 1  
 92 00717 000000000 DSC 9,000000000  
 93  
 94 \* INVALID (0XD) IN ALL POSITIONS  
 95 00726 39 01705 00100 WATY MAR13  
 96 00738 34 00000 00102 RCTY  
 97  
 98 00750 33 00001 00000 CF 00001  
 99 00762 33 00010 00000 CF 00010  
 100 00774 33 00100 00000 CF 00100  
 101 00786 33 01000 00000 CF 01000  
 102 00798 33 10000 00000 CF 10000  
 103  
 104 \* INVALID (0XE) IN ALL POSITIONS  
 105 00810 39 01745 00100 WATY MAR14  
 106 00822 34 00000 00102 RCTY  
 107  
 108 00834 33 00001 00000 CF 00001  
 109 00846 33 00010 00000 CF 00010  
 110 00858 33 00100 00000 CF 00100  
 111 00870 33 01000 00000 CF 01000  
 112 00882 33 10000 00000 CF 10000  
 113  
 114 \* GROUP MARK (0XF) IN ALL POSITIONS  
 115 00894 39 01785 00100 WATY MAR15

|     |       |               |       |       |      |       |               |
|-----|-------|---------------|-------|-------|------|-------|---------------|
| 116 | 00906 | 34            | 00000 | 00102 |      | RCTY  |               |
| 117 |       |               |       |       |      |       |               |
| 118 | 00918 | 33            | 00001 | 00000 | CF   | 00001 |               |
| 119 | 00930 | 33            | 00010 | 00000 | CF   | 00010 |               |
| 120 | 00942 | 33            | 00100 | 00000 | CF   | 00100 |               |
| 121 | 00954 | 33            | 01000 | 00000 | CF   | 01000 |               |
| 122 | 00966 | 33            | 10000 | 00000 | CF   | 10000 |               |
| 123 |       |               |       |       |      |       |               |
| 124 | 00978 | 39            | 01829 | 00100 | INST | WATY  | INSTT         |
| 125 | 00990 | 34            | 00000 | 00102 |      | RCTY  |               |
| 126 |       |               |       |       |      |       |               |
| 127 | 01002 | 39            | 01895 | 00100 |      | WATY  | INSTB         |
| 128 | 01014 | 34            | 00000 | 00102 |      | RCTY  |               |
| 129 |       |               |       |       |      |       |               |
| 130 | 01026 | 7700000000000 |       |       | DSC  | 12,   | 7700000000000 |
| 131 |       |               |       |       |      |       |               |
| 132 | 01038 | 39            | 01945 | 00100 |      | WATY  | INSTN         |
| 133 | 01050 | 34            | 00000 | 00102 |      | RCTY  |               |
| 134 |       |               |       |       |      |       |               |
| 135 | 01062 | 0100000000000 |       |       | DSC  | 12,   | 0100000000000 |
| 136 |       |               |       |       |      |       |               |
| 137 | 01074 | 1000000000000 |       |       | DSC  | 12,   | 1000000000000 |
| 138 |       |               |       |       |      |       |               |
| 139 | 01086 | 39            | 02001 | 00100 |      | WATY  | INSTU         |
| 140 | 01098 | 34            | 00000 | 00102 |      | RCTY  |               |
| 141 |       |               |       |       |      |       |               |
| 142 | 01110 | 26            | 00011 | 02375 |      | TF    | 11,IMEM+11    |
| 143 | 01122 | 49            | 08421 | 00000 |      | B     | 08421         |
| 144 |       |               |       |       |      |       |               |
| 145 | 01134 | 26            | 00011 | 02363 | MEM  | TF    | 11,ISTR+11    |
| 146 | 01146 | 39            | 02061 | 00100 |      | WATY  | MEMT          |
| 147 | 01158 | 34            | 00000 | 00102 |      | RCTY  |               |
| 148 |       |               |       |       |      |       |               |
| 149 | 01170 | 39            | 02121 | 00100 |      | WATY  | MEMH          |
| 150 | 01182 | 34            | 00000 | 00102 |      | RCTY  |               |
| 151 |       |               |       |       |      |       |               |
| 152 | 01194 | 33            | 60000 | 00000 |      | CF    | 60000         |
| 153 | 01206 | 33            | 99999 | 00000 |      | CF    | 99999         |
| 154 |       |               |       |       |      |       |               |
| 155 | 01218 | 39            | 02163 | 00100 | IO   | WATY  | IOT           |
| 156 | 01230 | 34            | 00000 | 00102 |      | RCTY  |               |
| 157 |       |               |       |       |      |       |               |
| 158 | 01242 | 39            | 02227 | 00100 |      | WATY  | IOR           |
| 159 | 01254 | 34            | 00000 | 00102 |      | RCTY  |               |
| 160 |       |               |       |       |      |       |               |
| 161 | 01266 | 34            | 00000 | 00101 |      | SPTY  |               |
| 162 | 01278 | 34            | 00000 | 00101 |      | SPTY  |               |
| 163 | 01290 | 34            | 00000 | 00101 |      | SPTY  |               |
| 164 | 01302 | 34            | 00000 | 00101 |      | SPTY  |               |
| 165 | 01314 | 37            | 10000 | 00100 |      | RATY  | 10000         |
| 166 | 01326 | 34            | 00000 | 00102 |      | RCTY  |               |
| 167 |       |               |       |       |      |       |               |
| 168 | 01338 | 39            | 02275 | 00100 |      | WATY  | IOW           |
| 169 | 01350 | 34            | 00000 | 00102 |      | RCTY  |               |
| 170 |       |               |       |       |      |       |               |
| 171 | 01362 | 39            | 10000 | 00100 |      | WATY  | 10000         |
| 172 |       |               |       |       |      |       |               |
| 173 | 01374 | 26            | 00011 | 02363 | END  | TF    | 11,ISTR+11    |
| 174 | 01386 | 34            | 00000 | 00102 |      | RCTY  |               |
| 175 | 01398 | 39            | 02327 | 00100 |      | WATY  | ENDT          |
| 176 | 01410 | 34            | 00000 | 00102 |      | RCTY  |               |
| 177 | 01422 | 48            | 00000 | 00000 |      | H     |               |
| 178 | 01434 | 49            | 00402 | 00000 |      | B     | START         |

```

179
180          *
181          * DATA
182          *

183 01447 434845..71040@      TITLE  DAC  23,CHECK STOP TEST (CS01)@

184 01493 544159..56550@      MART   DAC  50,MAR CHECKS - NON-NUMERIC DIGITS IN
EVERY POSITION@

185 01593 000020..75040@      MAR10  DAC  18, - DIGIT 8-2 (5)@

186 01629 000020..75040@      MAR11  DAC  20, - DIGIT 8-2-1 (5)@

187 01669 000020..75040@      MAR12  DAC  18, - DIGIT 8-4 (5)@

188 01705 000020..75040@      MAR13  DAC  20, - DIGIT 8-4-1 (5)@

189 01745 000020..75040@      MAR14  DAC  20, - DIGIT 8-4-2 (5)@

190 01785 000020..75040@      MAR15  DAC  22, - DIGIT 8-4-2-1 (5)@

191 01829 565743..55620@      INSTT  DAC  33,OPCODE CHECKS - BAD INSTRUCTIONS@

192 01895 000020..71040@      INSTB  DAC  25, - UNDEFINED OPCODE (1)@

193 01945 000020..72040@      INSTN  DAC  28, - NON-NUMERIC OPCODES (2)@

194 02001 000020..71040@      INSTU  DAC  30, - UNALIGNED INSTRUCTION (1)@

195 02061 544554..45620@      MEMT   DAC  30,MEMORY CHECKS - BAD ADDRESSES@

196 02121 000020..72040@      MEMH   DAC  21, - OUT-OF-RANGE (2)@

197 02163 495600..63450@      IOT    DAC  32,IO CHECK - UNALIGNED READ/WRITE@

198 02227 000020..71040@      IOR    DAC  24, - READ ALPHAMERIC (1)@

199 02275 000020..04000@      IOW    DAC  26, - WRITE ALPHAMERIC (1)@

200 02327 455544..63620@      ENDT   DAC  13,END OF TESTS@

201

202 02352 49 00402 00000     ISTRT  B    START,,0
203 02364 49 01134 00000     IMEM   B    MEM,,0
204
205 00402                      DEND   START

```

#### Symbol Cross-Reference Table

---

| Symbol | Addr. | Type   | Defined | References |
|--------|-------|--------|---------|------------|
| END    | 01374 | <inst> | 173     |            |
| ENDT   | 02327 | DAC    | 200     | 175        |
| IMEM   | 02364 | <inst> | 203     | 142        |
| INST   | 00978 | <inst> | 124     |            |
| INSTB  | 01895 | DAC    | 192     | 127        |
| INSTN  | 01945 | DAC    | 193     | 132        |

|        |       |        |     |     |     |     |
|--------|-------|--------|-----|-----|-----|-----|
| INSTT  | 01829 | DAC    | 191 | 124 |     |     |
| INSTU  | 02001 | DAC    | 194 | 139 |     |     |
| IO     | 01218 | <inst> | 155 |     |     |     |
| IOR    | 02227 | DAC    | 198 | 158 |     |     |
| IOT    | 02163 | DAC    | 197 | 155 |     |     |
| IOW    | 02275 | DAC    | 199 | 168 |     |     |
| ISTRRT | 02352 | <inst> | 202 | 145 | 173 |     |
| MAR    | 00450 | <inst> | 33  |     |     |     |
| MAR10  | 01593 | DAC    | 185 | 37  |     |     |
| MAR11  | 01629 | DAC    | 186 | 61  |     |     |
| MAR12  | 01669 | DAC    | 187 | 71  |     |     |
| MAR13  | 01705 | DAC    | 188 | 95  |     |     |
| MAR14  | 01745 | DAC    | 189 | 105 |     |     |
| MAR15  | 01785 | DAC    | 190 | 115 |     |     |
| MART   | 01493 | DAC    | 184 | 33  |     |     |
| MEM    | 01134 | <inst> | 145 | 203 |     |     |
| MEMH   | 02121 | DAC    | 196 | 149 |     |     |
| MEMT   | 02061 | DAC    | 195 | 146 |     |     |
| START  | 00402 | <inst> | 27  | 205 | 178 | 202 |
| TITLE  | 01447 | DAC    | 183 | 28  |     | 205 |



## **DX05 - Core Storage 20K Diagnostic**



```
//=====
//  
// DX05L - Core Storage L 20K Diagnostic  
//  
// Program Switch settings:  
//  
// PS1: ON - Bypass error type out  
// OFF - Type out routine number on error  
// PS2: ON - Loop in routine  
// OFF - Continue to next routine  
// PS3: not used  
// PS4: ON - Repeat test DX05L  
// OFF - Run test DX05L once  
//  
// Check switches settings:  
//  
// DISK I/O - STOP  
// PARITY - STOP  
// I/O - STOP  
// O'FLOW - STOP  
//  
// Start addresses:  
//  
// 05052 - Full test  
//  
// Directions:  
//  
// 1. Load DX05L diagnostic  
// 2. Press START  
//  
//=====
```

```
//=====  
//  
// DX05H - Core Storage H 20K Diagnostic  
//  
// Program Switch settings:  
//  
// PS1: ON - Bypass error type out  
// OFF - Type out routine number on error  
// PS2: ON - Loop in routine  
// OFF - Continue to next routine  
// PS3: not used  
// PS4: ON - Repeat test DX05H  
// OFF - Run test DX05H once  
//  
// Check switches settings:  
//  
// DISK I/O - STOP  
// PARITY - STOP  
// I/O - STOP  
// O'FLOW - STOP  
//  
// Start addresses:  
//  
// 00402 - Full test  
//  
// Directions:  
//  
// 1. Load DX05H diagnostic  
// 2. Press START  
//  
//=====
```



## Sample Output – DX05

DTXØ5L  
PASS COMPLETE

DTXØ5H  
PASS COMPLETE



NO. 2172342  
SHEET 0  
OF 19

# DIAGNOSTIC TEST

TITLE CORE STORAGE TEST - L 20K - DTX054  
MACH. TYPE 1620-1 BY HNJ APPR.  DATE

## ENGINEERING CHANGE HISTORY

| E/C NO. | DATE   | SHEETS AFFECTED |
|---------|--------|-----------------|
| 404980  | 5-7-64 | 1 - 19          |
|         |        |                 |
|         |        |                 |
|         |        |                 |
|         |        |                 |
|         |        |                 |
|         |        |                 |
|         |        |                 |
|         |        |                 |
|         |        |                 |
|         |        |                 |
|         |        |                 |
|         |        |                 |
|         |        |                 |
|         |        |                 |

|         |        |  |  |  |  |  |  |
|---------|--------|--|--|--|--|--|--|
| E/C NO. | 404980 |  |  |  |  |  |  |
| DATE    | 5-7-64 |  |  |  |  |  |  |

DTX05 L

Because this test destroys the contents of core, it is not DIPAL compatible.

PURPOSE OF TEST

This diagnostic tests the standard 20 K storage for marginal conditions by generating worst case half select noise patterns. It is divided into two parts which are loaded separately as if two different diagnostics.

5H - Tests all addresses ending in 50 through 99 (over 50 sense segment)

5L - Tests all addresses ending in 00 through 49 (under 50 sense segment)

The running time of either part is 36 seconds per pass.

SWITCH CONTROL

The Console Program Switches have the following control functions in this test:

Program Switch 1      ON - Bypass all error routines  
                          OFF - Type out errors

Program Switch 2      ON - Loop at test address  
                          OFF - Sequence through entire test

Program Switch 3      - Not Used

Program Switch 4      ON - Repeat Diagnostic  
                          OFF - Card Input: Load next program at end of pass

The PARITY Switch set in the PROGRAM position will allow the program to run without manual intervention but in the case where the error forms an illegal character it will be necessary to run with the switch in the STOP position in order to determine the failing bit.

The I/O and OVERFLOW Switches are set to the PROGRAM position.

TEST PROCEDURE

Card Input:

1. Clear Core Storage by inserting 31 00003 00002. Release and Start.
2. Load test deck from 1622 by pushing LOAD button or by inserting 36 00000 00300 R-S.

3. Both programs are on the same tape, however they must be loaded separately. The first program on the tape is X05H, the second is X05L.

To reproduce the Paper Tape, insert 3600000 00300, release, and press "SIE" button. DO NOT reposition the tape on the Reader after the program is read in, as the second program is in position to be read. After the program has been loaded, insert

| LOC   |    |       |
|-------|----|-------|
| 00000 | 38 | 00024 |
| 00012 | 35 | 00102 |
| 00024 | 49 | 00102 |
| 00036 | 36 | 00102 |
| 00048 | 36 | 10002 |
| 00060 | 49 | 00102 |
|       |    | 0000+ |

After MAR has counted to 04954, stop by pressing "SCE", reset, insert

| LOC   |    |       |
|-------|----|-------|
| 00000 | 35 | 19999 |
| 00012 | 35 | 10002 |
| 00024 | 35 | 19999 |
| 00036 | 48 |       |

Release/start.

This is done to prevent writing 5000 zeros on tape.

When the first program, DTX05H, has been punched, clear core and insert 36 00000 00300 to read the second program, DTX05L. Release, and press "SIE" button.

After the program has been loaded, insert

| LOC   |    |       |
|-------|----|-------|
| 00000 | 38 | 00024 |
| 00012 | 35 | 05052 |
| 00024 | 49 | 05052 |
| 00036 | 36 | 05052 |
| 00048 | 36 | 15052 |
| 00060 | 49 | 05052 |
|       |    | 0000+ |

Release/start.

When MAR reaches 09604, stop by pressing "SCE" button, insert

| LOC   |    |       |
|-------|----|-------|
| 00000 | 35 | 19999 |
| 00012 | 35 | 15052 |
| 00024 | 35 | 19999 |
| 00036 | 48 |       |

Release/start.

When MAR reaches 16779, stop by pressing "SCE" button, reset, and start.

4. 1620 will Halt with 00011 in MAR after deck is loaded. Push START to execute program.

The diagnostic was assembled by the SPS Assembly Program and uses a standard SPS Load routine. A detailed listing of the loader along with a brief introduction to the SPS Assembly Program may be found in the DTX02 Diagnostic write-up.

#### TEST DESCRIPTION

The pattern 7788 is written in the area to be tested and then each address in turn is complimented and then restored to its original value. Read out of the originally written character is with the half select noise in phase. Read out of the complimented character is with the half select noise out of phase. After all addresses are tested the pattern is reversed and the procedure is repeated so that every core is tested under both conditions.

In order to provide the best chance of successful test operation, the two parts of the test are confined to diagonally opposite corners of storage. No common X or Y drive line, or sense segments are used in the program area. There is no possibility of isolation in the address decode, matrix switch area.

The machine add and multiply tables are not used in this program as no arithmetic instructions have been used. The program is made up of information Transfer and Branch type instructions only.

Any reference to add tables in the listing or flow chart are to program tables, not the machine add table.

The pattern is first written throughout the tested area of storage with a Transmit Record instruction in blocks of fifty characters. If an error occurs during this phase of the program, the error routine must scan the fifty character field with a Transmit Digit instruction in order to find the specific address that failed.

The Compliment and Restore phase uses a Transmit Digit instruction, so the error address is always known. Because of the lengthy nature of this test, a rather large address modification loop is used in order to reduce the running time to a minimum. Ten addresses are completely checked each time through the loop. The pattern set up in the loop is 7788778877 (10 digits). It can be seen that it will be necessary to compliment this pattern each time through the loop in order to keep it progressing properly. In the flow chart, this is done in a clock labelled "Swap Test Digit Area".

#### ERROR HALTS

#### Explanation

00011

Program Loading Complete

04637

LH Pass complete and Program Switch 4 off.

09287

Waiting for card reader

LL Pass complete and Program Switch 4 off.

Waiting for card reader

#### ERROR PRINT OUT

In the pattern writing phase, an error print out may be one or two lines. An error in an even adr only will give a one line print out. An error in an odd address will give a two line print out. One for both the even and odd address.

Even address error:

X is error char      XXXXX is error ADR (Even Address)

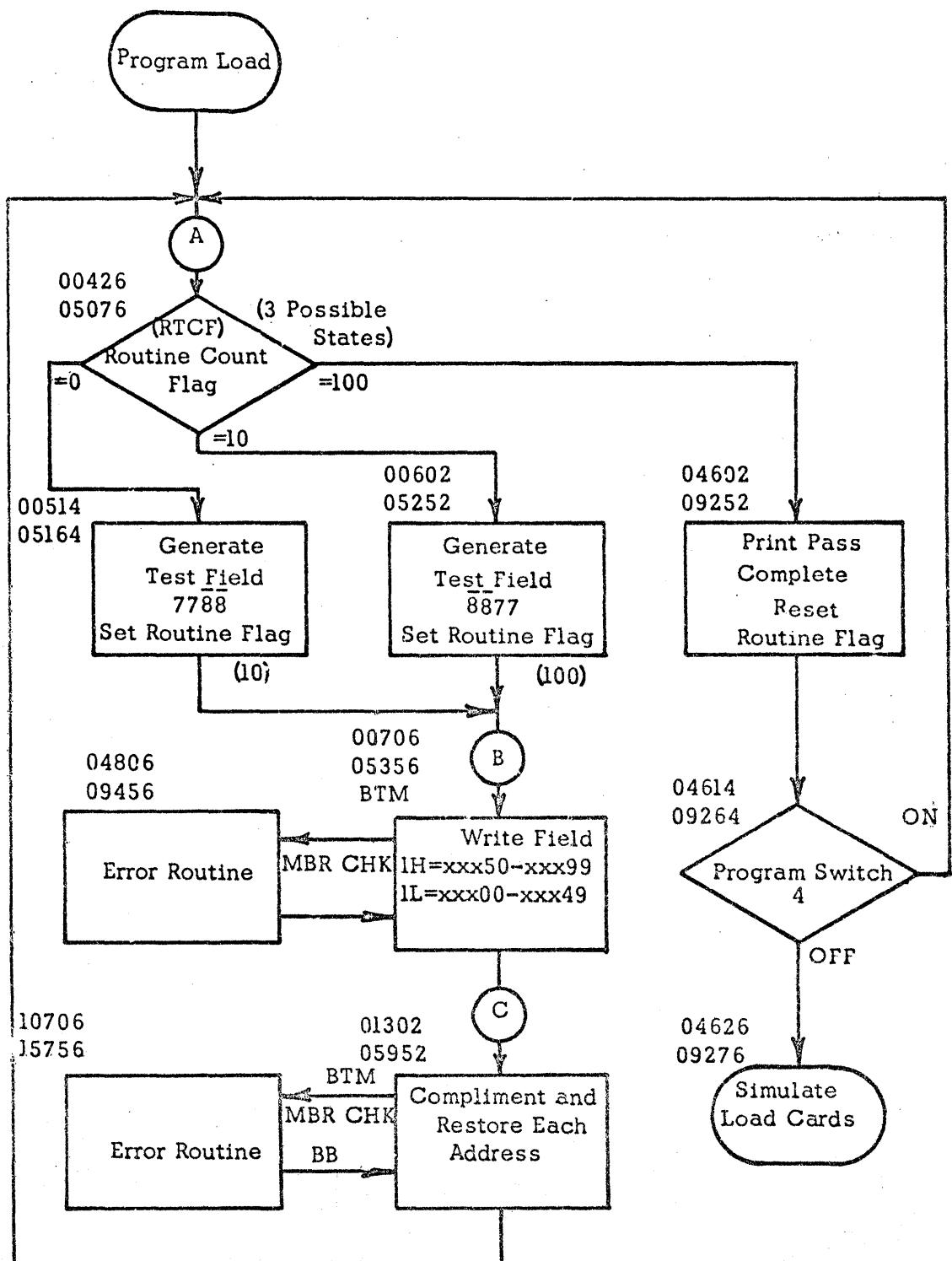
Odd address error:

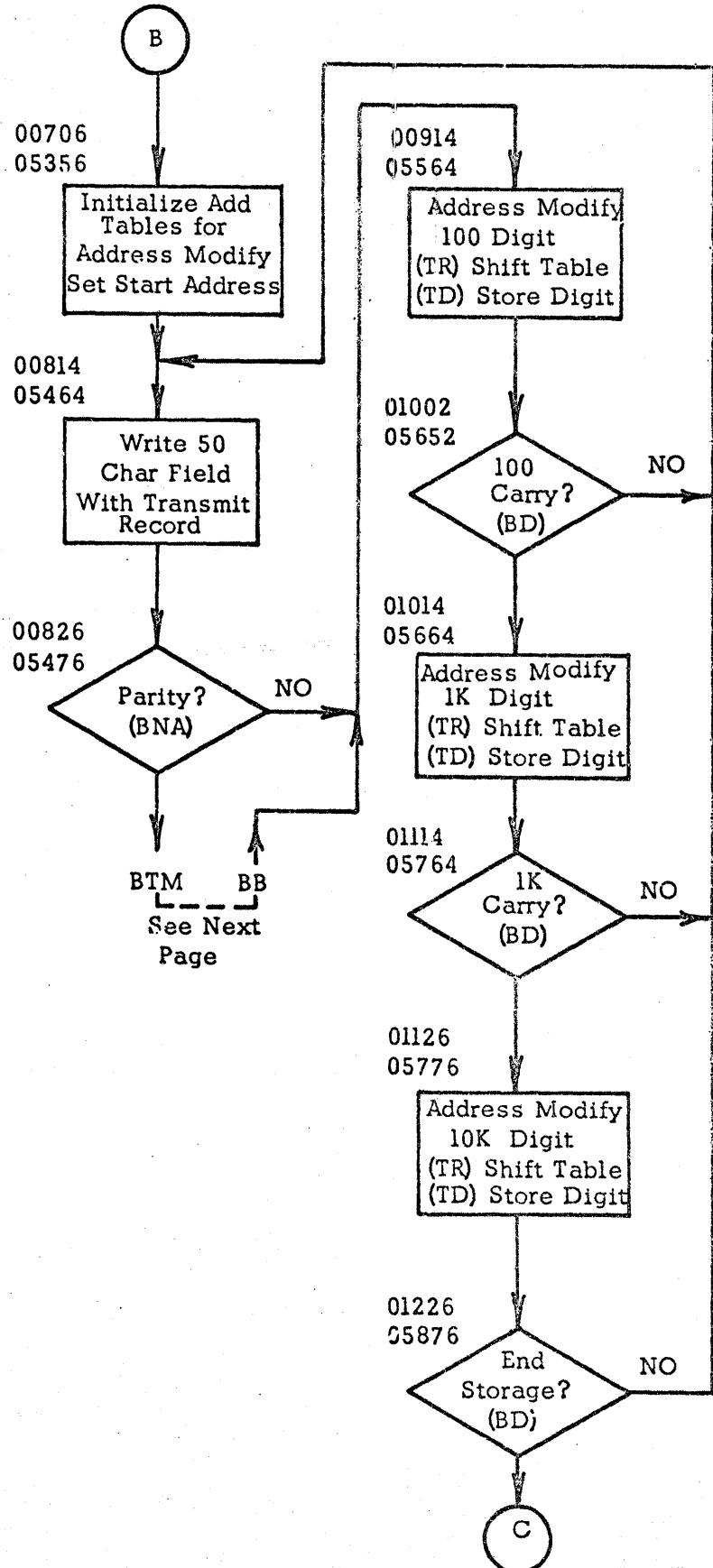
X is error char      XXXXX is error ADR (Even Address)  
X is error char      XXXXX is error ADR (Odd Address)

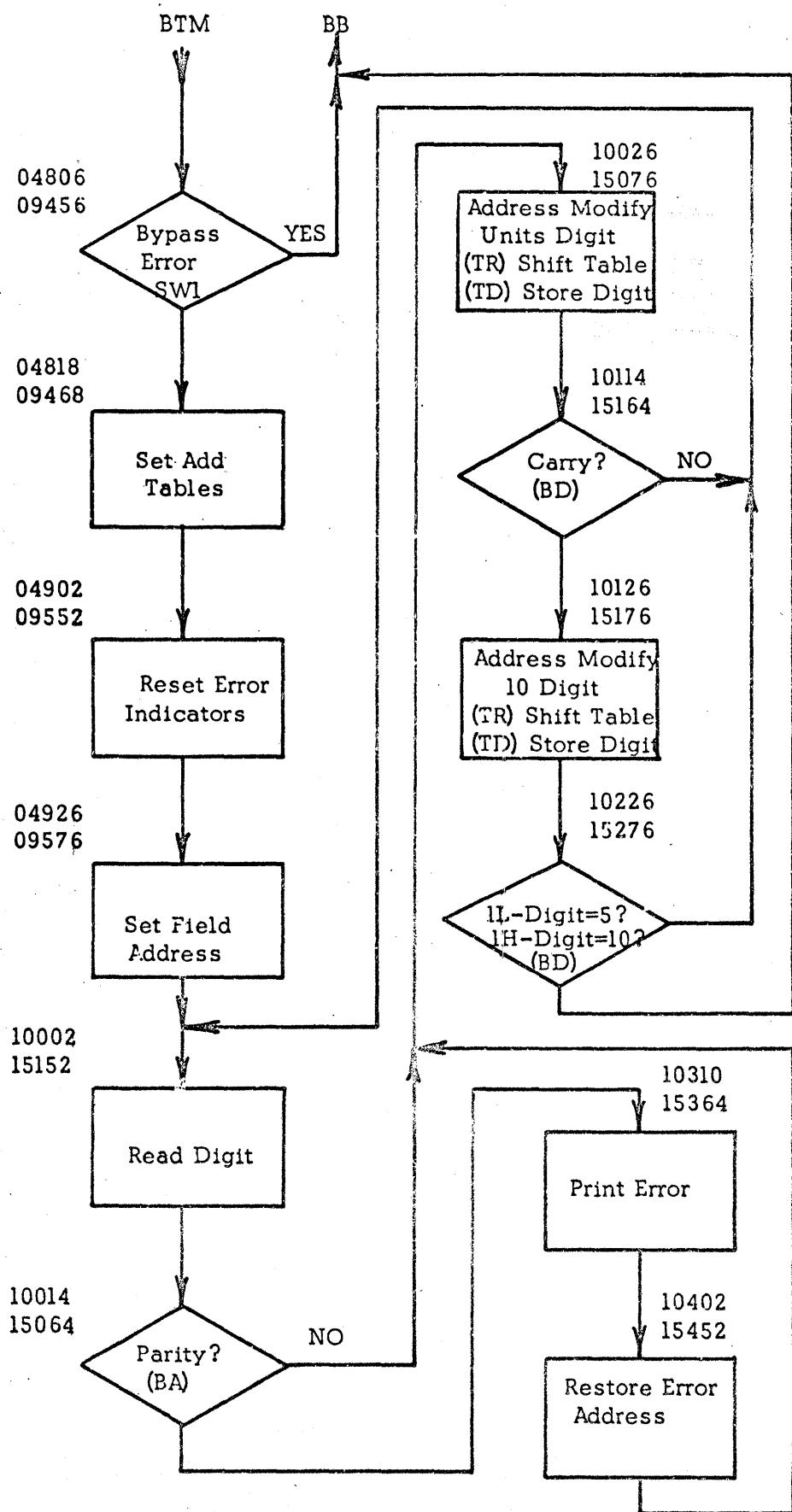
In the Compliment and Restore phase the characters from both even and odd addresses are always printed along with the even address on a single line.

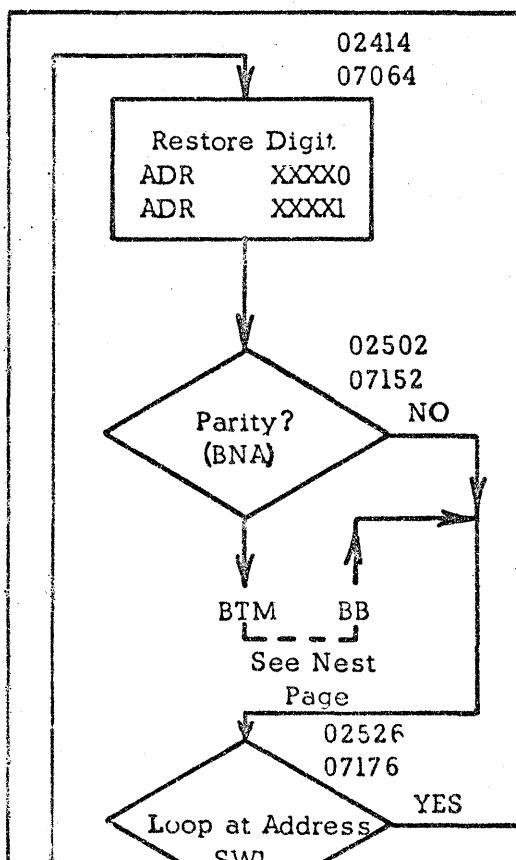
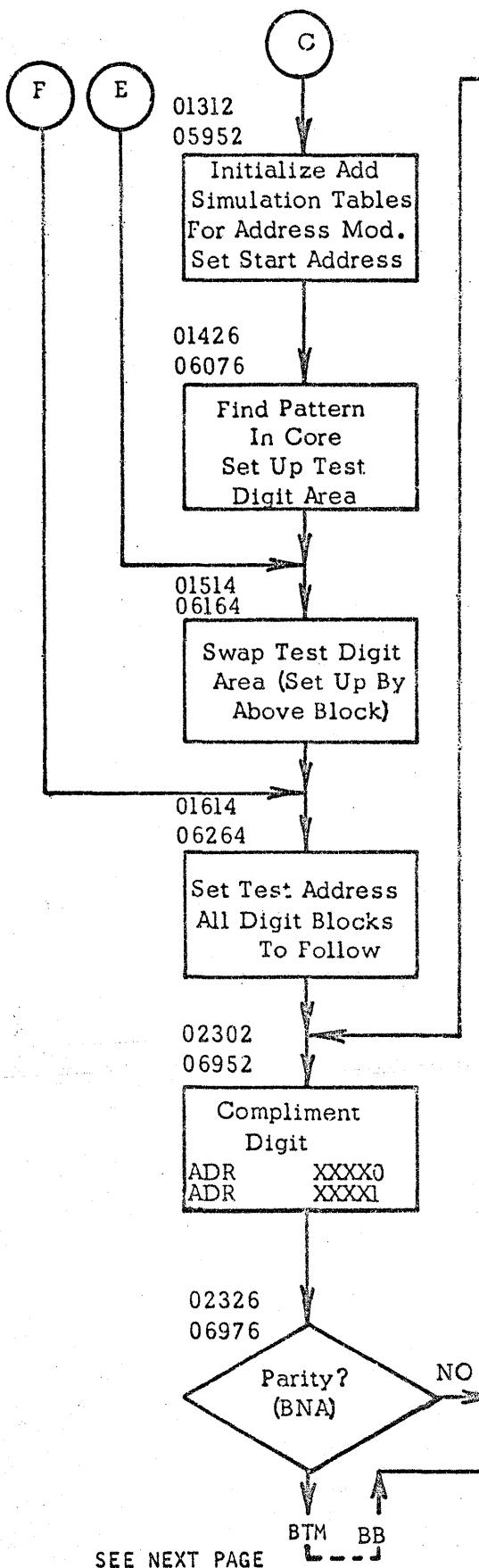
XX is error char      XXXXX is error ADR (Even Address)

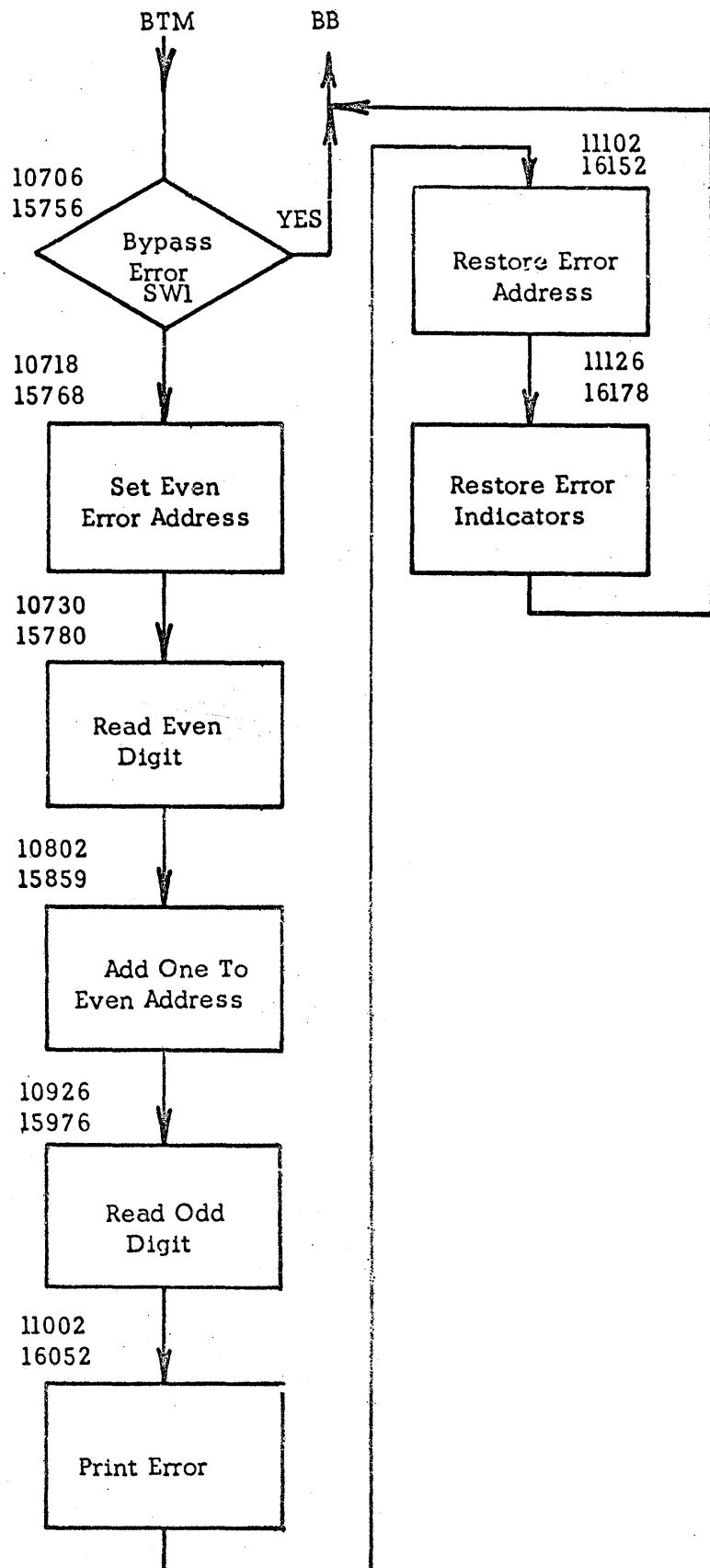
Both characters will be indicated as out of parity regardless of the failure.

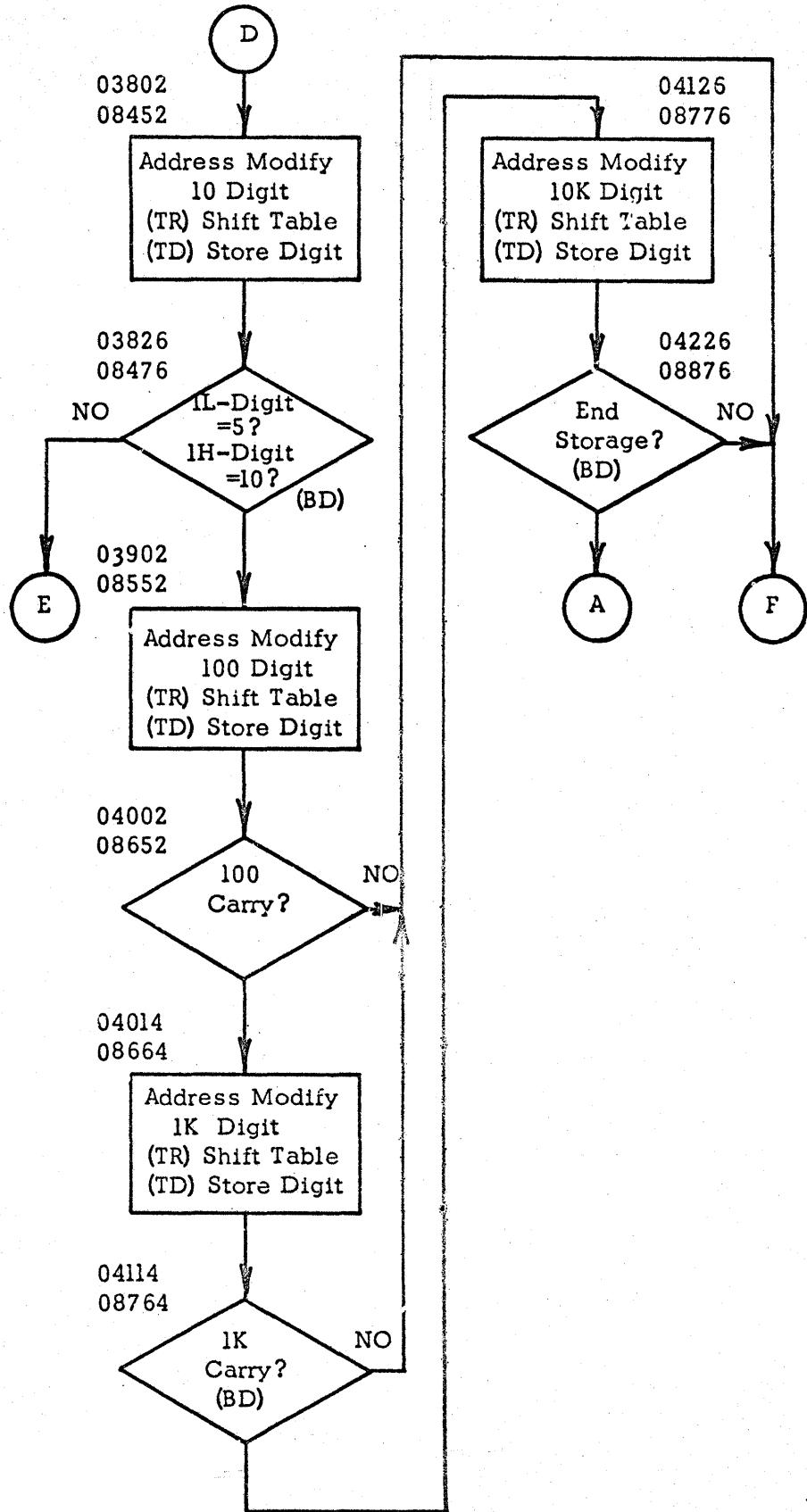












**DTX05L**  
**1620 MEMORY TEST 20K MACHINE**

THIS FIRST PART KEEPS TRACK OF WHICH PATTERN IS  
TO BE WRITTEN NEXT AND GENERATES SAME IN LOWEST  
TESTED AREA IN STORAGE 00-49 FOR 1L 50-99 FOR 1H

|       |    |      |         |                             |
|-------|----|------|---------|-----------------------------|
| 05052 |    | DORG | 5052    |                             |
| 05052 | 16 | RTFM | RTCF,,, | RESET ROUTINE COUNT         |
| 05064 | 49 | B    | HEAD    |                             |
| 05076 | 43 | RCB  | BD      | EXIT,RTCF-1,, EXIT          |
| 05088 | 49 |      | B       | RCC                         |
| 05152 |    |      | DORG    | *+53                        |
| 05152 | 43 | RCC  | BD      | RCD,RTCF,, BR PASS TWO 8877 |
| 05164 | 31 |      | TR      | ,TP1,, SET UP               |
| 05176 | 31 |      | TR      | 26,TP1+2,, 7788 TEST        |
| 05188 | 17 |      | BTM     | IA,1,                       |
| 05252 |    |      | DORG    | *+53                        |
| 05252 | 31 | RCD  | TR      | ,TP2,, SET UP               |
| 05264 | 31 |      | TR      | 26,TP2+2,, 8877 TEST        |
| 05276 | 17 |      | BTM     | IA,10,                      |
| 05288 | 41 |      | NOP     |                             |
| 05351 |    |      | DORG    | *+52                        |

WRITE PATTERN THROUGH STORAGE  
IN BLOCKS OF 50 WITH TRANSMIT RECORD

|       |       |       |       |     |      |             |                                   |
|-------|-------|-------|-------|-----|------|-------------|-----------------------------------|
| 05355 | 00005 |       | RTCF  | DC  | 5,0, |             |                                   |
| 05356 | 31    | 09163 | 08981 | IA  | TR   | AAD,KAD,,   | INITIALIZE                        |
| 05368 | 31    | 09188 | 08981 |     | TR   | BAD,KAD,,   | ADD                               |
| 05380 | 31    | 09084 | 08995 |     | TR   | CAD,KCAD,,  | SIMULATION TABLES                 |
| 05392 | 49    | 05452 | 00000 |     | B    | PUA         |                                   |
| 05452 |       |       |       |     | DORG | *+49        |                                   |
| 05452 | 16    | 05470 | -0000 | PUA | TFM  | WTR+6,,,    | SET START ADR                     |
| 05464 | 31    | 00000 | 00000 | WTR | TR   | ,,,         | WRITE FROM 00-49 INTO XXX00-XXX49 |
| 05476 | 47    | 05564 | 01900 |     | BNA  | AMA         |                                   |
| 05488 | 49    | 05552 | 00000 |     | B    | PUB         |                                   |
| 05552 |       |       |       |     | DORG | *+53        |                                   |
| 05552 | 27    | 09556 | 05470 | PUB | BT   | FR,WTR+6,.. | ERROR                             |

THIS ROUTINE STEPS THE TRANSMIT RECORD ADDRESS IN  
INCREMENTS OF 100

|       |    |       |       |  |     |      |             |             |
|-------|----|-------|-------|--|-----|------|-------------|-------------|
| 05564 | 31 | 09162 | 09163 |  | AMA | TR   | AAD-1,AAD,, | STEP 100    |
| 05576 | 25 | 05468 | 09163 |  |     | TD   | WTR+4,AAD,, | SET 100     |
| 05588 | 49 | 05652 | 00000 |  |     | B    | AMB         |             |
| 05652 |    |       |       |  |     | DORG | *+53        |             |
| 05652 | 43 | 05464 | 09163 |  | AMB | BD   | WTR,AAD,,   | BR NO CARRY |
| 05664 | 31 | 09163 | 08981 |  |     | TR   | AAD,KAD,,   | RESTORE 100 |
| 05676 | 31 | 09187 | 09188 |  |     | TR   | BAD-1,BAD,, | STEP 1K     |
| 05688 | 49 | 05752 | 00000 |  |     | B    | AMC         |             |
| 05752 |    |       |       |  |     | DORG | *+53        |             |
| 05752 | 25 | 05467 | 09188 |  | AMC | TD   | WTR+3,BAD,, | SET 1K      |
| 05764 | 43 | 05464 | 09188 |  |     | BD   | WTR,BAD,,   | BR NO CARRY |
| 05776 | 31 | 09188 | 08981 |  |     | TR   | BAD,KAD,,   | RESTORE 1K  |
| 05788 | 49 | 05852 | 00000 |  |     | B    | AMD         |             |
| 05852 |    |       |       |  |     | DORG | *+53        |             |
| 05852 | 31 | 09083 | 09084 |  | AMD | TR   | CAD-1,CAD,, | STEP 10K    |

05864 25 05466 09084  
05876 43 05464 09084  
05888 49 05952 00000  
05952

TD WTR+2,CAD,, SET 10K  
BD WTR,CAD,, NO BR ON END MEM  
B HKL  
DORG \*\*+53

\* \* \* \* \* COMPLEMENT AND RESTORE THE PATTERN DIGIT BY DIGIT

\* \* \* \* \* FIRST SET UP STARTING ADDRESSES

05952 15 06957 00005  
05964 31 15789 06891  
05976 31 09188 08981  
05988 49 06052 00000  
06052  
06052 31 09163 08981  
06064 31 09084 08995  
06076 25 06963 00000  
06088 49 06152 00000  
06152  
06152 25 07263 00002  
06164 25 06263 06963  
06176 25 06963 07263  
06188 49 06252 00000  
06252  
06252 15 07263 00000  
06263 00000

HKL TDM WRA+5,5,, SET STARTING ADDRESS  
TR RAD,KRAD,, INITIALIZE  
TR SAD,KAD,, ADD  
B HKM  
DORG \*\*+53  
HKM TR TAD,KAD,, SIMULATION  
TR UAD,KCAD,, TABLES  
TD X,,, INITIALIZE X  
B HKN  
DORG \*\*+53  
HKN TD Y,2,, INITIALIZE Y  
HKP TD XS,X,, SWAP  
TD X,Y,, TEST  
B HKQ  
DORG \*\*+53  
HKQ TDM Y,,, DIGITS  
XS DS ,\*

\* \* \* \* \* THE SUCCEEDING ARRAY OF TRANSMIT FIELD INSTRUCTIONS  
ARE USED TO UPDATE THE CURRENT ADDRESS IN THE FOLLOWING  
COMPLEMENT AND-RESTORE ROUTINE

06264 26 06969 06957  
06276 26 07069 06957  
06288 49 06352 00000  
06352  
06352 26 07257 06957  
06364 26 07081 06957  
06376 26 07269 06957  
06388 49 06452 00000  
06452  
06452 26 07557 06957  
06464 26 07369 06957  
06476 26 07381 06957  
06488 49 06552 00000  
06552  
06552 26 07569 06957  
06564 26 07669 06957  
06576 26 07681 06957  
06588 49 06652 00000  
06652  
06652 26 07857 06957  
06664 26 07869 06957  
06676 26 07969 06957  
06688 49 06752 00000  
06752  
06752 26 08157 06957  
06764 26 08169 06957  
06776 26 07981 06957  
06788 49 06852 00000

HKQ1 TF WRB+5,WRA+5,, SET ADR  
TF WRE+5,WRA+5,,  
B HKS  
DORG \*\*+53  
HKS TF WRG+5,WRA+5,,  
TF WRF+5,WRA+5,,  
TF WRH+5,WRA+5,,  
B HKU  
DORG \*\*+53  
HKU TF WRN+5,WRA+5,,  
TF WRL+5,WRA+5,,  
TF WRM+5,WRA+5,,  
B HKV  
DORG \*\*+53  
HKV TF WRP+5,WRA+5,,  
TF WRS+5,WRA+5,,  
TF WRT+5,WRA+5,,  
B HKW  
DORG \*\*+53  
HKW TF WRU+5,WRA+5  
TF WRV+5,WRA+5  
TF WRY+5,WRA+5,,  
B HKY  
DORG \*\*+53  
HKY TF WRAA+5,WRA+5,,  
TF WRBA+5,WRA+5,,  
TF WRZ+5,WRA+5,,  
B HKZ

|  |       |           |      |                   |           |
|--|-------|-----------|------|-------------------|-----------|
| 06852  |       | DORG *+53 |      |                   |           |
| 06852 26   | 08269 | 06957     | HKZ  | TF WREA+5,WRA+5,, |           |
| 06864 26   | 08281 | 06957     |      | TF WRFA+5,WRA+5,, |           |
| 06876 49   | 06952 | 00000     |      | B WRA             |           |
| 06886  | 00000 |           | TST  | DS ,*-1           |           |
| 06888 41   | 00000 | 00000     |      | NOP               |           |
| 06891  | 00007 |           | KRAD | DSC 7,012340*,*-8 |           |
| 06891  | 00000 |           | KEAD | DS ,KRAD          |           |
| 06952  |       | DORG *+53 |      |                   |           |
| *  |       |           |      |                   |           |
| * NOW WE ACTUALLY COMPLEMENT AND RESTORE THE TESTED DIGIT    |       |           |      |                   |           |
| * THE BIG LOOP IS USED TO SPEED UP THE PROGRAM WHICH         |       |           |      |                   |           |
| * WOULD BE IMPOSSIBLY SLOW WITH A ONE ADDRESS AT A TIME LGOI |       |           |      |                   |           |
| *  |       |           |      |                   |           |
| 06952 15   | -0000 | 00000     | WRA  | TDM 0,,2,         | WR COMP 0 |
| 06963  | 00000 |           | X    | DS ,*             |           |
| 06964 25   | 00001 | 06963     | WRB  | TD 1,X,,          | WR COMP 1 |
| 06976 47   | 07064 | 01900     |      | BNA WRE           |           |
| 06988 49   | 07052 | 00000     |      | B WRC1            |           |
| 07052  |       |           |      | DORG *+53         |           |
| 07052 27   | 15856 | 06958     | WRC1 | BT ERR,WRA+6,,    | ERROR     |
| 07064 25   | 00000 | 07263     | WRE  | TD 0,Y,,          | RESTORE 0 |
| 07076 25   | 00001 | 07263     | WRF  | TD 1,Y,,          | RESTORE 1 |
| 07088 49   | 07152 | 00000     |      | B WRF1            |           |
| 07152  |       |           |      | DORG *+52         |           |
| 07152 47   | 07176 | 01900     | WRF1 | BNA WRF2          |           |
| 07164 27   | 15856 | 07070     |      | BT ERR,WRE+6,,    | ERROR     |
| 07176 46   | 06952 | 00200     | WRF2 | BC2 WRA,,,        | LCOP      |
| 07188 49   | 07252 | 00000     |      | B WRG             |           |
| 07252  |       |           |      | DORG *+53         |           |
| 07252 15   | 00002 | 07263     | WRG  | TDM 2,Y,,         | WR COMP 2 |
| 07263  | 00000 |           | Y    | DS ,*             |           |
| 07264 25   | 00003 | 07263     | WRH  | TD 3,Y,,          | WR COMP 3 |
| 07276 47   | 07364 | 01900     |      | BNA WRL           |           |
| 07288 49   | 07352 | 00000     |      | B WRH1            |           |
| 07352  |       |           |      | DORG *+53         |           |
| 07352 27   | 15856 | 07258     | WRH1 | BT ERR,WRG+6,,    | ERROR     |
| 07364 25   | 00002 | 06963     | WRL  | TD 2,X,,          | RESTORE 2 |
| 07376 25   | 00003 | 06963     | WRM  | TD 3,X,,          | RESTORE 3 |
| 07388 49   | 07452 | 00000     |      | B WRM1            |           |
| 07452  |       |           |      | DORG *+53         |           |
| 07452 47   | 07476 | 01900     | WRM1 | BNA WRM2          |           |
| 07464 27   | 15856 | 07370     |      | BT ERR,WRL+6,,    | ERROR     |
| 07476 46   | 07252 | 00200     | WRM2 | BC2 WRG,,,        | LOOP      |
| 07488 49   | 07552 | 00000     |      | B WRN             |           |
| 07552  |       |           |      | DORG *+53         |           |
| 07552 25   | 00004 | 06963     | WRN  | TD 4,X,,          | WR COMP 4 |
| 07564 25   | 00005 | 06963     | WRP  | TD 5,X,,          | WR COMP 5 |
| 07576 47   | 07664 | 01900     |      | BNA WRS           |           |
| 07588 49   | 07652 | 00000     |      | B WRP1            |           |
| 07652  |       |           |      | DORG *+53         |           |
| 07652 27   | 15856 | 07558     | WRP1 | BT ERR,WRN+6,,    | ERROR     |
| 07664 25   | 00004 | 07263     | WRS  | TD 4,Y,,          | RESTORE 4 |
| 07676 25   | 00005 | 07263     | WRT  | TD 5,Y,,          | RESTORE 5 |
| 07688 49   | 07752 | 00000     |      | B WRT1            |           |
| 07752  |       |           |      | DORG *+52         |           |
| 07752 47   | 07776 | 01900     | WRT1 | BNA WRT2          |           |
| 07764 27   | 15856 | 07670     |      | BT ERR,WRS+6,,,   | ERROR     |
| 07776 46   | 07552 | 00200     | WRT2 | BC2 WRN,,,        | LOOP      |

|   |    |       |       |       |                 |             |
|---|----|-------|-------|-------|-----------------|-------------|
| 07788   | 49 | 07852 | 00000 | B     | WRU             |             |
| 07852   |    |       |       | DORG  | #+53            |             |
| 07852   | 25 | 00006 | 07263 | WRU   | TD 6,Y,,        | WR COMP 6   |
| 07864   | 25 | 00007 | 07263 | WRV   | TD 7,Y,,        | WR COMP 7   |
| 07876   | 47 | 07964 | 01900 | BNA   | WRY             |             |
| 07888   | 49 | 07952 | 00000 | B     | WRV1            |             |
| 07952   |    |       |       | DORG  | #+53            |             |
| 07952   | 27 | 15856 | 07858 | WRV1  | BT ERR,WRU+6,,  | ERROR       |
| 07964   | 25 | 00006 | 06963 | WRY   | TD 6,X,,        | RESTORE 6   |
| 07976   | 25 | 00007 | 06963 | WRZ   | TD 7,X,,        | RESTORE 7   |
| 07988   | 49 | 08052 | 00000 | B     | WRZ1            |             |
| 08052   |    |       |       | DORG  | #+53            |             |
| 08052   | 47 | 08076 | 01900 | WRZ1  | BNA WRZ2        |             |
| 08064   | 27 | 15856 | 07970 |       | BT ERR,WRY+6,,  | ERROR       |
| 08076   | 46 | 07852 | 00200 | WRZ2  | BC2 WRU,,,      | LOOP        |
| 08088   | 49 | 08152 | 00000 | B     | WRAA            |             |
| 08152   |    |       |       | DORG  | #+53            |             |
| 08152   | 25 | 00008 | 06963 | WRAA  | TD 8,X,,        | WR COMP 8   |
| 08164   | 25 | 00009 | 06963 | WRBA  | TD 9,X,,        | WR COMP 9   |
| 08176   | 47 | 08264 | 01900 | BNA   | WREA            |             |
| 08188   | 49 | 08252 | 00000 | B     | WRBA1           |             |
| 08252   |    |       |       | DORG  | #+53            |             |
| 08252   | 27 | 15856 | 08158 | WRBA1 | BT ERR,WRAA+6,, | ERROR       |
| 08264   | 25 | 00008 | 07263 | WREA  | TD 8,Y,,        | RESTORE 8   |
| 08276   | 25 | 00009 | 07263 | WRFA  | TD 9,Y,,        | RESTORE 9   |
| 08288   | 49 | 08352 | 00000 | B     | WRFA1           |             |
| 08352   |    |       |       | DORG  | #+53            |             |
| 08352   | 47 | 08376 | 01900 | WRFA1 | BNA WRFA2       |             |
| 08364   | 27 | 15856 | 08270 |       | BT ERR,WREA+6,, | ERROR       |
| 08376   | 46 | 08152 | 00200 | WRFA2 | BC2 WRAA,,,     | LOOP        |
| 08388   | 49 | 08452 | 00000 | B     | ASRA            |             |
| 08452   |    |       |       | DORG  | #+53            |             |
| * THIS SECTION STEPS THE ADDRESS OF THE COMPLEMENT AND RESTORE LOOP |    |       |       |       |                 |             |
| 08452   | 31 | 15788 | 15789 | ASRA  | TR RAD-1,RAD,,  | STEP TENS   |
| 08464   | 25 | 06957 | 15789 |       | TD WRA+5,RAD,,  | SET TENS    |
| 08476   | 43 | 06164 | 15789 | ASRB  | BD HKP,RAD,,    | BR NO CARRY |
| 08488   | 49 | 08552 | 00000 |       | B ASRB          |             |
| 08552   |    |       |       | DORG  | #+53            |             |
| 08552   | 31 | 15789 | 06891 | ASRB  | TR RAD,KRAD,,   | RESTORE     |
| 08564   | 31 | 09187 | 09188 |       | TR SAD-1,SAD,,  | STEP 100    |
| 08576   | 25 | 06956 | 09188 | ASRC  | TD WRA+4,SAD,,  | SET 100     |
| 08588   | 49 | 08652 | 00000 |       | B ASRC          |             |
| 08652   |    |       |       | DORG  | #+53            |             |
| 08652   | 43 | 06264 | 09188 | ASRC  | BD HKQ1,SAD,,   | BR NO CARRY |
| 08664   | 31 | 09188 | 08931 |       | TR SAD,KAD,,    | RESTORE 100 |
| 08676   | 31 | 09162 | 09163 | ASRD  | TR TAD-1,TAD,,  | STEP 1K     |
| 08688   | 49 | 08752 | 00000 |       | B ASRD          |             |
| 08752   |    |       |       | DORG  | #+53            |             |
| 08752   | 25 | 06955 | 09163 | ASRD  | TD WRA+3,TAD,,  | SET 1K      |
| 08764   | 43 | 06264 | 09163 |       | BD HKQ1,TAD,,   | BR NO CARRY |
| 08776   | 31 | 09163 | 08981 | ASRE  | TR TAD,KAD,,    | RESTORE 1K  |
| 08788   | 49 | 08852 | 00000 |       | B ASRE          |             |
| 08852   |    |       |       | DORG  | #+53            |             |
| 08852   | 31 | 09083 | 09084 | ASRE  | TR UAD-1,UAD,,  | STEP 10K    |
| 08864   | 25 | 06954 | 09084 |       | TD WRA+2,UAD,,  | SET 10K     |
| 08876   | 43 | 06264 | 09084 | ASRE  | BD HKQ1,UAD,,   | BR NO CARRY |

|  |      |                                   |                     |
|--|------|-----------------------------------|---------------------|
| 08888 49 05076 00000                             |      | B RCB                             |                     |
| 08952  |      | DORG **53                         |                     |
| * * CONSTANTS AND ARITHMETIC WORKING AREAS *     |      |                                   |                     |
| 08952 00027                                      | TPI  | DSS 27,,<br>DORG **27             | FIELD OF 7788       |
| 08951  |      | DC 4,-8778                        |                     |
| 08954 00004                                      |      | DC 4,-8778                        |                     |
| 08958 00004                                      |      | DC 4,-8778                        |                     |
| 08962 00004                                      |      | DC 4,-8778                        |                     |
| 08966 00004                                      |      | DC 4,-8778                        |                     |
| 08970 00004                                      |      | DC 4,-8778                        |                     |
| 08974 00004                                      |      | DC 4,-8778                        |                     |
| 08978 00004                                      |      | DC 4,-8778                        |                     |
| 08981 00013                                      | KAD  | DSC 13,012345678901',TP1+29       |                     |
| 08995 00004                                      | KCAD | DSC 4,010',TP1+43                 |                     |
| 08997 00002                                      |      | DC 2,-10,KCAD+2                   |                     |
| 09052  |      | DORG TP1+100                      |                     |
| 09052 00027                                      | TP2  | DSS 27,,<br>DORG **26             | FIELD OF 8877       |
| 09052  |      | DC 1,8                            |                     |
| 09056 00001                                      |      | DC 4,-8778                        |                     |
| 09060 00004                                      |      | DC 4,-8778                        |                     |
| 09064 00004                                      |      | DC 4,-8778                        |                     |
| 09068 00004                                      |      | DC 4,-8778                        |                     |
| 09072 00004                                      |      | DC 4,-8778                        |                     |
| 09076 00004                                      |      | DC 4,-8778                        |                     |
| 09078 00002                                      |      | DC 2,8'                           |                     |
| 09163 00013                                      | AAD  | DSS 13,TP2+111, 100 ADD WORK AREA |                     |
| 09188 00012                                      | BAD  | DSS 12,AAD+25, 1K ADD WORK AREA   |                     |
| 09084 00004                                      | CAD  | DSS 4,TP2+32, 10K ADD WORK AREA   |                     |
| 09163 00000                                      | TAD  | DSS ,AAD                          |                     |
| 09188 00000                                      | SAD  | DSS ,BAD                          |                     |
| 09084 00000                                      | UAD  | DSS ,CAD                          |                     |
| 09252  |      | DORG AAD+89                       |                     |
| * * PASS COUNTER *                               |      |                                   |                     |
| 09252 39 09453 00100                             | EXIT | WATY PCNT,,,                      | PRINT PASS COMPLETE |
| 09264 46 05052 00400                             |      | BC4 RCA                           |                     |
| 09276 36 00000 00500                             |      | RNCD ,,,                          | READ NEXT PROGRAM   |
| 09288 49 00000 00000                             |      | B                                 |                     |
| 09352  |      | DORG EXIT+100                     |                     |
| 09352 34 00000 00102                             | HEAD | RCTY                              |                     |
| 09364 39 09481 00100                             |      | WATY HD,,,                        | PRINT FALSE 1       |
| 09376 34 00000 00102                             |      | RCTY                              |                     |
| 09388 49 05076 00000                             |      | B RCB                             |                     |
| 09452  |      | DORG HEAD+100                     |                     |
| 09453 00014                                      | PCNT | DAC 14,PASS COMPLETE',            |                     |
| 09481 00007                                      | HD   | DAC 7,DTX05L',                    |                     |
| 09551  |      | DORG PCNT+98                      |                     |
| * * ERROR ROUTINE- ERROR WHILE WRITING PATTERN * |      |                                   |                     |
| 09555 00005                                      | ERRX | DC 5,0,                           |                     |
| 09556 46 15388 00100                             | ER   | BC1 BB,,,                         | BYPASS ERROR        |
| 09568 31 16587 08981                             |      | TR DAD,KAD,,                      | SET ADD CONSTANTS   |
| 09580 31 15789 06891                             |      | TR EAD,KEAD                       |                     |
| 09592 49 15052 00000                             |      | B ERA                             |                     |

|                |       |  |
|----------------|-------|--|
| 15052          |       | DORG 15052   |
| 15052 47 15064 | 51655 | ERA BNI ERA1,51655,, RESET MBR-E CHECK IND         |
| 15064 47 15076 | 51755 | ERA1 BNI ERA2,51755,, RESET MBR-O CHECK IND        |
| 15076 26 15163 | 09555 | ERA2 TF CTD+11,ERRX,, SET ERROR FIELD ADDRESS      |
| 15088 49 15152 | 00000 | B CTD  |
| 15152          |       | DORG *+53  |
| 15152 25 16688 | -0000 | CTD TD PRC,,7, READ DIGIT                          |
| 15164 46 15452 | 01900 | BA ERD,,, ERROR                                    |
| 15176 31 16586 | 16587 | CTD2 TR DAD-1,DAD,, STEP UNIT ADR                  |
| 15188 49 15252 | 00000 | B ERB  |
| 15252          |       | DORG *+53  |
| 15252 25 15163 | 16587 | ERB TD CTD+11,DAD                                  |
| 15264 43 15152 | 16587 | BD CTD,DAD   |
| 15276 31 16587 | 08981 | TR DAD,KAD,, RESTORE UNITS                         |
| 15288 49 15352 | 00000 | B ERC  |
| 15352          |       | DORG *+53  |
| 15352 31 15788 | 15789 | ERC TR EAD-1,EAD,, STEP TENS                       |
| 15364 25 15162 | 15789 | TD CTD+10,EAD                                      |
| 15376 43 15152 | 15789 | BD CTD,EAD,, BR NO CARRY                           |
| 15388 42 00000 | 00000 | BB BB,,, RETURN                                    |
| 15452          |       | DORG *+53  |
| 15452 26 16686 | 15163 | ERD TF PRA+4,CTD+11,,SET ERROR ADDRESS             |
| 15464 38 16688 | 00100 | WNTY PRC,,, PRINT ERROR CHAR                       |
| 15476 26 15558 | 15163 | TF ERE+6,CTD+11                                    |
| 15488 49 15552 | 00000 | B ERE  |
| 15552          |       | DORG *+53  |
| 15552 25 0-000 | 16688 | ERE TD ,PRC,3, RESTORE ADR                         |
| 15564 47 15576 | 50755 | BNI ERE1,50755,, RESET WRITE CHECK IND             |
| 15576 47 15652 | 51755 | ERE1 BNI ERF,51755,, RESET MBR-U CHECK IND         |
| 15588 49 15652 | 00000 | B ERF  |
| 15652          |       | DORG *+53  |
| 15652 47 15664 | 51655 | ERF BNI ERF1,51655,, RESET MBR-E CHECK IND         |
| 15664 39 16753 | 00100 | ERF1 WATY PRB                                      |
| 15676 38 16682 | 00100 | WNTY PRA,,, PRINT ERROR ADR                        |
| 15688 49 15752 | 00000 | B ERG  |
| 15752          |       | DORG *+53  |
| 15752 39 16653 | 00100 | ERG WATY PR  |
| 15764 34 00000 | 00102 | RCTY   |
| 15776 49 15176 | 00000 | B CTD2   |
| 15789 00007    |       | EAD DSS 7,*+2                                      |
| 15789 00000    |       | RAD DSS ,EAD                                       |
| 15788 41 00000 | 00000 | NOP  |
| 15851          |       | DORG *+52  |
| *              | *     | ERROR ROUTINE - ERROR DURING COMPLIMENT OR RESTORE |
| *              | *     |  |
| 15855 00065    |       | ERRY DC 5,0,                                       |
| 15856 46 16564 | 00100 | ERR BC1 RET,,, BYPASS ERROR                        |
| 15868 26 15891 | 15855 | TF ERR1+11,ERRY,,SET EVEN ERROR ADDRESS            |
| 15880 25 15973 | 00000 | ERR1 TD PRJ,,, READ EVEN DIGIT                     |
| 15892 49 15952 | 00000 | B ERRJ   |
| 15951          |       | DORG *+48  |
| 15952 25 16063 | 15855 | ERRJ TD ERRK+11,ERRY,,SET ADD TABLE ADDRESS        |
| 15964 49 16052 | 00000 | B ERRK   |
| 15973 00002    |       | PRJ DSS 2,*-2                                      |
| 15975 00001    |       | DC 1,*,*   |
| 15976 41 00000 | 00000 | NOP  |
| 15988 41 00000 | 00000 | NOP  |
| 15990 00009    |       | KHAD DSC 9,123456789,*-9                           |

|          |             |  |
|----------|-------------|--|
| 16052    |             | DORG *+53                                      |
| 16052 25 | 15855 15990 | TD ERRY,KHAD,, READ TABLE                      |
| 16064 26 | 16087 15855 | TF ERK1+11,ERRY,,SET ODD ERROR ADDRESS         |
| 16076 25 | 15974 00000 | ERK1 TD PRJ+1,,, READ ODD DIGIT                |
| 16088 49 | 16152 00000 | B ERRL   |
| 16152    |             | DORG *+53                                      |
| 16152 38 | 15973 00100 | WNTY PRJ,,, PRINT ERROR DIGITS                 |
| 16164 26 | 16258 15891 | TF ERM+6,ERR1+11                               |
| 16176 26 | 16270 16087 | TF ERMI+6,ERK1+11                              |
| 16188 49 | 16252 00000 | B ERM  |
| 16252    |             | DORG *+53                                      |
| 16252 25 | 00000 15973 | TD vPRJ,, RESTORE ERROR DIGITS                 |
| 16264 25 | 00000 15974 | TD vPRJ+1                                      |
| 16276 47 | 16352 50755 | BNI ERRN,50755,, RESTORE CHECK IND             |
| 16286 49 | 16352 00000 | B ERRN,  |
| 16352    |             | DORG *+53                                      |
| 16352 47 | 16364 51755 | BNI ERN1,51755                                 |
| 16364 47 | 16376 51655 | BNI ERN2,51655                                 |
| 16376 39 | 16753 00100 | WATY PRB                                       |
| 16388 49 | 16452 00000 | B ERRP   |
| 16452    |             | DORG *+53                                      |
| 16452 26 | 16573 15891 | TF ERY1+4,ERR1+11,,SET ERROR ADDRESS FOR PRINT |
| 16464 38 | 16569 00100 | WNTY ERY1,,, PRINT ERROR ADR                   |
| 16476 39 | 16653 00100 | WATY PR  |
| 16488 49 | 16552 00000 | B ERRQ   |
| 16552    |             | DORG *+53                                      |
| 16552 34 | 00000 00102 | RCTY   |
| 16564 42 | 00000 00000 | RET  |
|          |             | BB *** RETURN                                  |
|          |             | *  |
|          |             | *  |
|          |             | *  |
| 16569    | 00006       | ERY1 DSC 6,*,-6                                |
| 16576 41 | 00000 00000 | NOP  |
| 16587    | 00012       | DAD DSS 12,*                                   |
| 16588 41 | 00000 00000 | NOP  |
| 16652    |             | DORG ERRQ+100                                  |
| 16653    | 00015       | PR DAC 15, IS ERROR ADR *,                     |
| 16682    | 00005       | PRA DSS 5                                      |
| 16687    | 00001       | DC 1,*   |
| 16688    | 00001       | PRC DSS 1                                      |
| 16689    | 00001       | DC 1,*   |
| 16752    |             | DORG PR+99                                     |
| 16753    | 00014       | PRB DAC 14, IS ERR CHAR *,                     |
| 05052    |             | DEND 5052                                      |

CONSTANTS AND ARITHMETIC WORKING AREAS

DT X05L 80/80 LIST

|  |                     |
|--|---------------------|
| 360007200500360020100500440001200276260005900274250001100000260009000269 | -0000               |
| 260009500264310000000200260011400274250000000011490001200000             | -0001               |
| 250726300002250626306963250696307263490625200000*                        | 0-1-6152-6200 -0002 |
| 1605355-00004909352000043092520535490515200000*                          | 0-1-5052-5100 -0003 |
| 430525205355310000089523100026089541705356-0001*                         | 0-1-5152-5200 -0004 |
| 3100000090523100026090541705356-0010410000000000*                        | 0-1-5252-5300 -0005 |
| -0000#   | 1-1-5351-5356 -0006 |
| 310916308981310918808981310908408995490545200000*                        | 0-1-5356-5404 -0007 |
| 1605470-000031000000000470556401900490555200000*                         | 0-1-5452-5500 -0008 |
| 270955605470310916209163250546809163490565200000*                        | 0-1-5552-5600 -0009 |
| 430546409163310916308981310918709188490575200000*                        | 0-1-5652-5700 -0010 |
| 250546709188430546409188310918808981490585200000*                        | 0-1-5752-5800 -0011 |
| 310908309084250546609084430546409084490595200000*                        | 0-1-5852-5900 -0012 |
| 150695700005311578906891310918808981490605200000*                        | 0-1-5952-6000 -0013 |
| 310916308981310908408995250696300000490615200000*                        | 0-1-6052-6100 -0014 |
| 250726300002250626306963250696307263490625200000*                        | 0-1-6152-6200 -0015 |
| 15072630000260696906957260706906957490635200000*                         | 0-1-6252-6300 -0016 |
| 260725706957260708106957260726906957490645200000*                        | 0-1-6352-6400 -0017 |
| 260755706957260736906957260738106957490655200000*                        | 0-1-6452-6500 -0018 |
| 260756906957260766906957260768106957490665200000*                        | 0-1-6552-6600 -0019 |
| 260785706957260786906957260796906957490675200000*                        | 0-1-6652-6700 -0020 |
| 260815706957260816906957260798106957490685200000*                        | 0-1-6752-6800 -0021 |
| 260826906957260828106957490695200000410000000000*                        | 0-1-6852-6900 -0022 |
| 012340#  | 1-1-6891-6898 -0023 |
| 15-000000000250000106963470706401900490705200000*                        | 0-1-6952-7000 -0024 |
| 27158560695825000007263250000107263490715200000*                         | 0-1-7052-7100 -0025 |
| 470717601900271585607070460695200200490725200000*                        | 0-1-7152-7200 -0026 |
| 150000207263250000307263470736401900490735200000*                        | 0-1-7252-7300 -0027 |
| 271585607258250000206963250000306963490745200000*                        | 0-1-7352-7400 -0028 |
| 470747601900271585607370460725200200490755200000*                        | 0-1-7452-7500 -0029 |
| 250000406963250000506963470766401900490765200000*                        | 0-1-7552-7600 -0030 |
| 271585607558250000407263250000507263490775200000*                        | 0-1-7652-7700 -0031 |
| 470777601900271585607670460755200200490785200000*                        | 0-1-7752-7800 -0032 |
| 250000607263250000707263470796401900490795200000*                        | 0-1-7852-7900 -0033 |
| 271585607858250000606963250000706963490805200000*                        | 0-1-7952-8000 -0034 |
| 470807601900271585607970460785200200490815200000*                        | 0-1-8052-8100 -0035 |
| 250000806963250000906963470826401900490825200000*                        | 0-1-8152-8200 -0036 |
| 271585608158250000807263250000907263490835200000*                        | 0-1-8252-8300 -0037 |
| 470837601900271585608270460815200200490845200000*                        | 0-1-8352-8400 -0038 |
| 311578815789250695715789430616415789490855200000*                        | 0-1-8452-8500 -0039 |
| 311578906891310918709188250695609188490865200000*                        | 0-1-8552-8600 -0040 |
| 430626409188310918808981310916209163490875200000*                        | 0-1-8652-8700 -0041 |
| 250695509163430626409163310916308981490885200000*                        | 0-1-8752-8800 -0042 |
| 310908309084250695409084430626409084490507600000*                        | 0-1-8852-8900 -0043 |
| Q77QQ77QQ77QQ77QQ77QQ77QQ77#   | 1-1-8951-8979 -0044 |
| 012345678901#  | 1-1-8981-8994 -0045 |
| 010#   | 1-1-8995-8999 -0046 |
| J-#  | 1-1-8996-8998 -0047 |
| QQ77QQ77QQ77QQ77QQ77QQ77QQ77#  | 1-1-9052-9079 -0048 |
| 39094530010046050520040036000000050049000000000000*                      | 0-1-9252-9300 -0049 |
| 34000000010239094810010034000000102490507600000*                         | 0-1-9352-9400 -0050 |
| N74162620043565457534563450#   | 1-1-9452-9480 -0051 |
| M463677075530#   | 1-1-9480-9494 -0052 |
| -0000#   | 1-1-9551-9556 -0053 |
| 46153800100311658708981311578906891491505200000*                         | 0-1-9556-9604 -0054 |
| 471506451655471507651755261516309555491515200000*                        | 0-1J5052J5100 -0055 |
| 2516688-0000461545201900311658616587491525200000*                        | 0-1J5152J5200 -0056 |
| 251516316587431515216587311658708981491535200000*                        | 0-1J5252J5300 -0057 |

|  |                     |
|--|---------------------|
| 3115788157892515162157894315152157894200000000000                        | 0-1J5352J5400 -0058 |
| 261668615163381668800100261555815163491555200000                         | 0-1J5452J5500 -0059 |
| 250-00016688471557650755471565251755491565200000                         | 0-1J5552J5600 -0060 |
| 471566451655391675300100381668200100491575200000                         | 0-1J5652J5700 -0061 |
| 391665300100340000000102491517600004100000000000                         | 0-1J5752J5800 -0062 |
| -0000#   | 1-1J5851J5856 -0063 |
| 46165640010026158911585525159730000491595200000                          | 0-1J5856J5904 -0064 |
| 251606315855491605200000   | 0-1J5952J5976 -0065 |
| #  | 1-1J5975J5976 -0066 |
| 41000000000410000000000  | 0-1J5976J6000 -0067 |
| 123456789#   | 1-1J5990J5999 -0068 |
| 25158551599026160871585525159740000491615200000                          | 0-1J6052J6100 -0069 |
| 381597300100261625815891261627016087491625200000                         | 0-1J6152J6200 -0070 |
| 250000015973250000015974471635250755491635200000                         | 0-1J6252J6300 -0071 |
| 471636451755471637651655391675300100491645200000                         | 0-1J6352J6400 -0072 |
| 261657315891381656900100391665300100491655200000                         | 0-1J6452J6500 -0073 |
| 34000000010242000000000  | 0-1J6552J6576 -0074 |
| 00000#   | 1-1J6569J6575 -0075 |
| 41000000000410000000000  | 0-1J6576J6600 -0076 |
| -0496200455959565900414459000  | 1-1J6652J6682 -0077 |
| #  | 1-1J6687J6688 -0078 |
| #  | 1-1J6689J6690 -0079 |
| -04962004559590043484159000  | 1-1J6752J6780 -0080 |
| 00000 L60000005004900000   | -8-0096-0115 -0081  |
| 360010000500360017200500360024400500360031600500360000000500             | -0082               |
| 00000000000102030400020406080003060902100408021610050015102006021814200  | -0083               |
| 704112820080614223009081726300000000005060708090012141618151811242720242 | -0084               |
| 822363520353045403632484455324946536048465462754453627180123456789123456 | -0085               |
| 789-23456789-J3456789-JK456789-JKL56789-JKLM6789-JKLMN789-JKLMN089-JKLMN | -0086               |
| M800000000049-50520P9-JKLMN0PQ# L10038800019M9000000000M900036C0000      | -0087               |

DT X05H 80/80 LIST

## **CU04 - Additional Core Diagnostic**



```
//=====
//  
// CU04 - Additional Core Diagnostic  
//  
// Program Switch settings:  
//  
//    PS1:    ON - Bypass error type out  
//            OFF - Type out routine number on error  
//    PS2:    ON - Loop in routine  
//            OFF - Continue to next routine  
//    PS3:    ON - Stop on error  
//            OFF - Do not stop on error, continue  
//    PS4:    not used  
//  
// Check switches settings:  
//  
//    DISK I/O - STOP  
//    PARITY   - STOP  
//    I/O       - STOP  
//    O'FLOW    - PROGRAM  
//  
// Start addresses:  
//  
//    00828 - Full test  
//  
// Directions:  
//  
//    1. Load CU04 diagnostic  
//    2. Press START  
//    3. Press START  
//    4. Type <flag 6> 0  
//    5. Press RELEASE-START  
//=====
```



## Sample Output – CU04

SW 1 OFF SW 2 OFF SW 3 OFF SW 4 OFF SET SWS FOR ADDITIONAL MEMORY TEST. THEN STA RT.  
START ROUTINES. ETOS FOLLOW. KEY IN MEM CONSTS RELEASE. START. ~~60\$~~  
399760123456789#12399989 3999894004  
ABCDEFIGHIJKLMNOPQRSTUVWXYZ.)+\$:-/, (=0123456789  
599760123456789#12599989 5999894900828  
0123456789.)+\$:-/, (=@ABCDEFGHIJKLMNOPQRSTUVWXYZ  
TEST ROUTINES COMPLETED. IF SW 1 OFF AND NO ROUTINE NOS TYPED OUT, MACHINE PERFO RMED TESTS PROPERLY.



// CU04 - Additional Core Diagnostic (IBM manual not available)

00000: 04 09 00 00 08 02 08 0A 00 00 00 00 00 00 00 00 00 00 00 00 // "I # " 00100: 00 00 00 00 00 00 00 00 00 00 00 01 00 02 00 03 00 04 00 // " +- " 00120: 00 00 02 00 04 00 06 00 08 00 00 00 03 00 06 00 09 00 02 01 // " - /" 00140: 00 00 04 00 08 00 02 01 06 01 00 00 05 00 00 01 05 01 00 02 // " / - J " 00160: 00 00 06 00 02 01 08 01 04 02 00 00 07 00 04 01 01 02 08 02 // " / B 0A " 00180: 00 00 08 00 06 01 04 02 02 03 00 00 09 00 08 01 07 02 06 03 // " B, 2T" 00200: 00 00 00 00 00 00 00 00 00 00 05 00 06 00 07 00 08 00 09 00 // " - 0 " 00220: 00 01 02 01 04 01 06 01 08 01 05 01 08 01 01 02 04 02 07 02 // " /A J B2" 00240: 00 02 04 02 08 02 02 03 06 03 05 02 00 03 05 03 00 04 05 04 // " B ,T K.L)M" 00260: 00 03 06 03 02 04 08 04 04 05 05 03 02 04 09 04 06 05 03 06 // ".T( E L( V " 00280: 00 04 08 04 06 05 04 06 02 07 05 04 04 05 03 06 02 07 01 08 // ") VF ME " 00300: 00 01 02 03 04 05 06 07 08 09 01 02 03 04 05 06 07 08 09 10 // ",EX @08 " 00320: 02 03 04 05 06 07 08 09 10 11 03 04 05 06 07 08 09 10 11 12 // ",EX @08 " 00340: 04 05 06 07 08 09 10 11 12 13 05 06 07 08 09 10 11 12 13 14 // "EX , 08 @" 00360: 06 07 08 09 10 11 12 13 14 15 07 08 09 10 11 12 13 14 15 16 // "X ,E 8 @O" 00380: 08 09 10 11 12 13 14 15 16 17 09 10 11 12 13 14 15 16 17 18 // " ,EX @08" 00400: 0A 00 00 00 00 00 00 05 02 04 05 06 08 00 00 04 09 05 05 // " KEY IN" 00420: 00 00 05 04 04 05 05 04 00 00 04 03 05 06 05 05 06 02 06 03 // " MEM CONST" 00440: 06 02 00 00 05 09 04 05 05 03 04 05 04 01 06 02 04 05 00 03 // "S REL EASE." 00460: 00 00 06 02 06 03 04 01 05 09 06 03 00 03 00 00 00 0A 00 00 // " STAR T. # " 00480: 00 00 00 00 00 00 00 00 00 00 00 00 06 02 06 03 04 01 05 09 // " STAR" 00500: 06 03 00 00 05 09 05 06 06 04 06 03 04 09 05 05 04 05 06 02 // "T ROU TINES" 00520: 00 03 00 00 04 05 06 03 05 06 06 02 00 00 04 06 05 06 05 03 // ". ETO S FOL" 00540: 05 03 05 06 06 06 00 03 00 00 00 0A 00 00 00 00 00 00 00 00 // "LOW. # " 00560: 00 00 00 00 06 02 06 06 00 00 07 01 00 00 05 06 05 05 00 00 // " SW 1 ON " 00580: 00 0A 06 02 06 06 00 00 07 01 00 00 05 06 04 06 04 06 00 00 // "#SW 1 OFF " 00600: 00 0A 06 02 06 06 00 00 07 02 00 00 05 06 05 05 00 00 00 0A // "#SW 2 ON #" 00620: 06 02 06 06 00 00 07 02 00 00 05 06 04 06 04 06 00 00 00 0A // "SW 2 OFF #" 00640: 06 02 06 06 00 00 07 03 00 00 05 06 05 05 00 00 00 0A 06 02 // "SW 3 ON #S" 00660: 06 06 00 00 07 03 00 00 05 06 04 06 04 06 00 00 00 0A 06 02 // "W 3 O FF #S" 00680: 06 06 00 00 07 04 00 00 05 06 05 05 00 00 00 0A 06 02 06 06 // "W 4 O N #SW" 00700: 00 00 07 04 00 00 05 06 04 06 04 06 00 00 00 0A 06 02 04 05 // " 4 OF F #SE" 00720: 06 03 00 00 06 02 06 06 06 02 00 00 04 06 05 06 05 09 00 00 // "T SWS FOR " 00740: 04 01 04 04 04 04 09 06 03 04 09 05 06 05 05 04 01 05 03 // "ADDITIONAL" 00760: 00 00 05 04 04 05 05 04 05 06 05 09 06 08 00 00 06 03 04 05 // " MEMO RY TE" 00780: 06 02 06 03 00 03 00 00 06 03 04 08 04 05 05 05 00 00 06 02 // "ST. T HEN S" 00800: 06 03 04 01 05 09 06 03 00 03 00 00 00 0A 00 00 00 00 00 00 // "TART. # " 00820: 00 00 00 00 00 00 00 00 04 06 00 00 08 05 02 00 00 01 00 00 // " F - " 00840: 04 07 00 00 08 07 06 00 00 01 00 00 03 09 00 00 05 06 05 00 // "G O- " 00860: 00 01 00 00 04 09 00 00 08 08 08 00 00 00 00 00 03 09 00 00 // " I " 00880: 05 08 03 00 00 01 00 00 04 06 00 00 09 01 02 00 00 02 00 00 // "Q F - " 00900: 04 07 00 00 09 03 06 00 00 02 00 00 03 09 00 00 06 00 03 00 // "G " 00920: 00 01 00 00 04 09 00 00 09 04 08 00 00 00 00 00 03 09 00 00 // " I " 00940: 06 02 01 00 00 01 00 00 04 06 00 00 09 07 02 00 00 03 00 00 // "S+ F -. " 00960: 04 07 00 00 09 09 06 00 00 03 00 00 03 09 00 00 06 04 01 00 // "G . U+" 00980: 00 01 00 00 04 09 00 01 00 00 08 00 00 00 00 00 03 09 00 00 // " I " 01000: 06 05 09 00 00 01 00 00 04 06 00 01 00 03 02 00 00 04 00 00 // "V F .-. " 01020: 04 07 00 01 00 05 06 00 00 04 00 00 03 09 00 00 06 07 09 00 // "G ) X " 01040: 00 01 00 00 04 09 00 01 00 06 08 00 00 00 00 00 03 09 00 00 // " I " 01060: 06 09 07 00 00 01 00 00 03 09 00 00 07 01 07 00 00 01 00 00 // "Z0 10 " 01080: 04 08 00 00 00 00 00 00 00 00 00 00 00 03 04 00 00 00 00 00 // "H @ " 01100: 00 01 00 02 03 09 00 00 04 09 03 00 00 01 00 00 04 09 00 01 // " I I " 01120: 01 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 // " \* " 01140: 03 09 00 00 04 00 09 00 00 01 00 00 03 06 00 01 01 03 03 00 // " \$ " 01160: 00 01 00 00 04 09 00 01 03 00 08 00 00 00 00 00 00 00 00 00 // " I " 01180: 00 00 00 00 00 00 00 00 10 00 00 03 00 04 01 00 01 03 01 04 // " .)+\$\*" 01200: 02 00 02 01 02 03 02 04 03 03 03 04 04 01 04 02 04 03 04 04 // "-/, (= @ABCD" 01220: 04 05 04 06 04 07 04 08 04 09 05 01 05 02 05 03 05 04 05 05 // "EFGHI JKLMN" 01240: 05 06 05 07 05 08 05 09 06 01 06 02 06 03 06 04 06 05 06 06 // "OPQR STUVW" 01260: 06 07 06 08 06 09 07 00 07 01 07 02 07 03 07 04 07 05 07 06 // "XYZ01 23456" 01280: 07 07 07 08 07 09 06 09 00 0A 00 00 00 00 00 00 00 00 00 00 // "789Z# "

01300: 00 00 00 00 00 00 00 00 03 01 02 09 09 05 00 00 01 01 08 08 // " " "  
01320: 02 04 00 01 02 08 07 03 00 00 04 09 00 01 04 07 04 09 04 07 00 01 03 08 00 00 // " ( 3 IG "  
01340: 01 02 00 00 04 09 00 01 04 07 06 00 00 00 00 00 00 00 00 00 00 // " I G "  
01380: 04 06 00 01 04 05 02 00 00 01 00 00 03 09 00 01 04 06 05 00 // " F E- F-"  
01400: 00 01 00 00 03 04 00 00 00 00 00 00 00 01 00 02 03 09 00 01 // " @ "  
01420: 01 08 09 00 00 01 00 00 03 04 00 00 00 00 00 00 00 01 00 02 // " @ "  
01440: 03 09 02 09 09 05 01 00 00 01 00 00 04 07 00 01 04 07 06 00 // " + G G "  
01460: 00 03 00 00 04 08 07 00 07 00 07 03 00 00 00 0A 04 06 00 01 // " . H00 3 #F "  
01480: 03 00 08 00 00 02 00 00 04 09 00 01 05 04 08 00 00 00 00 00 // " I M "  
01540: 00 00 00 00 00 00 00 00 03 01 00 09 09 05 00 02 09 09 05 00 // " - "  
01560: 02 04 03 00 00 04 09 01 00 00 04 09 04 07 00 01 06 03 02 00 // " ( ) IG T-"  
01580: 01 02 00 00 04 09 00 01 07 02 08 00 00 00 00 00 00 00 00 00 // " I 2 "  
01620: 00 00 00 00 00 00 00 00 00 00 00 00 00 04 06 00 01 07 00 04 00 // " F 0 "  
01640: 00 01 00 00 03 09 00 01 07 01 07 00 00 01 00 00 03 04 00 00 // " 1 0 @ "  
01660: 00 00 00 00 00 01 00 02 03 09 02 09 09 05 01 00 00 01 00 00 // " + "  
01680: 03 04 00 00 00 00 00 00 00 01 00 02 03 09 00 09 09 05 01 00 // " @ + "  
01700: 00 01 00 00 04 07 00 01 07 02 08 00 00 03 00 00 00 04 08 07 00 // " G 2 . H0 "  
01720: 07 00 07 04 00 00 00 0A 04 06 00 01 05 04 08 00 00 02 00 00 // " 04 #F M "  
01740: 04 09 00 01 08 07 02 00 00 00 00 00 00 00 00 00 00 00 00 00 // " I - "  
01760: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 04 03 05 06 // " CO "  
01780: 05 05 06 02 06 03 06 02 00 00 04 09 05 05 04 03 05 06 05 09 // " NSTS INCOR "  
01800: 05 09 00 03 00 00 05 02 04 05 06 08 00 00 04 09 05 05 00 00 // " R. KE Y IN "  
01820: 04 03 05 06 05 09 05 09 00 00 04 03 05 06 05 05 06 02 06 03 // " CORR CONST "  
01840: 06 06 00 00 04 01 05 05 04 04 00 00 06 02 06 03 04 01 05 09 // " W AND STAR "  
01860: 04 05 06 03 00 03 00 00 00 0A 00 00 01 04 00 01 01 03 04 00 // " ET. # \* \$ "  
01880: 00 00 14 00 04 06 00 03 00 09 06 00 01 02 00 00 01 04 00 01 // " F. \* "  
01900: 01 03 04 00 00 00 16 00 04 06 00 02 00 08 08 00 01 02 00 00 // " \$ F "  
01920: 03 09 00 01 07 07 07 00 00 01 00 00 04 09 00 01 01 04 00 00 // " 70 I \* "  
01960: 00 00 00 00 00 00 00 00 16 09 07 09 07 08 07 07 07 06 07 05 // " Z 98765 "  
01980: 07 04 07 03 07 02 07 01 07 00 06 09 06 08 06 07 06 06 06 05 // " 43210 ZYXWV "  
02000: 06 04 06 03 06 02 06 01 05 09 05 08 05 07 05 06 05 05 05 04 // " UTS R QPONM "  
02020: 05 03 05 02 05 01 04 09 04 08 04 07 04 06 04 05 04 04 04 03 // " LKJIH GFEDC "  
02040: 04 02 04 01 03 04 03 03 02 04 02 03 02 01 02 00 01 04 01 03 // " BA@=( ,/-\*\$ "  
02060: 01 00 00 04 00 00 00 03 00 0A 00 00 00 00 00 00 00 00 00 00 // " +) .# "  
02080: 00 00 00 00 00 00 00 03 01 04 09 09 05 00 00 01 09 06 08 // " I Y "  
02100: 02 04 00 02 00 06 07 05 00 00 04 09 04 07 00 02 01 06 00 00 // " ( 5 IG "  
02120: 01 02 00 00 04 09 00 02 02 05 06 00 00 00 00 00 00 00 00 00 // " I "  
02160: 04 06 00 02 02 03 02 00 00 01 00 00 03 09 00 02 02 04 05 00 // " F , - (-"  
02180: 00 01 00 00 03 04 00 00 00 00 00 00 00 01 00 02 03 09 00 01 // " @ "  
02200: 09 06 09 00 00 01 00 00 03 04 00 00 00 00 00 00 01 00 02 // " @ "  
02220: 03 09 04 09 09 05 01 00 00 01 00 00 04 07 00 02 02 05 06 00 // " I + G "  
02240: 00 03 00 00 04 08 07 00 07 00 07 06 00 00 00 0A 04 06 00 02 // " . H00 6 #F "  
02260: 00 08 08 00 00 02 00 00 04 09 00 02 03 00 04 00 00 00 00 00 // " I "  
02300: 00 00 00 00 03 01 00 09 09 05 00 04 09 09 05 00 02 04 05 00 // " ) - (-"  
02320: 00 04 09 01 00 00 04 09 04 07 00 02 03 07 06 00 01 02 00 00 // " ) IG "  
02340: 04 09 00 02 04 07 02 00 00 00 00 00 00 00 00 00 00 00 00 00 // " I G- "  
02360: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 04 06 00 02 // " F "  
02380: 04 04 08 00 00 01 00 00 03 09 00 02 04 06 01 00 00 01 00 00 // " D F+ "  
02400: 03 04 00 00 00 00 00 00 00 01 00 02 03 09 04 09 09 05 01 00 // " @ I + "  
02420: 00 01 00 00 03 04 00 00 00 00 00 00 00 01 00 02 03 09 00 09 // " @ "  
02440: 09 05 01 00 00 01 00 00 04 07 00 02 04 07 02 00 00 03 00 00 // " + G G- . "  
02460: 04 08 07 00 07 00 07 03 00 00 00 0A 04 06 00 02 03 00 04 00 // " H003 #F "  
02480: 00 02 00 00 04 09 00 02 06 04 00 00 00 00 00 00 00 00 00 00 // " I U "  
02520: 14 01 04 02 04 03 04 04 04 05 04 06 04 07 04 08 04 09 05 01 // " ABCDE FGHIJ "  
02540: 05 02 05 03 05 04 05 05 05 06 05 07 05 08 05 09 09 06 01 06 02 // " KLMNO PQR S "  
02560: 06 03 06 04 06 05 06 06 06 07 06 08 06 09 00 00 00 03 00 04 // " TUVWX YZ . ) "  
02580: 01 00 01 03 01 04 02 00 02 01 02 03 02 04 03 03 03 04 07 00 // " +\$\*- / , (=0" "  
02600: 07 01 07 02 07 03 07 04 07 05 07 06 07 07 07 08 07 09 06 09 // " 12345 6789Z "  
02620: 00 0A 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 // " # "  
02640: 03 01 02 09 08 05 00 00 02 05 02 00 03 01 04 09 09 05 00 02 // " - I "  
02660: 09 08 05 00 02 04 05 00 00 04 09 02 09 09 04 09 04 07 00 02 // " - ( - ) IG "  
02680: 07 02 04 00 01 02 00 00 04 09 00 02 08 02 00 00 00 00 00 00 // " 2 I "  
02720: 00 00 00 00 04 06 00 02 07 09 06 00 00 01 00 00 03 09 00 02 // " F 9 "



59960: 00 01 00 00 04 09 00 03 04 02 00 0A 00 00 00 00 05 09 09 07 // " I.B # R "  
59980: 06 00 01 02 03 04 05 06 07 08 09 0A 11 12 05 09 09 08 09 // " @08 # R "

// End

## **DX03 – Console Typewriter Diagnostic**



```
//=====
//  
// DX03 - Console Typewriter Diagnostic  
//  
// Program Switch settings:  
//  
// PS1: ON - Bypass error type out  
// OFF - Type out routine number on error  
// PS2: ON - Loop in routine  
// OFF - Continue to next routine  
// PS3: ON - Stop on error  
// OFF - Do not stop on error, continue  
// PS4: ON - Repeat test DX03  
// OFF - Run test DX03 once  
//  
// Check switches settings:  
//  
// DISK I/O - STOP  
// PARITY - STOP  
// I/O - STOP  
// O'FLOW - PROGRAM  
//  
// Start addresses:  
//  
// 00440 - Full test w/ title  
// 00726 - Full test w/o title  
// 01982 - Alphabetic echo test  
// 02256 - Numeric echo test  
//  
// Directions:  
//  
// 1. Load DX03 diagnostic  
// 2. Tab stops are automatically set at 45 & 75  
// 3. Press START  
// 4. Press START  
// 5. Press INSERT  
// 6. Type 4901982  
// 7. Press RELEASE  
// 8. Press START  
// 9. Type alphabetic characters, end with record mark  
// 10. Press RELEASE-START  
// 11. Press INSERT  
// 12. Type 4902256  
// 13. Press RELEASE  
// 14. Press START  
// 15. Type numeric characters, end with record mark  
// 16. Press RELEASE-START  
//=====
```



## Sample Output – DX03

ABCDEFGHIJKLMNPQRSTUVWXYZ  
ABCDEFGHIJKLMNPQRSTUVWXYZ  
ABCDEFGHIJKLMNPQRSTUVWXYZ

. )+\$%-/, (=@-\$123456789  
. )+\$%-/, (=@-\$123456789  
. )+\$%-/, (=@-\$123456789

\$123456789@  
\$123456789@  
\$123456789@

\$123456789@#  
\$123456789@#  
\$123456789@#

TABULATE  
TABULATE  
TABULATE

RETURN CARRIAGE  
RETURN CARRIAGE  
RETURN CARRIAGE

6789  
6789  
6789

\$12345  
\$12345  
\$12345

SPACE TWICE SPACE TWICE SPACE TWICE SPACE TWICE SPACE TWICE  
DTX03 TYPEWRITER TEST COMPLETE  
49\$1982

KEY IN ALPHA RECORD, TERMINATE WITH RECORD MARK  
ABCDEFGHIJKLMNPQRSTUVWXYZ@()=%.-+\$/#\$  
ABCDEFGHIJKLMNPQRSTUVWXYZ@()=%.-+\$/  
49\$2256

KEY IN NUMERIC RECORD, TERMINATE WITH RECORD MARK  
\$123456789\$123456789#\$  
\$123456789\$123456789



NO. 2172336  
SHEET 0  
OF 12

# DIAGNOSTIC TEST

DIPAL NAME DX03

TITLE TYPEWRITER TEST - DTX03  
MACH. TYPE 1620 - I BY HNT APPR.    DATE   

## ENGINEERING CHANGE HISTORY

| E/C NO. | DATE   | SHEETS AFFECTED |
|---------|--------|-----------------|
| 404980  | 5-7-64 | 1 - 12          |
|         |        |                 |
|         |        |                 |
|         |        |                 |
|         |        |                 |
|         |        |                 |
|         |        |                 |
|         |        |                 |
|         |        |                 |
|         |        |                 |
|         |        |                 |

|         |        |  |  |  |  |  |  |
|---------|--------|--|--|--|--|--|--|
| E/C NO. | 404980 |  |  |  |  |  |  |
| DATE    | 5-7-64 |  |  |  |  |  |  |

DTX03  
1620-1 TYPEWRITER TEST  
DIPAL NAME DX03

PROGRAM DESCRIPTION

1. Purpose

This program tests all operation of the 1620-1 Console Typewriter, including read numeric and read alpha if desired.

2. Test Method

This program is a fault detection test and is made up of short, independent routines. Each operation and character set is executed three times before proceeding to the next routine Standard program switch control is provided.

3. Modifications

This program contains the necessary linkage to make it compatible with the DIPAL Monitor.

4. Units of System Required

This test requires the basic 1620-1 and 1622 card reader on 1621 paper tape reader.

5. E/C Level

All levels.

LOADING INSTRUCTIONS

1. Clear core by inserting 31 00003 00002.  
Release/Start.
2. Load test deck from 1622 by pushing LOAD button.
3. Load from paper tape Insert 36 00000 00300 K-S
4. To reproduce the paper tape,  
Insert 36 00000 00300, Release, Press  
"SIE" Button. After tape has loaded insert

LOC  
00000 35 00000 00200  
00012 41 00416 00000  
00024 16 00013 00049  
00036 16 00001 00041  
00048 49 00416 00000

DTX03 PAGE 1  
PN 2172336  
EC 404980

4. Continued

Release/Start

When MAR reaches 03202, Stop by pressing "SCE" Button, Reset, and Insert 35 19999 00200. Release/Start

5. Machine will halt with 00011 in MAR. Press START to execute test.

OPERATING INSTRUCTIONS

1. The machine will type instructions for setting margins and tab stops. After setting these, press START to continue.
2. After one program pass is complete, pass complete message is typed out. If SW4 is on, the program is repeated. If SW4 is off, the next program is read from the 1622.
3. Read Alpha Test

A manual branch to location 01982 must be executed in order to enter the Read Alpha test routine. Instructions will be typed out, and then a Read Alpha instruction executed. Any length record may be entered. Terminate with a record mark, release and start. The same record will be typed out. Switch 2 will cause the routine to loop in either the read or write phase, and Switch 4 will repeat the complete Read Alpha test. If SW4 and SW2 are off, the program will halt after writing the record. Pressing START will cause the routine to repeat.

4. Read Numeric Test

Same as the Read Alpha test, except a manual branch to location 02256.

5. Program Console Switches

The program console switches have the following control:

Switch 1    ON: Bypass all error routines  
              OFF: Test Switch 3 on error

Switch 2    ON: Loop in test routine  
              OFF: Continue to next routine

Switch 3    ON: Halt on error if SW1 off  
              OFF: Typeout on error if SW1 off

Switch 4    ON: Repeat program  
              OFF: Load next program from 1622

6. Data Check Switches - as desired.

7. Normal Program Halts

00560 Allow Tab and Margin Settings  
02138 Read Alpha Test Complete and SW4 OFF.  
02412 Read Numeric Test Complete and SW4 OFF.

ERROR INFORMATION

1. Error Halts

There is one error halt in the program.

02710 Detected error. Display LR2 for location +12 of error exit.

2. Error Typeouts

Error messages are typed out in the following format:

ERROR EXIT ADR 01100 MBR-E CK MBR-O CK

TYPEWRITER TEST DTX03

Set Margins at 10 and 90, Tab stops at 55 and 85

ABCDEFGHIJKLMNPQRS TUWXYZ  
ABCDEFGHIJKLMNPQRS TUWXYZ  
ABCDEFGHIJKLMNPQRS TUWXYZ

.)+\$\*-/, (=@-0123456789  
.)+\$\*-/, (=@-0123456789  
.)+\$\*-/, (=@-0123456789

0123456789@  
0123456789@  
0123456789@

0123456789@#  
0123456789@#  
0123456789@#

TABULATE  
TABULATE  
TABULATE

RETURN CARRIAGE  
RETURN CARRIAGE  
RETURN CARRIAGE

6789

6789

6789

DTX03 Page 3  
PN 2172336  
EC 404980

SPACE TWICE SPACE TWICE SPACE TWICE SPACE TWICE SPACE TWICE  
DTX03 TYPEWRITER TEST COMPLETE

4901982RS

KEY IN ALPHA RECORD, TERMINATE WITH RECORD MARK  
ABCDEFGHIJKLMNOPQRSTUVWXYZU10JKLM,.+\$-/@()#RS  
ABCDEFGHIJKLMNOPQRSTUVWXYZU10JKLM,.+\$-/@()

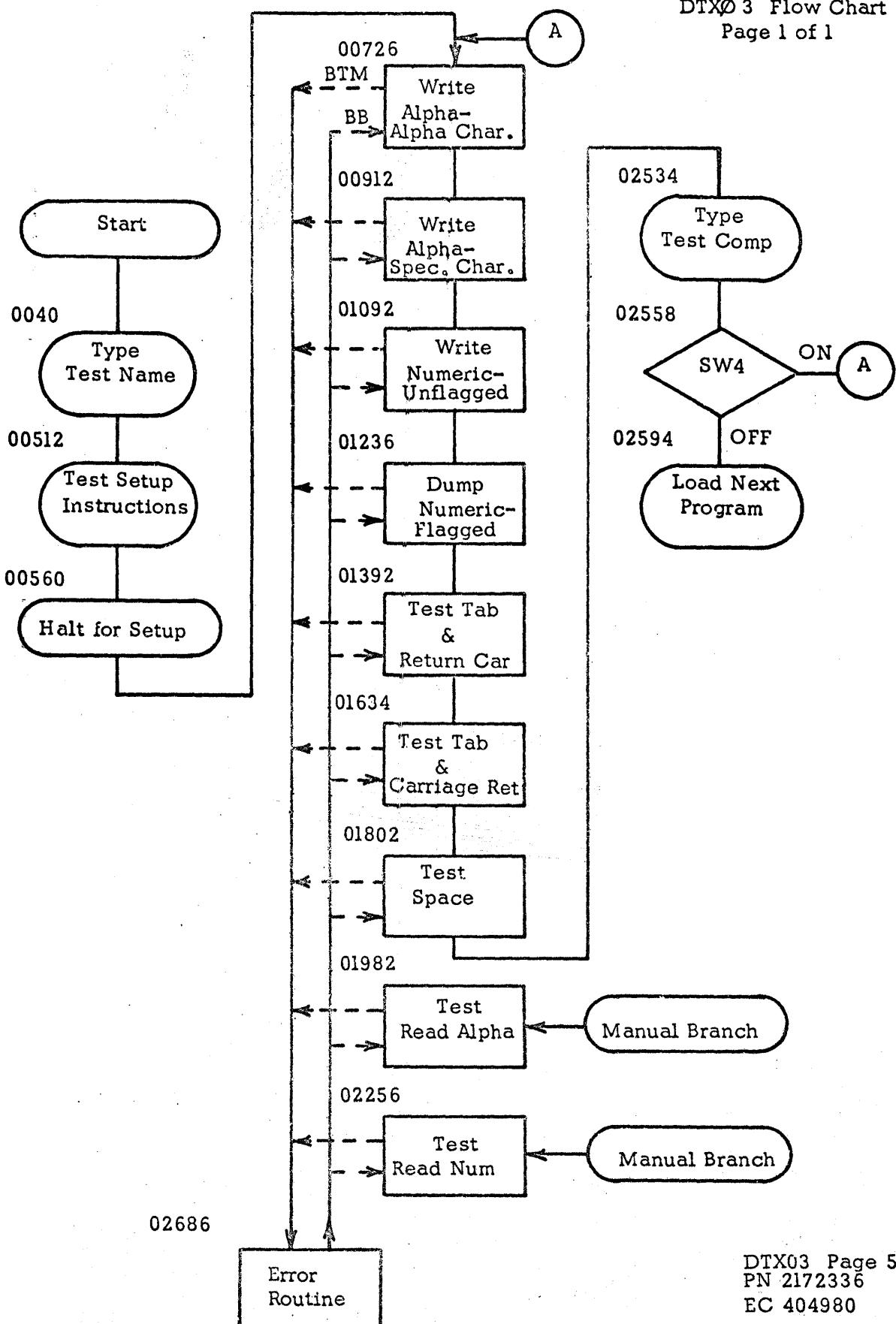
4902256RS

KEY IN NUMERIC RECORD, TERMINATE WITH RECORD MARK

12345678912345678900#RS

12345678912345678900@

DTX03 Page 4  
PN 2172336  
EC 404980



\* DTX03  
 \* 1620-1 TYPEWRITER TEST  
 \*

|          |             |                                       |
|----------|-------------|---------------------------------------|
| 00402    |             | DORG 402                              |
| 18000    | 00000       | MONIT DS ,18000                       |
| 18117    | 00000       | MON DS ,18117                         |
| 00403    | 00004       | NAME DAC 4,DX03,                      |
| 00414    | 00005 -3202 | DSA LAST                              |
| 00416 45 | 00440 18117 | ORG BNR *+24,MON                      |
| 00428 49 | 18000 00000 | B MONIT                               |
| 00440 34 | 00726 00102 | START RCTY T1.0                       |
| 00452 16 | 00441 000M9 | TFM *-11,49,10                        |
| 00464 39 | 00585 00100 | WATY IDEN,,, TYPE TEST NAME           |
| 00476 47 | 00500 01900 | BNA *+24,,, TEST ANY DATA CK          |
| 00488 17 | 02686 -0488 | BTM ERROR,,, GO TO ERROR ROUTINE      |
| 00500 34 | 00000 00102 | RCTY                                  |
| 00512 39 | 00629 00100 | WATY INST,,, TYPE INSTRUCTIONS        |
| 00524 47 | 00548 01900 | BNA *+24,,, TEST ANY DATA CK          |
| 00536 17 | 02686 -0536 | BTM ERROR,,, GO TO ERROR ROUTINE      |
| 00548 34 | 00000 00102 | RCTY                                  |
| 00560 48 | 00000 00000 | H ,,, HALT TO ALLOW TAB SETTING       |
| 00572 49 | 00726 00000 | B T1.0,,, GO TO FIRST TEST            |
| 00585    | 00022       | IDEN DAC 22,TYPEWRITER TEST DTX03*    |
| 00629    | 00025       | INST DAC 25,SET MARGINS AT 10 AND 90, |
| 00679    | 00023       | DAC 23,TAB STOPS AT 55 AND 85*        |

\*  
 \* THIS ROUTINE WILL TYPE THE ALPHABETIC  
 \* CHARACTERS 3 TIMES.  
 \*

|          |             |   |
|----------|-------------|---|
| 00725    | 00002       | COUNT DC 2,0,, 2 DIGIT FIELD FOR PASS COUNT |
| 00726 16 | 00725 000-0 | T1.0 TFM COUNT,0,10, RESET PASS COUNT TO 0  |
| 00738 34 | 00000 00102 | RCTY  |
| 00750 34 | 00000 00102 | RCTY  |
| 00762 39 | 00859 00100 | WATY K1.0,,, TYPE FIRST PATTERN             |
| 00774 47 | 00798 01900 | BNA *+24,,, TEST ANY DATA CK                |
| 00786 17 | 02686 -0786 | BTM ERROR,,, GO TO ERROR ROUTINE            |
| 00798 46 | 00750 00200 | BC2 T1.0+24,,, LOOP IF SW2 ON               |
| 00810 11 | 00725 000-1 | AM COUNT,1,10, UPDATE PASS COUNT            |
| 00822 14 | 00725 000-3 | CM COUNT,3,10, SEE IF 3 LINES TYPED         |
| 00834 47 | 00750 01300 | BL T1.0+24,,, GO TYPE ANOTHER LINE          |
| 00846 49 | 00912 00000 | B T2.0,,, GO TO NEXT TEST                   |

|       |       |   |
|-------|-------|---|
| 00859 | 00027 | K1.0 DAC 27,ABCDEFIGHJKLMNOPQRSTUVWXYZ* |
|-------|-------|---|

\*  
 \* THIS ROUTINE WRITES ALL NUMERALS AND  
 \* SPECIAL CHARACTERS 3 TIMES IN ALPHA MODE.  
 \*

|          |             |  |
|----------|-------------|--|
| 00912 16 | 00725 000-0 | T2.0 TFM COUNT,0,10, RESET PASS COUNT TO 0 |
| 00924 34 | 00000 00102 | RCTY                                       |
| 00936 34 | 00000 00102 | RCTY                                       |
| 00948 39 | 01045 00100 | WATY K2.0,,, TYPE TEST PATTERN             |
| 00960 47 | 00984 01900 | BNA *+24,,, TEST ANY DATA CK               |
| 00972 17 | 02686 -0972 | BTM ERROR,,, GO TO ERROR ROUTINE           |
| 00984 46 | 00936 00200 | BC2 T2.0+24,,, LOOP IF SW2 ON              |
| 00996 11 | 00725 000-1 | AM COUNT,1,10, UPDATE PASS COUNT           |

|  |   |
|--|---|
| 01008 14 00725 000-3   | CM COUNT,3,10, SEE IF 3 LINES TYPED           |
| 01020 47 00936 01300   | BL T2.0+24,,, GO TYPE ANOTHER LINE            |
| 01032 49 01092 00000   | B T3.0,,, GO TO NEXT TEST                     |
| *  |   |
| 01045 00024  | K2.0 DAC 24, .)+\$*-/, (='-0123456789'        |
| *  |   |
| * THIS ROUTINE WILL TYPE 3 LINES OF UNFLAGGED NUMERIC CHARACTERS.                          |   |
| *  |   |
| 01092 16 00725 000-0   | T3.0 TFM COUNT,0,10, RESET PASS COUNT TO 0    |
| 01104 34 00000 00102   | RCTY  |
| 01116 34 00000 00102   | RCTY  |
| 01128 38 01224 00100   | WNTY K3.0,,, TYPE TEST PATTERN                |
| 01140 47 01164 01900   | BNA *+24,,, TEST ANY DATA CK                  |
| 01152 17 02686 -1152   | BTM ERROR,,, GO TO ERROR ROUTINE              |
| 01164 46 01116 00200   | BC2 T3.0+24,,, LOOP IF SW2 ON                 |
| 01176 11 00725 000-1   | AM COUNT,1,10, UPDATE PASS COUNT              |
| 01188 14 00725 000-3   | CM COUNT,3,10, SEE IF 3 LINES TYPED           |
| 01200 47 01116 01300   | BL T3.0+24,,, GO TYPE ANOTHER LINE            |
| 01212 49 01236 00000   | B T4.0,,, GO TO NEXT TEST                     |
| *  |   |
| 01224 00010  | K3.0 DSC 10,0123456789                        |
| 01234 00001  | DNB 1,,, 8-4 CHAR                             |
| 01235 00001  | DC 1,'', RECORD MARK                          |
| *  |   |
| * THIS ROUTINE TYPES 3 LINES OF FLAGGED NUMERIC CHARACTERS USING DUMP NUMERIC INSTRUCTION. |   |
| *  |   |
| 01236 16 00725 000-0   | T4.0 TFM COUNT,0,10, RESET PASS COUNT TO 0    |
| 01248 31 19988 01380   | TR 19988,K4.0,,, SET UP DATA FIELD            |
| 01260 34 00000 00102   | RCTY  |
| 01272 34 00000 00102   | RCTY  |
| 01284 35 19988 00100   | DNTY 19988,,, TYPE TEST PATTERN               |
| 01296 47 01320 01900   | BNA *+24,,, TEST ANY DATA CK                  |
| 01308 17 02686 -1308   | BTM ERROR,,, GO TO ERROR ROUTINE              |
| 01320 46 01272 00200   | BC2 T4.0+36,,, LOOP IF SW2 ON                 |
| 01332 11 00725 000-1   | AM COUNT,1,10, UPDATE PASS COUNT              |
| 01344 14 00725 000-3   | CM COUNT,3,10, SEE IF 3 LINES TYPED           |
| 01356 47 01272 01300   | BL T4.0+36,,, GO TYPE ANOTHER LINE            |
| 01368 49 01392 00000   | B T5.0,,, GO TO NEXT TEST                     |
| *  |   |
| 01380 00001  | K4.0 DC 1,-0                                  |
| 01382 00002  | DC 2,-12                                      |
| 01384 00002  | DC 2,-34                                      |
| 01386 00002  | DC 2,-56                                      |
| 01388 00002  | DC 2,-78                                      |
| 01389 00001  | DC 1,-9                                       |
| 01390 00001  | DNB 1,,, 8-4 CHAR                             |
| 01391 00001  | DC 1,'', RECORD MARK                          |
| *  |   |
| * THIS ROUTINE TESTS THE TABULATE AND RETURN CARRIAGE OPERATIONS.                          |   |
| *  |   |
| 01392 16 00725 000-0   | T5.0 TFM COUNT,0,10, RESET PASS COUNT TO ZERO |
| 01404 34 00000 00102   | RCTY  |
| 01416 34 00000 00102   | RCTY  |
| 01428 39 01585 00100   | WATY K5.0,,, TYPE TABULATE                    |
| 01440 34 00000 00108   | TBTY ,,, TAB TO 45                            |

|  |      |             |                             |
|--|------|-------------|-----------------------------|
| 01452 47 01476 01900                         | BNA  | *+24,,,     | TEST ANY DATA CK            |
| 01464 17 02686 -1464                         | BTM  | ERROR,,,    | GO TO ERROR ROUTINE         |
| 01476 39 01603 00100                         | WATY | K5.1,,,     | TYPE RETURN CARRIAGE        |
| 01488 34 00000 00102                         | RCTY |             |                             |
| 01500 47 01524 01900                         | BNA  | *+24,,,     | TEST ANY DATA CK            |
| 01512 17 02686 -1512                         | BTM  | ERROR,,,    | GO TO ERROR ROUTINE         |
| 01524 46 01428 00200                         | BC2  | T5.0+36,,,  | LOOP IF SW2 ON              |
| 01536 11 00725 000-1                         | AM   | COUNT,1,10, | UPDATE PASS COUNT           |
| 01548 14 00725 000-3                         | CM   | COUNT,3,10, | SEE IF 3 PASSES MADE        |
| 01560 47 01428 01300                         | BL   | T5.0+36,,,  | DO AGAIN                    |
| 01572 49 01634 00000                         | B    | T6.0,,,     | GO TO NEXT TEST             |
| *  |      |             |                             |
| 01585 00009                                  | K5.0 | DAC         | 9,TABULATE*                 |
| 01603 00016                                  | K5.1 | DAC         | 16,RETURN CARRIAGE*         |
| *  |      |             |                             |
| *  |      |             |                             |
| THIS ROUTINE TESTS THE TABULATE AND          |      |             |                             |
| CARRIAGE RETURN.                             |      |             |                             |
| *  |      |             |                             |
| 01634 16 00725 000-0                         | TFM  | COUNT,0,10, | RESET PASS COUNT TO 0       |
| 01646 34 00000 00102                         | RCTY |             |                             |
| 01658 34 00000 00102                         | RCTY |             |                             |
| 01670 34 00000 00108                         | TBTY | ,,,         | TAB CARRIAGE                |
| 01682 34 00000 00108                         | TBTY | ,,,         | TAB CARRIAGE                |
| 01694 38 01790 00100                         | WNTY | K6.0,,,     | TYPE TEST PATTERN           |
| 01706 47 01730 01900                         | BNA  | *+24,,,     | TEST ANY DATA CK            |
| 01718 17 02686 -1718                         | BTM  | ERROR,,,    | GO TO ERROR ROUTINE         |
| 01730 46 01658 00200                         | BC2  | T6.0+24,,,  | LOOP IF SW2 ON              |
| 01742 11 00725 000-1                         | AM   | COUNT,1,10, | UPDATE PASS COUNT           |
| 01754 14 00725 000-3                         | CM   | COUNT,3,10, | SEE IF 3 PASSES MADE        |
| 01766 47 01658 01300                         | BL   | T6.0+24,,,  | DO AGAIN                    |
| 01778 49 01802 00000                         | B    | T7.0,,,     | GO TO NEXT TEST             |
| *  |      |             |                             |
| 01790 00011                                  | K6.0 | DSC         | 11,0123456789*              |
| *  |      |             |                             |
| *  |      |             |                             |
| THIS ROUTINE TESTS THE SPACE OPERATION       |      |             |                             |
| *  |      |             |                             |
| 01802 16 00725 000-0                         | TFM  | COUNT,0,10, | RESET PASS COUNT TO 0       |
| 01814 34 00000 00102                         | RCTY |             |                             |
| 01826 34 00000 00102                         | RCTY |             |                             |
| 01838 39 01959 00100                         | WATY | K7.0,,,     | TYPE-SPACE TWICE            |
| 01850 34 00000 00101                         | SPTY |             |                             |
| 01862 34 00000 00101                         | SPTY |             |                             |
| 01874 47 01898 01900                         | BNA  | *+24,,,     | TEST ANY DATA CHECK         |
| 01886 17 02686 -1886                         | BTM  | ERROR,,,    | GO TO ERROR ROUTINE         |
| 01898 46 01838 00200                         | BC2  | T7.0+36,,,  | LOOP IF SW2 ON              |
| 01910 11 00725 000-1                         | AM   | COUNT,1,10, | UPDATE PASS COUNT           |
| 01922 14 00725 000-5                         | CM   | COUNT,5,10, | SEE IF 5 LOOPS MADE         |
| 01934 47 01838 01300                         | BL   | T7.0+36,,,  | REPEAT                      |
| 01946 49 02534 00000                         | B    | FINISH,,,   | GO TO PROG COMPLETE ROUTINE |
| *  |      |             |                             |
| 01959 00012                                  | K7.0 | DAC         | 12,SPACE TWICE*             |
| *  |      |             |                             |
| *  |      |             |                             |
| A MANUAL ENTRY TO THIS ROUTINE WILL SET UP   |      |             |                             |
| A READ ALPHA OPERATION, AND WILL ACCEPT ANY  |      |             |                             |
| ALPHA RECORD KEYED IN. THE SAME MESSAGE WILL |      |             |                             |
| BE TYPED OUT                                 |      |             |                             |

|                      |        |  |   |
|----------------------|--------|--|---|
| 01982 34 00000 00102 | T8.0   | RCTY<br>WATY INST2,,,<br>RCTY<br>RATY RDIN,,,<br>BNA *+24,,,<br>BTM ERROR,,,<br>BC2 T8.0,,,<br>RCTY<br>WATY RDIN,,,<br>BNA *+24,,,<br>BTM ERROR,,,<br>BC2 *-48,,,<br>BC4 T8.0,,,<br>H<br>B T8.0,,, | TYPE INSTRUCTIONS<br>READ IN RECORD<br>TEST ANY DATA CK<br>GO TO ERROR ROUTINE<br>LOOP IN READ SECTION<br>TYPE SAME RECORD OUT<br>TEST ANY DATA CK<br>GO TO ERROR ROUTINE<br>LOOP IN WRITE SECTION<br>LOOP IN ROUTINE IF SW4 ON<br>REPEAT ROUTINE |
| 01994 39 02163 00100 |        |  |   |
| 02006 34 00000 00102 |        |  |   |
| 02018 37 03199 00100 |        |  |   |
| 02030 47 02054 01900 |        |  |   |
| 02042 17 02686 -2042 |        |  |   |
| 02054 46 01982 00200 |        |  |   |
| 02066 34 00000 00102 |        |  |   |
| 02078 39 03199 00100 |        |  |   |
| 02090 47 02114 01900 |        |  |   |
| 02102 17 02686 -2102 |        |  |   |
| 02114 46 02066 00200 |        |  |   |
| 02126 46 01982 00400 |        |  |   |
| 02138 48 00000 00000 |        |  |   |
| 02150 49 01982 00000 |        |  |   |
| 02163 00047          | INST2  | DAC 47,KEY IN ALPHA RECORD,TERMINATE WITH RECORD MARK*   |   |
|                      | *      |  |   |
|                      | *      |  |   |
|                      | *      | A MANUAL ENTRY TO THIS ROUTINE WILL SET UP   |   |
|                      | *      | A READ NUMERIC OPERATION, AND WILL ACCEPT  |   |
|                      | *      | ANY NUMERIC RECORD KEYED IN. THE SAME MESSAGE  |   |
|                      | *      | WILL BE TYPED OUT.   |   |
|                      | *      |  |   |
| 02256 34 00000 00102 | T9.0   | RCTY<br>WATY INST3,,,<br>RCTY<br>RNRY RDIN,,,<br>DNA *+24,,,<br>BTM ERROR,,,<br>BC2 T9.0,,,<br>RCTY<br>WNTY RDIN,,,<br>BNA *+24,,,<br>BTM ERROR,,,<br>BC2 *-48,,,<br>BC4 T9.0,,,<br>H<br>B T9.0,,, | TYPE INSTRUCTIONS<br>READ IN RECORD<br>TEST ANY DATA CK<br>GO TO ERROR ROUTINE<br>LOOP IN READ SECTION<br>TYPE SAME RECORD OUT<br>TEST ANY DATA CK<br>GO TO ERROR ROUTINE<br>LOOP IN WRITE SECTION<br>LOOP IN ROUTINE<br>REPEAT ROUTINE           |
| 02268 39 02437 00100 |        |  |   |
| 02280 34 00000 00102 |        |  |   |
| 02292 36 03199 00100 |        |  |   |
| 02304 47 02328 01900 |        |  |   |
| 02316 17 02686 -2316 |        |  |   |
| 02328 46 02256 00200 |        |  |   |
| 02340 34 00000 00102 |        |  |   |
| 02352 38 03199 00100 |        |  |   |
| 02364 47 02388 01900 |        |  |   |
| 02376 17 02686 -2376 |        |  |   |
| 02388 46 02340 00200 |        |  |   |
| 02400 46 02256 00400 |        |  |   |
| 02412 48 00000 00000 |        |  |   |
| 02424 49 02256 00000 |        |  |   |
| 02437 00049          | INST3  | DAC 49,KEY IN NUMERIC RECORD,TERMINATE WITH RECORD MARK*   |   |
|                      | *      |  |   |
|                      | *      |  |   |
|                      | *      | PROGRAM FINISHED ROUTINE   |   |
| 02534 34 00000 00102 | FINISH | RCTY<br>WATY FINI<br>BC4 T1.0,,,<br>BNR *+24,MON<br>B MONIT<br>RNCD,,,<br>B 0,,,<br>FINI DAC 31,DTX03 TYPEWRITER TEST COMPLETE*  | REPEAT PROG IF SW4 ON<br>READ NEXT PROG IF SW4 OFF<br>GO TO LOADER  |
| 02546 39 02619 00100 |        |  |   |
| 02558 46 00726 00400 |        |  |   |
| 02570 45 02594 18117 |        |  |   |
| 02582 49 18000 00000 |        |  |   |
| 02594 36 00000 00500 |        |  |   |
| 02606 49 00000 00000 |        |  |   |
| 02619 00031          |        |  |   |
| 02684 00005          |        |  |   |
|                      | *      |  |   |
|                      | *      |  |   |
|                      | *      | COMMON ERROR ROUTINE   |   |
| 02686 46 02938 00100 | ERROR  | BC1 RSET,,,<br>BNC3 *+36,,,  | BYPASS ERROR RTN IF SW1 ON<br>BYPASS HALT IF SW3 OFF  |
| 02698 47 02734 00300 |        |  |   |

|       |       |       |   |  |                                      |
|-------|-------|-------|---|--|--------------------------------------|
| 02710 | 48    | 00000 | 00000                                   | H     ,,,  | DISPLAY IR2 FOR LOC+12 OF ERROR EXIT |
| 02722 | 49    | 02938 | 00000                                   | B     RSET,,,                                      | GO RESET DATA CK INDICATORS          |
| *     |       |       |   | ERROR TYPEOUT SECTION                              |                                      |
| 02734 | 26    | 03060 | 02685                                   | TF     OUT+4,ERROR-1,,SET EXIT ADR IN TYPEOUT AREA |                                      |
| 02746 | 34    | 00000 | 00102                                   | RCTY   |                                      |
| 02758 | 39    | 03011 | 00100                                   | WATY EXT,,,  |                                      |
| 02770 | 38    | 03056 | 00100                                   | WNTY OUT,,,  | TYPE ADDRESS                         |
| *     |       |       |   | TYPE OUT WHICH DATA CK INDICATORS ARE ON           |                                      |
| 02782 | 47    | 02806 | 00600                                   | BNI   #+24,600,,                                   | READ CK                              |
| 02794 | 39    | 03043 | 00100                                   | WATY RDK   |                                      |
| 02806 | 47    | 02830 | 00700                                   | BNI   #+24,700,,                                   | WRITE CK                             |
| 02818 | 39    | 03063 | 00100                                   | WATY WRK   |                                      |
| 02830 | 47    | 02854 | 00800                                   | BNI   #+24,800,,                                   | MAR CK                               |
| 02842 | 39    | 03077 | 00100                                   | WATY MRK   |                                      |
| 02854 | 47    | 02878 | 01600                                   | BNI   #+24,1600,,                                  | MBRE CK                              |
| 02866 | 39    | 03093 | 00100                                   | WATY BRE   |                                      |
| 02878 | 47    | 02902 | 01700                                   | BNI   #+24,1700,,                                  | MBRO CK                              |
| 02890 | 39    | 03113 | 00100                                   | WATY BRO   |                                      |
| 02902 | 47    | 02926 | 01900                                   | BNI   #+24,1900,,                                  | ANY DATA CK                          |
| 02914 | 39    | 03133 | 00100                                   | WATY HUH   |                                      |
| 02926 | 42    | 00000 | 00000                                   | BB     ,,,   | RETURN TO PROG                       |
| *     |       |       |   | IND RESET IF SW1 OR 3 ON                           |                                      |
| 02938 | 46    | 02950 | 00600                                   | RSET   BI   #+12,600                               |                                      |
| 02950 | 46    | 02962 | 00700                                   | BI   #+12,700                                      |                                      |
| 02962 | 46    | 02974 | 00800                                   | BI   #+12,800                                      |                                      |
| 02974 | 46    | 02986 | 01600                                   | BI   #+12,1600                                     |                                      |
| 02986 | 46    | 02998 | 01700                                   | BI   #+12,1700                                     |                                      |
| 02998 | 42    | 00000 | 00000                                   | BB     ,,,   | RETURN TO PROG                       |
| 03011 | 00016 | EXT   | DAC 16,ERROR EXIT ADR                   | *  |                                      |
| 03043 | 00007 | RDK   | DAC 7, RD CK                            | *  |                                      |
| 03056 | 00006 | OUT   | DSC 6,0                                 | *  |                                      |
| 03063 | 00007 | WRK   | DAC 7, WR CK                            | *  |                                      |
| 03077 | 00008 | MRK   | DAC 8, MAR CK                           | *  |                                      |
| 03093 | 00010 | BRE   | DAC 10, MBR-E CK                        | *  |                                      |
| 03113 | 00010 | BRO   | DAC 10, MBR-O CK                        | *  |                                      |
| 03133 | 00033 | HUH   | DAC 33, DATA CK CAUSING ERROR NOT RESET | *  |                                      |
| 03199 | 00002 | RDIN  | DAC 2,                                  | *  |                                      |
| 03202 | 00001 | LAST  | DSC 1,0                                 | *  |                                      |
| 00416 |       |       | DEND ORG                                |  |                                      |

## DT X03 80/80 LIST

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 0368574566594963455900634562630044636770730# 1-1-0584-0628 -0007  
 0245630054415947495562004163007170041554400797023# 1-1-0628-0678 -0008  
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 -0# 1-1-0724-0726 -0010  
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 490123600000# 0-1-1212-1224 -0021  
 0123456789# 1-1-1224-1234 -0022  
 \*# -7-1234-1235 -0023  
 \*# 1-1-1235-1236 -0024  
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 \*# 1-1-1391-1392 -0030  
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|   |                                      |       |
|---|--------------------------------------|-------|
| 57534563450*  | 1-1-2668-2680                        | -0058 |
| -0000‡  | 1-1-2680-2685                        | -0059 |
| 46029380010047027340030048000000000049029380000260306002685‡              | 0-1-2686-2746                        | -0060 |
| 340000000102390301100100380305600100470280600600390304300100‡             | 0-1-2746-2806                        | -0061 |
| 470283000700390306300100470285400800390307700100470287801600‡             | 0-1-2806-2866                        | -0062 |
| 390309300100470290201700390311300100470292601900390313300100‡             | 0-1-2866-2926                        | -0063 |
| 420000000000460295000600460296200700460297400800460298601600‡             | 0-1-2926-2986                        | -0064 |
| 460299801700420000000000‡   | 0-1-2986-3010                        | -0065 |
| M559595659004567496300414459000‡  | 1-1-3010-3042                        | -0066 |
| -059440043520‡  | 1-1-3042-3056                        | -0067 |
| 00000‡  | 1-1-3056-3062                        | -0068 |
| -066590043520‡  | 1-1-3062-3076                        | -0069 |
| -05441590043520‡  | 1-1-3076-3092                        | -0070 |
| -054425920450043520‡  | 1-1-3092-3112                        | -0071 |
| -054425920700043520‡  | 1-1-3112-3132                        | -0072 |
| -0444163410043520043416462495547004559595659005556‡                       | 1-1-3132-3182                        | -0073 |
| 630059456245630‡  | 1-1-3182-3198                        | -0074 |
| -00‡  | 1-1-3198-3202                        | -0075 |
| 0‡  | 1-1-3202-3203                        | -0076 |
| 00000 L600000005004900000‡1205723-000133057230000049057120000-8-0096-0115 | -0077                                |       |
| 360010000500360017200500360024400500360031600500360000000500              | -0078                                |       |
| 000000000000102030400020406080003060902100408021610050015102006021814200‡ | -0079                                |       |
| 704112820080614223009081726300000000005060708090012141618151811242720242‡ | -0080                                |       |
| 82236352035304540363248445324946536048465462754453627180123456789123456‡  | -0081                                |       |
| 789-23456789-J3456789-JK456789-JKL56789-JKLM6789-JKLMN789-JKLMN089-JKLMN‡ | -0082                                |       |
| M8000000000049-04160P9-JKLMNOPQ‡  | L10038800019M90000000000M90003600000 | -0083 |



## **IO02 - Card I/O Diagnostic**



```
//=====
//  
// IO02 - Card I/O Diagnostic  
//  
// Program Switch settings:  
//  
// PS1:   ON - Bypass error type out  
//         OFF - Type out routine number on error  
// PS2:   ON - Loop in routine  
//         OFF - Continue to next routine  
// PS3:   ON - Stop on error  
//         OFF - Do not stop on error, continue  
// PS4:   ON - Repeat test IO02  
//         OFF - Run test IO02 once  
//  
// Check switches settings:  
//  
// DISK I/O - STOP  
// PARITY   - STOP  
// I/O       - PROGRAM  
// O'FLOW    - PROGRAM  
//  
// Start addresses:  
//  
// 00828 - Full test  
// 07152 - Punch alphabetic ripple deck  
// 02796 - Verify alphabetic ripple deck  
// 07188 - Punch numeric ripple deck  
// 05304 - Verify numeric ripple deck  
//  
// Directions:  
//  
// 1. Load IO02 diagnostic  
// 2. Press START  
// 3. Press START  
// 3. Press RELEASE  
// 5. Press RESET  
// 6. Press INSERT  
// 7. Type 4907152  
// 8. Press RELEASE-START  
// 9. Verify that PUNCH NO FEED light is lit  
// 10. Insert empty card deck into punch  
// 11. Press START  
// 12. Verify that READER NO FEED light is lit  
// 13. Move card deck from punch to reader  
// 14. Press RELEASE  
// 15. Press RESET  
// 16. Press INSERT  
// 17. Type 4907188  
// 18. Press RELEASE-START  
// 19. Verify that PUNCH NO FEED light is lit  
// 20. Insert empty card deck into punch  
// 21. Press START  
// 22. Verify that READER NO FEED light is lit  
// 23. Move card deck from punch to reader  
//=====
```



## Sample Output – IO02

SW 1 OFF SW 2 OFF SW 3 OFF SW 4 OFF SET SWS FOR IO02 THEN START.  
KEY IN 80 ALPHA CHARACTERS TO GENERATE RIPPLE DECK.

4907152RS

RIPPLE DECK PUNCHED LOAD INTO READER - START.

ALPHA OK - KEY IN 80 NUMERIC CHARACTERS TO GENERATE RIPPLE DECK.

4907188RS

RIPPLE DECK PUNCHED LOAD INTO READER - START.

IF NO ETOS IO02 SUCCESSFUL.



NO. 2125684

SHEET 0

OF 27

# DIAGNOSTIC TEST

TITLE 1622 CARD INPUT/OUTPUT DIAGNOSTIC TEST - IO02

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

## ENGINEERING CHANGE HISTORY

| E/C NO. | DATE    | SHEETS AFFECTED   |
|---------|---------|---|
| 404618  | 5-15-61 | 1-26  |
| 404675  | 4-11-62 | 2, 3, 4, 10, 12, 13, 15, 19, 20<br>22, 23, 24, 25, 26, 27 |
| 404839  | 2-27-63 | 5, 8  |
|         |         |   |
|         |         |   |
|         |         |   |
|         |         |   |
|         |         |   |
|         |         |   |
|         |         |   |

|         |         |         |         |  |  |  |  |
|---------|---------|---------|---------|--|--|--|--|
| E/C NO. | 404618  | 404675  | 404839  |  |  |  |  |
| DATE    | 5-15-61 | 4-11-62 | 2-27-63 |  |  |  |  |

## 1622 DIAGNOSTICS

### TEST J002

#### A. SCOPE:

This test was designed to check all characters in all positions of the buffers in the 1622 punch and read, the last card indicator, and the read and write checks; both in alpha and numeric modes.

#### B. SET UP:

Sense Switch settings give the same result as standard 1620 diagnostic programs. To obtain the greatest amount of printed information in regard to errors place all Sense Switches in the Off position.

C. TEST METHOD:

The first two cards of the test deck contain loading instructions for the math tables which are contained on the following five cards. The eighth card contains the loading instructions for the program.

The entire deck plus two blank cards at the end are loaded into the reader bed, and with the computer in manual mode the Load Key is depressed.

When the last card has been read, a printout advising of the Sense Switch settings occurs and the computer halts.

Depressing the computer Start key continues the program until instructions are printed out to key in 80 alpha characters. Load the punch bed with a deck of blank cards and depress the card reader Start key on the punch. At this point the operator has a choice of one of two options:

- I. Key in 80 characters, release, start.
- II. Reset, insert, key in: 4907152 Release, Start.  
(This causes a ripple deck of 80 cards to be punched.)

Option I allows the operator to select any desired sequence of characters, or any characters except the record mark he may wish including spacings. One need not key in 80 characters. A count of keyed in characters is unnecessary because an automatic function of the program allows only the first 80 characters to be used.

Option II allows the operator to use a table of 80 characters previously placed in core storage by the program. Option II is selected by branching to 07152 for alphabetic and to 07188 for numeric.

Option I may be preferable when a trouble is known to exist in a definite sequence.

A write check error occurring during the punching of the ripple deck causes a print out advising of such and a halt. Depression of the computer Start key reinitiates conditions for a restart without the need to reload the program.

When the printout occurs advising completion of the punching, depress Non Process Run out keys on the reader and punch. Remove the last two cards, (they will be unpunched), from the deck and place the deck in the read bed. Removal of last two cards is necessary to check the Last Card Indicator. Depress the reader Start key. Depress computer Start key.

C. TEST METHOD - continued

When the ripple deck is being read a noticeable variation of the reading rate of the cards may be observed. This being due to the searching of the computer through a comparison of a table. The rate may be fluctuated by shuffling the ripple deck prior to placing it in the read bed.

The program provides up to three attempts to successfully transfer the information read from the card from the 1622 to the 1620 in the event of a Read Check on the first attempt. If a Read Check occurs on the first transfer but the second or third attempted transfer is successful, a typeout stating the specific circumstance will occur. If a Read Check occurs on all three attempts, a print out advising of a restart is made. A restart at this point requires reloading of the ripple deck in the read bed.

If a card does not compare correctly after being read and all Sense Switches are off, a branch to error routine H001 is performed. After printing out H001 and the typewriter carriage is returned, a printout of the information contained on the erroneous card is performed followed by a print out of the table with which a comparison was attempted.

The table was generated automatically by the keyed in 80 characters doubled. By visually checking the card erroneously read, the operator can ascertain whether the punch incorrectly punched the data or the reader incorrectly read the punched data. Because each character keyed in passes through the punch and read buffers at least one time a defective punch or read circuit may be located.

Depressing computer Start Key continues the reading of the ripple deck with the card following the erroneous card.

An excellent check of the error portion of this program would be to insert a blank card or a card with known data into the ripple deck prior to loading into the reader and observing the results.

C. TEST METHOD - continued

The reader stops after the 78th card is read. It is necessary to depress the reader Start key to read the final two cards and check the Last Card Indicator.

Two checks of the Last Card Indicator are performed. The first checks that it is on and the second checks that it is turned off after inquiry.

H002 - Last Card indicator not on.

H003 - Last Card indicator not off.

The numeric portion of the test is conducted in the same manner as the alpha.

Option II will be 49 07188

H004 will be analogous to H001

H005 will be analogous to H002

H006 will be analogous to H003.

The ripple deck reading portions of the test may be run individually using prepunched ripple decks by branching to 02796 for alphabetic and to 05304 for numeric.

The complete normal typeout information will be as follows: (Note: The specific alphabetic and numeric data keyed in is optional to the operator: or options I and/or II may be used.)

SW 1 OFF SW 2 OFF SW 3 OFF SW 4 OFF SET SWS FOR 1002  
THEN START.

KEY IN 80 ALPHA CHARACTERS TO GENERATE RIPPLE DECK.  
ABCDEFGHIJKLMNPQRSTUVWXYZ0123456789@()=\*.+-\$/.,

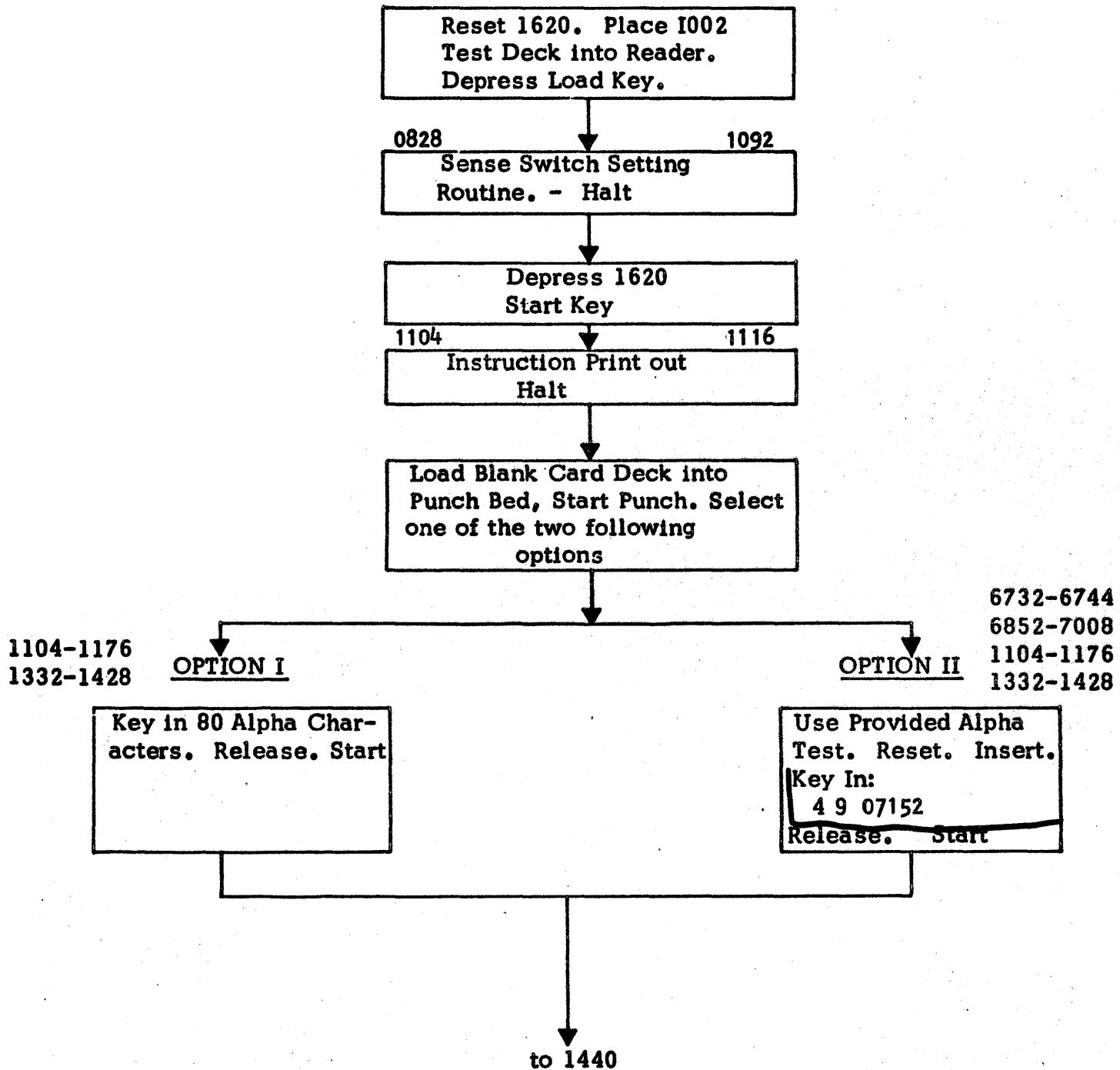
ABCDEFGHIJKLMNPQRSTUVWXYZ0123456  
RIPPLE DECK PUNCHED LOAD INTO READER - START.  
ALPHA OK - KEY IN 80 NUMERIC CHARACTERS TO GENERATE  
RIPPLE DECK.

0123456789012345678901234567890123456789

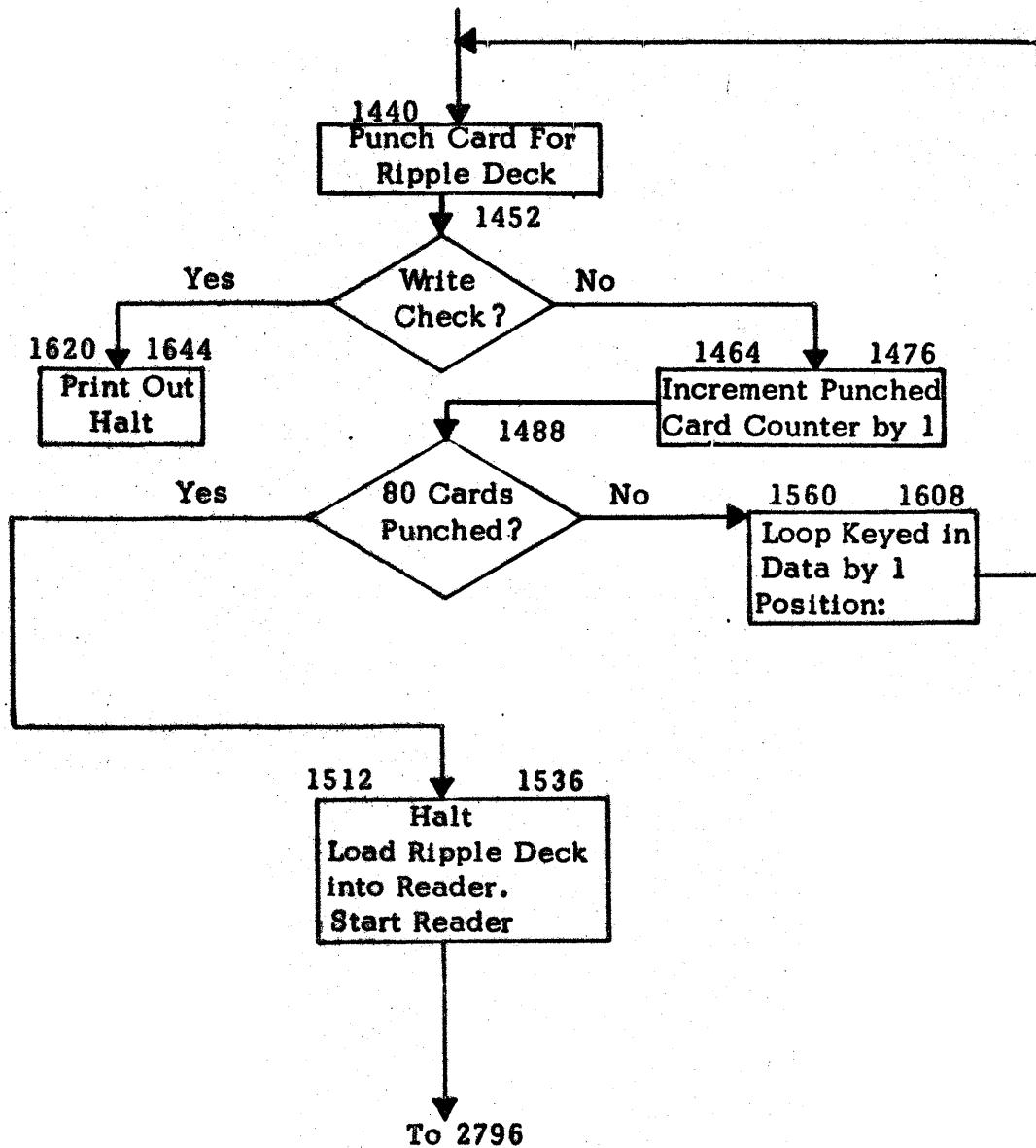
0123456789012345678901234567890123456789

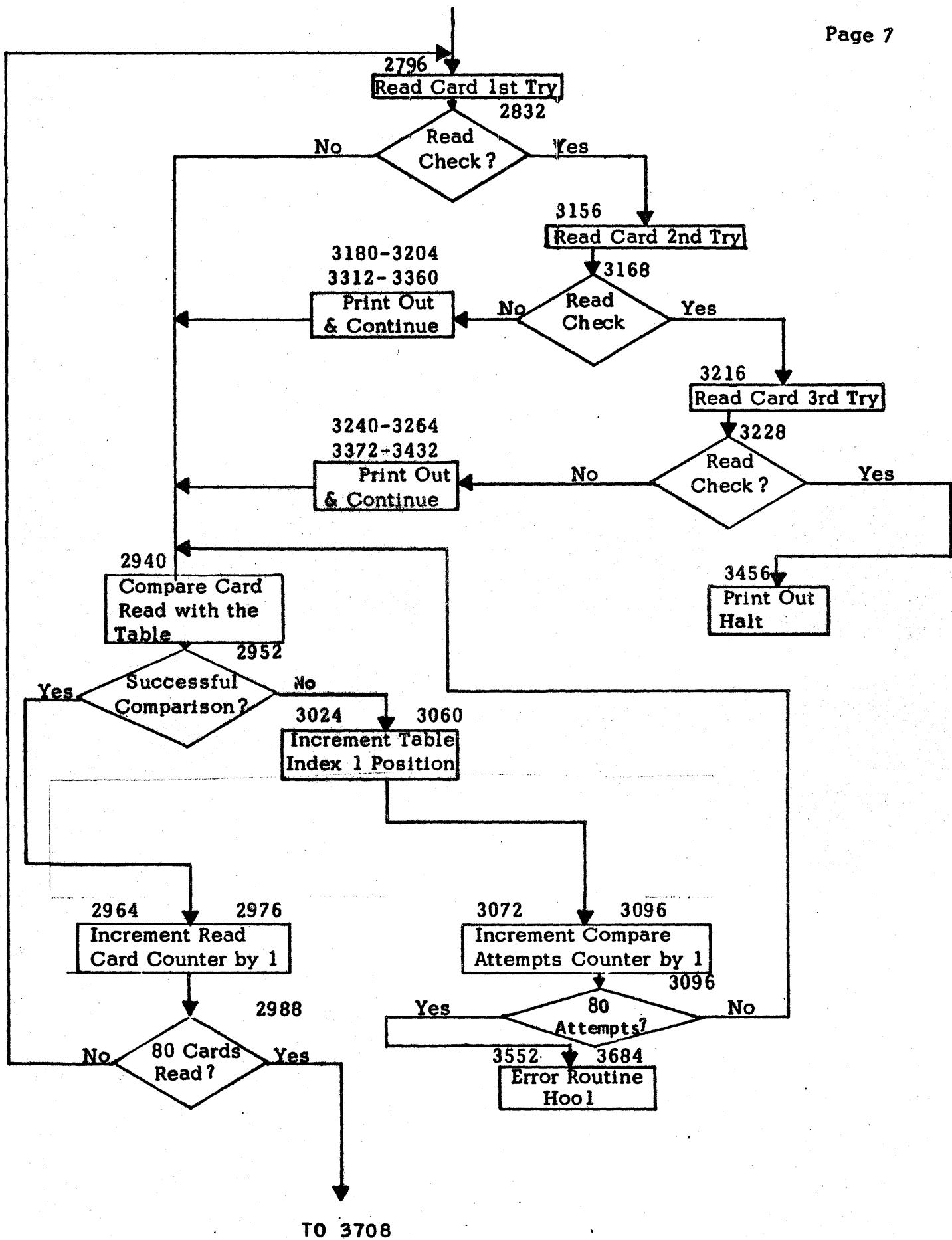
RIPPLE DECK PUNCHED LOAD INTO READER - START.  
IF NO ETOS 1002 SUCCESSFUL.

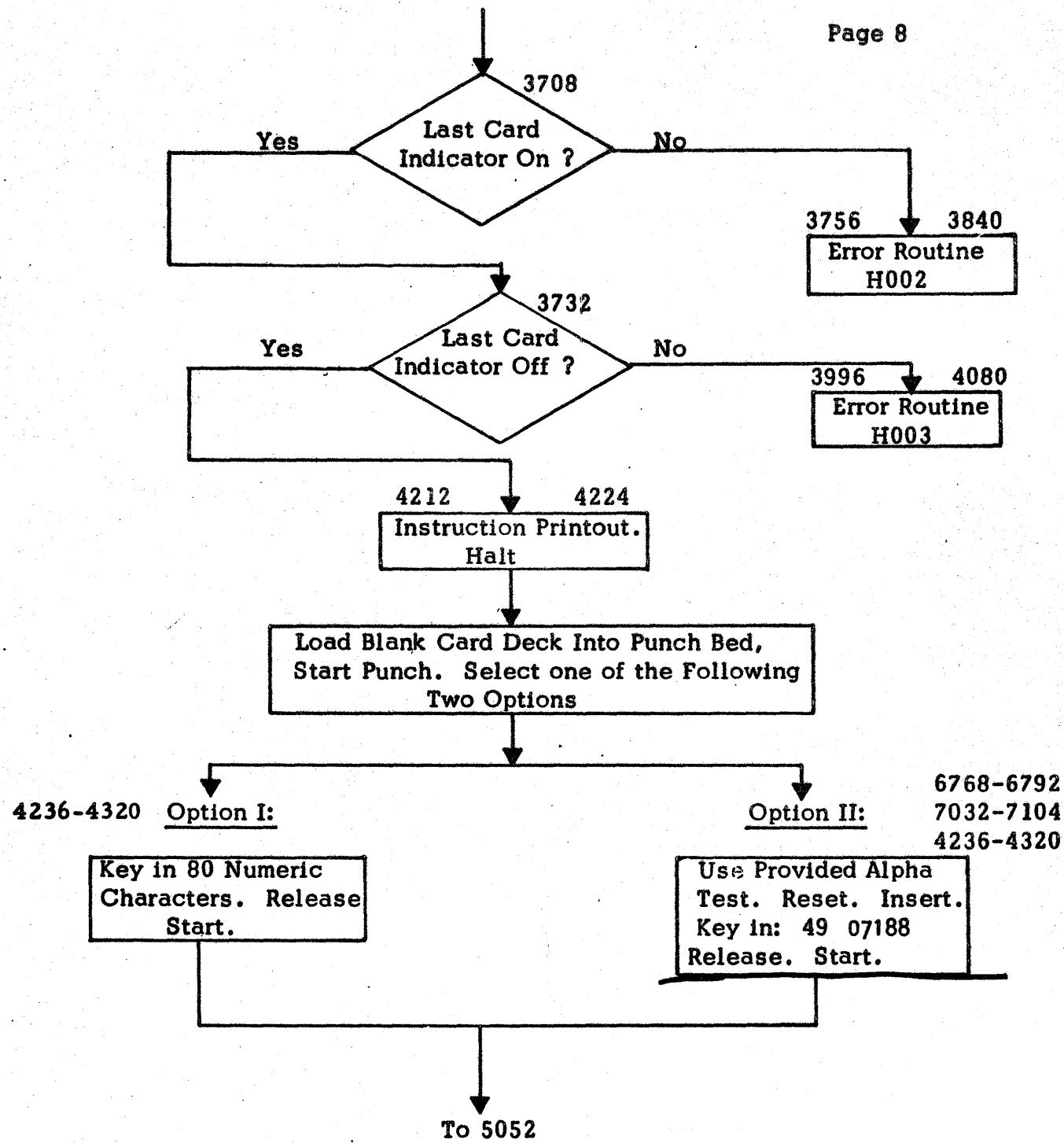
I002

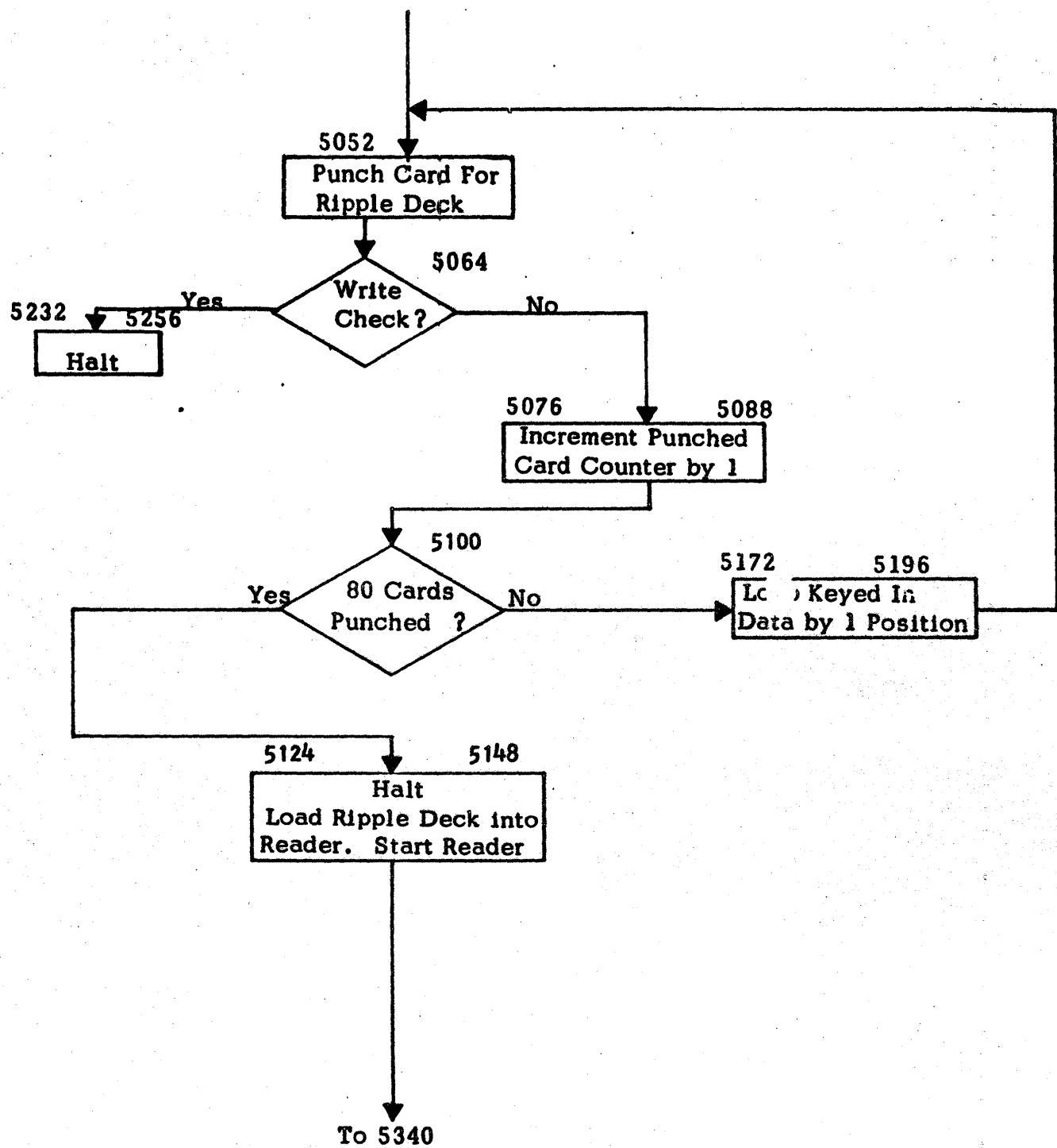


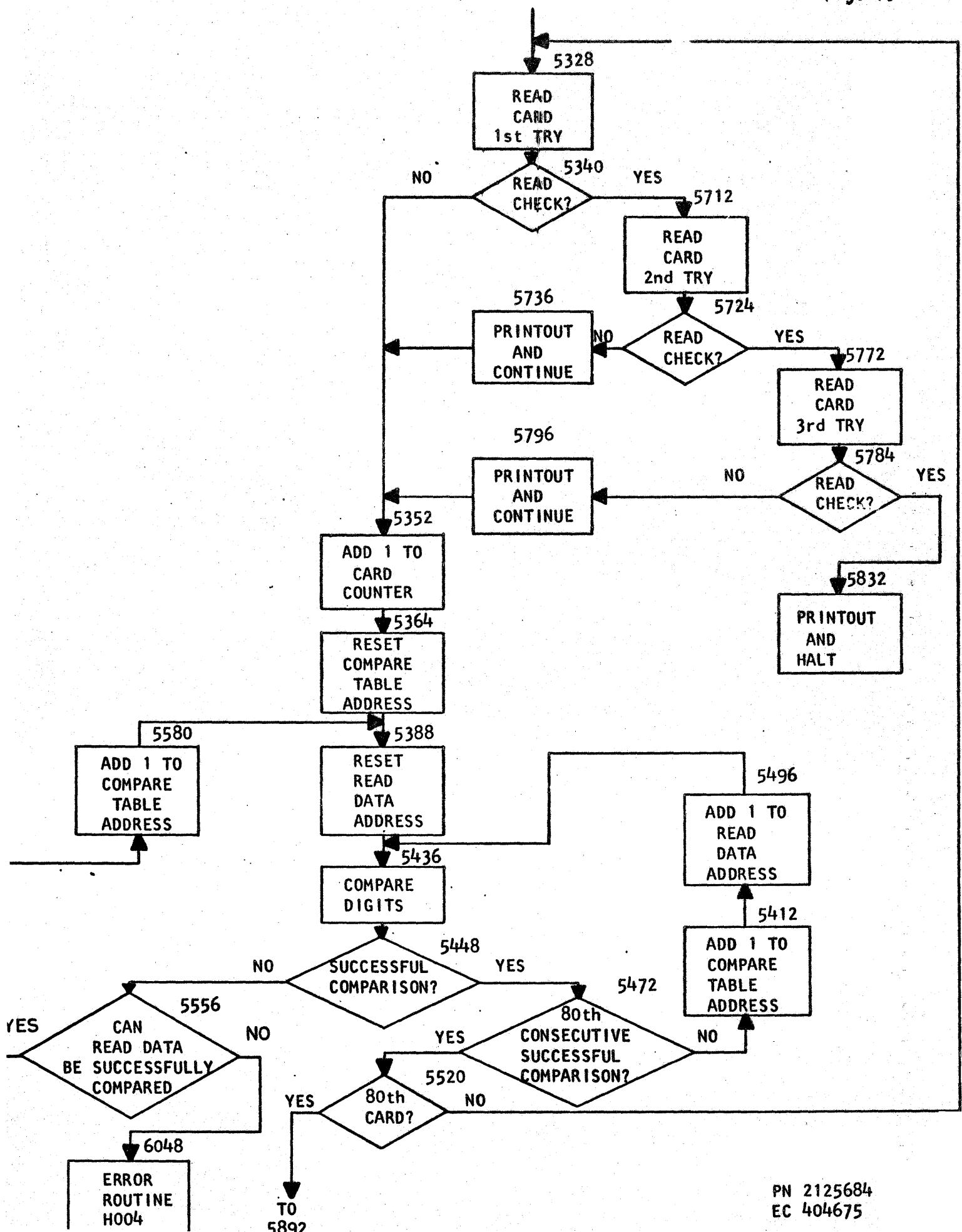
PN 2125684  
EC 404839

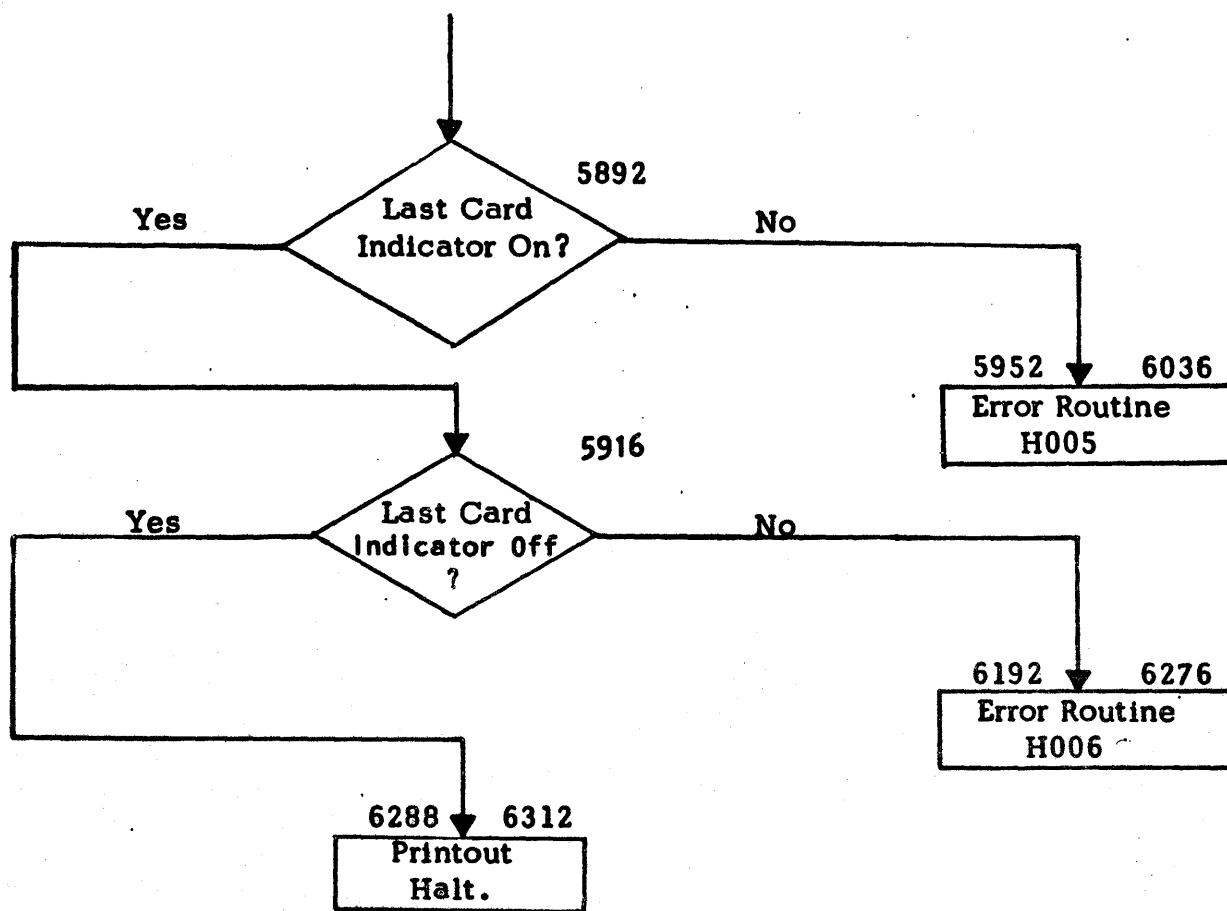












1 0 0 2

|    |       |       |    |          |
|----|-------|-------|----|----------|
| 36 | 00060 | 00500 | RN | 1st Card |
| 36 | 00100 | 00500 | RN |          |
| 36 | 00160 | 00500 | RN |          |
| 36 | 00220 | 00500 | RN |          |
| 36 | 00280 | 00500 | RN |          |
| 36 | 00340 | 00500 | RN | 2nd Card |
| 36 | 00000 | 00500 | RN |          |
| 49 | 00000 |       | B  |          |
| 00 | 00000 | 00000 |    | 3rd Card |
| 10 | 20304 | 00020 |    |          |
| 40 | 60800 | 03060 |    |          |
| 90 | 21004 | 08021 |    |          |
| 61 | 00500 | 15102 |    |          |
| 00 | 60218 | 14200 |    | 4th Card |
| 70 | 41128 | 20080 |    |          |
| 61 | 42230 | 09081 |    |          |
| 72 | 63000 | 00000 |    |          |
| 00 | 50607 | 08090 |    |          |
| 01 | 21416 | 18151 |    | 5th Card |
| 81 | 12427 | 20242 |    |          |
| 82 | 23635 | 20353 |    |          |
| 04 | 54036 | 32484 |    |          |
| 45 | 53249 | 46536 |    |          |
| 04 | 84654 | 62754 |    | 6th Card |
| 45 | 36271 | 80123 |    |          |
| 45 | 67891 | 23456 |    |          |
| 78 | 90234 | 56789 |    |          |
| 01 | 34567 | 89012 |    |          |
| 45 | 67890 | 12356 |    | 7th Card |
| 78 | 90123 | 46789 |    |          |
| 01 | 23457 | 89012 |    |          |
| 34 | 56890 | 12345 |    |          |
| 67 | 90123 | 45678 |    |          |
| 36 | 00612 | 00500 | RN | 8th Card |
| 11 | 00006 | 00060 | AM |          |
| 14 | 00006 | 07212 | CM |          |
| 46 | 00828 | 01200 | BI |          |
| 49 | 00000 | 00000 | B  |          |

PN 2125684  
EC 404675

1 0 0 2

0432

444

456

468

480

0492

504

516

528

540

0552

564

576

588

600

|      |    |     |      |       |    |
|------|----|-----|------|-------|----|
| 0612 | 62 | 66  | 7    | 1     | 56 |
| 624  | 55 | 0   | ≠6   | 266   |    |
| 636  | 71 | 564 |      | 646   |    |
| 648  | 0  | ≠   | 6266 | 72    |    |
| 660  | 56 | 55  | 0    | ≠6266 |    |

|   |   |   |   |
|---|---|---|---|
| S | W | I | 0 |
| N | S | W |   |
| I | O | F | F |
| S | W | 2 |   |
| O | N | S | W |

|      |    |      |      |       |     |
|------|----|------|------|-------|-----|
| 0672 |    | 72   | 5    | 64646 |     |
| 684  |    | 0    | ≠626 | 6     | 73  |
| 696  |    | 5655 |      | 0     | ≠62 |
| 708  | 66 | 73   |      | 5646  |     |
| 720  | 46 | 0    | ≠6   | 266   |     |

|   |   |   |   |
|---|---|---|---|
| 2 | O | F | F |
| S | W | 3 |   |
| O | N | S |   |
| W | 3 | O | F |
| F | S | W |   |

|      |    |      |   |      |      |   |
|------|----|------|---|------|------|---|
| 0732 | 74 | 565  |   | 5    | 0    | ≠ |
| 744  | 62 | 66   | 7 | 4    | 56   |   |
| 756  | 46 | 46   | 0 | ≠    | 6245 |   |
| 768  | 63 | 626  |   | 662  |      |   |
| 780  | 46 | 5659 |   | 4970 |      |   |

|   |   |   |   |   |
|---|---|---|---|---|
| 4 | O | N |   |   |
| S | W | 4 | 0 |   |
| F | F | S | E |   |
| T | S | W | S |   |
| F | O | R | I | 0 |

|      |    |       |   |       |
|------|----|-------|---|-------|
| 0792 | 56 | 72    | 6 | 34845 |
| 0804 | 55 | 626   |   | 34159 |
| 16   | 63 | 03    | 0 | ≠     |
| 28   | 46 | 00852 |   | 00100 |
| 40   | 47 | 00876 |   | 00100 |

|   |   |   |   |    |
|---|---|---|---|----|
| 0 | 2 |   |   |    |
| T | H | E | N | S  |
| T | A | R | T | .≠ |
| C | h | e | c | k  |
| C | h | e | c | k  |

|      |    |       |  |       |
|------|----|-------|--|-------|
| 0852 | 39 | 00613 |  | 00100 |
| 64   | 49 | 00888 |  | B     |
| 76   | 39 | 00631 |  | 00100 |
| 88   | 46 | 00912 |  | W A   |
| 0900 | 47 | 00936 |  | 00200 |

|   |   |   |     |   |
|---|---|---|-----|---|
| S | W | 1 | on  |   |
| B |   |   |     |   |
| S | W | 1 | off |   |
| B | I |   |     |   |
| C | h | e | c   | k |
| C | h | e | c   | k |

|      |    |       |       |       |                          |                   |
|------|----|-------|-------|-------|--------------------------|-------------------|
| 0912 | 39 | 00651 | 00100 | W A   | S W 2 on                 |                   |
|      | 24 | 49    | 00948 | B     |                          |                   |
|      | 36 | 39    | 00669 | W A   | S W 2 off                |                   |
|      | 48 | 46    | 00972 | B I   | Check S W 3 on           |                   |
|      | 60 | 47    | 00996 | BNI   | Check S W 3 off          |                   |
| 0972 | 39 | 00689 | 00100 | W A   | S W 3 on                 |                   |
|      | 84 | 49    | 01008 | B     |                          |                   |
|      | 96 | 39    | 00707 | W A   | S W 3 off                |                   |
| 1008 | 46 | 01032 | 00400 | B I   | Check S W 4 on           |                   |
|      | 20 | 47    | 01056 | BNI   | Check S W 4 off          |                   |
| 1032 | 39 | 00727 | 00100 | W A   | S W 4 on                 |                   |
|      | 44 | 49    | 01068 | B     |                          |                   |
|      | 56 | 39    | 00745 | W A   | S W 4 off                |                   |
|      | 68 | 39    | 00765 | W A   |                          |                   |
|      | 80 | 34    | 00102 | K     | Carriage return          |                   |
| 1092 | 48 |       |       | H     |                          |                   |
| 1104 | 39 | 01213 | 00100 | W A   | Key in 80 alpha etc.     |                   |
|      | 16 | 34    | 00102 | K     | carriage return          |                   |
|      | 28 | 37    | 01933 | R A   | place 80 char in buffers |                   |
|      | 40 | 15    | 02093 | TDM   | set R M                  |                   |
| 1152 | 34 |       | 00102 | K     |                          |                   |
|      | 64 | 32    | 01932 | S F   |                          |                   |
|      | 76 | 49    | 01332 | B     |                          |                   |
|      | 88 |       |       |       |                          |                   |
| 1200 |    |       |       |       |                          |                   |
| 1212 | 52 | 4568  | 4955  |       | Key in                   |                   |
|      | 24 | 7870  | 4153  |       | 80 Al                    |                   |
|      | 36 | 57    | 4841  |       | Pha Ch                   |                   |
|      | 48 | 41    | 59414 |       | aracte                   |                   |
|      | 60 | 59    | 62 6  |       | rs To                    |                   |
| 1272 | 47 | 45554 | 55941 |       | Genera                   |                   |
|      | 84 | 63    | 45 5  |       | te Rip                   |                   |
|      | 96 | 57    | 4345  |       | ple De                   |                   |
| 1308 | 43 | 5203  | 07    |       | ck. ≠                    |                   |
|      | 20 |       |       |       |                          |                   |
| 1332 | 31 | 02112 | 01932 | T R   | Generate work area       |                   |
|      | 44 | 31    | 02472 | 01932 | T R                      | Generate table'   |
|      | 56 | 31    | 02632 | 01932 | T R                      | look - up         |
|      | 68 | 33    | 02632 |       | C F                      | area              |
|      | 80 | 46    | 01392 | 01400 | B I                      | Turn off overflow |

|      |    |       |       |     |                                   |
|------|----|-------|-------|-----|-----------------------------------|
| 1392 | 46 | 01404 | 00600 | B I | turn off R/C ind                  |
| 1404 | 46 | 01416 | 00700 | B I | turn off W/C ind                  |
| 16   | 46 | 01428 | 00900 | B I | turn off L/C ind                  |
| 28   | 46 | 06612 | 01900 | B I | check Any latch.                  |
| 40   | 39 | 02113 | 00400 | W A | punch ripple deck                 |
| 1452 | 46 | 01620 | 00700 | B I | W/C error                         |
| 64   | 11 | 06347 | 01    | A M | Add 1 to punched card counter     |
| 76   | 14 | 06347 | 80    | C M |                                   |
| 88   | 47 | 01560 | 01200 | BNI | ripple deck complete?             |
| 1500 | 16 | 06347 | 00    | TFM | reset punched card counter        |
| 1512 | 39 | 01669 | 00100 | W A | ripple deck has been punched etc. |
| 24   | 34 |       | 00102 | K   |                                   |
| 36   | 48 |       |       | H   |                                   |
| 48   | 49 | 02796 |       | B   |                                   |
| 60   | 31 | 02110 | 02112 | T R |                                   |
| 1572 | 26 | 02271 | 02111 | T F |                                   |
| 84   | 33 | 02270 |       | C F |                                   |
| 96   | 32 | 02112 |       | S F |                                   |
| 1608 | 49 | 01440 |       | B   |                                   |
| 20   | 39 | 01765 | 00100 | W A | W/C error etc.                    |
| 1632 | 34 |       | 00102 | K   |                                   |
| 44   | 48 |       |       | H   |                                   |
| 56   | 49 | 01104 |       | B   |                                   |
| 68   | 59 | 49575 | 75345 |     | Ripple                            |
| 80   |    | 44454 | 352   |     | Deck                              |
| 1692 | 57 | 64554 | 34845 |     | Punche                            |
| 1704 | 44 | 535   | 64144 |     | d Load                            |
| 16   |    | 49556 | 356   |     | Into                              |
| 28   | 59 | 45414 | 44559 |     | Reader                            |
| 40   |    | 20 6  | 26341 |     | - Sta                             |
| 1752 | 59 | 6303  | 0#    |     | R T . #                           |
| 64   | 66 | 2143  | 4559  |     | W/C Er                            |
| 76   | 59 | 5659  | 20    |     | ror -                             |
| 88   | 59 | 45626 | 34159 |     | restar                            |
| 1800 | 63 | 03 0  | #     |     | t. #                              |
| 1812 |    |       |       |     |                                   |
| 24   |    |       |       |     |                                   |
| 36   |    |       |       |     |                                   |
| 48   |    |       |       |     |                                   |
| 60   |    |       |       |     |                                   |

1872  
84  
96  
1908  
20

1932  
44  
56  
68  
80

1992  
2004  
16  
28  
40

2052  
64  
76  
88

0~~f~~

2112  
24  
36  
48  
60

**Data xferred from 1932**

2172  
84  
96  
2208  
20

2232  
44  
56  
68  
80

0~~f~~

2292  
2304  
16  
28  
40

**Read in area for comp**

2352  
64  
76  
88  
2400

**PN 2125684  
EC 404618**

|      |    |       |       |     |                                     |
|------|----|-------|-------|-----|-------------------------------------|
| 2412 |    |       |       |     |                                     |
| 24   |    |       |       |     |                                     |
| 36   |    |       |       |     |                                     |
| 48   | 0≠ |       |       |     |                                     |
| 60   |    |       |       |     |                                     |
| 2472 |    |       |       |     | table look up area                  |
| 84   |    |       |       |     |                                     |
| 96   |    |       |       |     |                                     |
| 2508 |    |       |       |     |                                     |
| 20   |    |       |       |     |                                     |
| 2532 |    |       |       |     |                                     |
| 44   |    |       |       |     |                                     |
| 56   |    |       |       |     |                                     |
| 68   |    |       |       |     |                                     |
| 80   |    |       |       |     |                                     |
| 2592 |    |       |       |     |                                     |
| 2604 |    |       |       |     |                                     |
| 16   |    |       |       |     |                                     |
| 28   |    |       |       |     |                                     |
| 40   |    |       |       |     |                                     |
| 2652 |    |       |       |     |                                     |
| 64   |    |       |       |     |                                     |
| 76   |    |       |       |     |                                     |
| 88   |    |       |       |     |                                     |
| 2700 |    |       |       |     |                                     |
| 2712 |    |       |       |     |                                     |
| 24   |    |       |       |     |                                     |
| 36   |    |       |       |     |                                     |
| 48   |    |       |       |     |                                     |
| 60   |    |       |       |     |                                     |
| 2772 |    |       |       |     |                                     |
| 84   |    | 0≠    |       |     |                                     |
| 96   | 16 | 06371 | 00    |     | Reset read card ctr to 0            |
| 2808 | 16 | 06407 | 00    |     | Reset attempts ctr to 0             |
| 20   | 37 | 02293 | 00500 |     | R A read card 1st try               |
| 2832 | 46 | 03156 | 00600 | B I | R/C ind on ?                        |
| 44   | 32 | 02292 |       | S F | set flag in read in area            |
| 56   | 26 | 02874 | 06395 | T F | set up compare position             |
| 68   | 33 |       |       | C F | clear flag from last used table pos |
| 80   | 32 | 02472 |       | S F | set flag in comp pos                |

|      |    |       |       |     |                               |
|------|----|-------|-------|-----|-------------------------------|
| 2892 | 26 | 06431 | 06419 | T F | set up comp pos.              |
| 2904 | 26 | 06395 | 06383 | T F | reset flag in table area      |
| 16   | 16 | 06407 | 00    | TFM | reset comp attempts str to a  |
| 28   | 26 | 02946 | 06419 | T F |                               |
| 40   | 24 | 02631 | 02451 | C   | Compare read with table       |
| 2952 | 47 | 03024 | 01200 | BNI | Compare?                      |
| 64   | 11 | 06371 | 01    | A M | add 1 to read completed cont  |
| 76   | 14 | 06371 | 80    | C   | 80 completed?                 |
| 88   | 47 | 02820 | 01200 | BNI | read next card                |
| 3000 | 16 | 06371 | 00    | TFM | reset read card counter to 0. |
| 3012 | 49 | 03708 |       | B   |                               |
| 24   | 26 | 03042 | 06395 | T F |                               |
| 36   | 33 |       | -     | C F |                               |
| 48   | 11 | 06395 | 02    | A M | Shift comp area in table      |
| 60   | 11 | 06431 | 02    | A M |                               |
| 3072 | 11 | 06407 | 01    | A M | add to #comp attempted        |
| 84   | 14 | 06407 | 80    | C   |                               |
| 96   | 46 | 03552 | 01200 | B I |                               |
| 3108 | 26 | 02946 | 06431 | T F |                               |
| 20   | 26 | 03138 | 06395 | T F |                               |
| 3132 | 32 |       |       | S F |                               |
| 44   | 49 | 02940 |       | B   |                               |
| 56   | 37 | 02293 | 00500 | R A | read card 2nd try             |
| 68   | 46 | 03216 | 00600 | B I |                               |
| 80   | 39 | 03313 | 00100 | W A |                               |
| 3192 | 34 |       | 00102 | K   |                               |
| 3204 | 49 | 02844 |       | B   |                               |
| 16   | 37 | 02293 | 00500 | R A | read card 3rd try             |
| 28   | 46 | 03280 | 00600 | B I |                               |
| 40   | 39 | 03373 | 00100 | W A |                               |
| 3252 | 34 |       | 00102 | K   |                               |
| 64   | 49 | 02844 |       | B   |                               |
| 76   |    |       |       |     |                               |
| 80   | 39 | 03457 | 00100 | W A |                               |
| 3300 | 49 | 01524 |       | B   |                               |
| 3312 | 59 | 2143  | 5655  |     | R/C on                        |
| 24   |    | 71626 | 3 63  |     | 1st t                         |
| 36   | 59 | 6823  | 7255  |     | ry, 2 n                       |
| 48   | 44 | 635   | 968   |     | d try                         |
| 60   | 56 | 5203  | 0#    |     | o k . #                       |

|      |    |       |       |          |                         |
|------|----|-------|-------|----------|-------------------------|
| 3372 | 59 | 2143  | 5655  | R/C on   |                         |
| 84   |    | 71626 | 3 10  | 1st +    |                         |
| 96   |    | 72554 | 4 63  | 2nd T    |                         |
| 3408 | 59 | 49456 | 223   | ries,    |                         |
| 20   | 73 | 5944  | 6359  | 3rd tr   |                         |
| <br> |    |       |       |          |                         |
| 3432 | 68 | 565   | 2030≠ | Y ok. ≠  |                         |
| 44   |    |       |       |          |                         |
| 56   | 59 | 2143  | 5655  | R/C on   |                         |
| 68   | 73 | 5944  | 63    | 3 rd t   |                         |
| 80   | 59 | 68 2  | 0 59  | ry - r   |                         |
| <br> |    |       |       |          |                         |
| 3492 | 45 | 53564 | 144   | e load   |                         |
| 3504 | 59 | 49575 | 75345 | ripple   |                         |
| 16   |    | 44454 | 352   | deck     |                         |
| 28   | 20 | 594   | 56263 | - rest   |                         |
| 40   | 41 | 59630 | 3 0≠  | art . .≠ |                         |
| <br> |    |       |       |          |                         |
| 3552 | 46 | 03672 | 00100 | B I      | Check S W 1             |
| 64   | 39 | 03685 | 00100 | W A      | H001 No compare         |
| 76   | 34 |       | 00102 | K        |                         |
| 88   | 39 | 02293 | 00100 | W A      | type out card contents  |
| 3600 | 34 |       | 00102 | K        |                         |
| <br> |    |       |       |          |                         |
| 3612 | 39 | 02473 | 00100 | W A      | type out table contents |
| 24   | 34 |       | 00102 | K        |                         |
| 36   | 48 |       |       | H        |                         |
| 48   | 46 | 02940 | 00200 | B I      |                         |
| 60   | 49 | 02964 |       | B        |                         |
| <br> |    |       |       |          |                         |
| 3672 | 47 | 03648 | 00300 | BNI      |                         |
| 84   | 48 | 70707 | 1 0≠  | H        |                         |
| 96   |    |       |       |          |                         |
| 3708 | 46 | 03732 | 00900 | B I      | Check L/C indicator     |
| 20   | 49 | 03756 |       | B        |                         |
| <br> |    |       |       |          |                         |
| 3732 | 46 | 03996 | 00900 | B I      | Check L/C ind off       |
| 44   | 49 | 04212 |       | B        |                         |
| 56   | 46 | 03780 | 00100 | B I      |                         |
| 68   | 39 | 03793 | 00100 | W A      | H002 L/C not on         |
| 80   | 47 | 03804 | 00300 | BNI      |                         |
| <br> |    |       |       |          |                         |
| 3792 | 48 | 70707 | 2 0≠  | H        |                         |
| 3804 | 47 | 04164 | 00200 | BNI      | continue to numeric     |
| 16   | 39 | 03925 | 00100 | W A      |                         |
| 28   | 34 |       | 00102 | K        |                         |
| 40   | 49 | 03708 |       | B        |                         |

|      |    |       |       |        |                  |
|------|----|-------|-------|--------|------------------|
| 3852 |    |       |       |        |                  |
| 64   |    |       |       |        |                  |
| 76   |    |       |       |        |                  |
| 88   |    |       |       |        |                  |
| 3900 |    |       |       |        |                  |
| 3912 |    |       |       |        |                  |
| 24   | 53 | 2143  | 4955  | L/C in |                  |
| 36   | 44 | 49434 | 16356 | dicato |                  |
| 48   | 59 | 624   | 85664 | r shou |                  |
| 60   | 53 | 44 4  | 245   | ld be  |                  |
| 3972 | 56 | 5503  | 0≠    | on . ≠ |                  |
| 84   |    |       |       |        |                  |
| 96   | 46 | 04020 | 00100 | B I    |                  |
| 4008 | 39 | 04033 | 00100 | W A    | H003 L/C not off |
| 20   | 47 | 04044 | 00300 | BNI    |                  |
| 4032 | 48 | 70707 | 3 0≠  | H      |                  |
| 44   | 47 | 04164 | 00200 | BNI    |                  |
| 56   | 39 | 04093 | 00100 | W A    |                  |
| 68   | 34 |       | 00102 | K      |                  |
| 80   | 49 | 03708 |       | B      |                  |
| 4092 | 53 | 2143  | 4955  | L/C in |                  |
| 4104 | 44 | 49434 | 16356 | dicato |                  |
| 16   | 59 | 555   | 663   | r not  |                  |
| 28   | 63 | 64595 | 54955 | turnin |                  |
| 40   | 47 | 564   | 64603 | g off. |                  |
| 4152 | 0≠ |       |       | ≠      |                  |
| 64   | 39 | 04357 | 00100 | W A    |                  |
| 76   | 49 | 04224 |       | B      |                  |
| 88   |    |       |       |        |                  |
| 4200 |    |       |       |        |                  |
| 4212 | 39 | 04333 | 00100 | W A    |                  |
| 24   | 34 |       | 00102 | K      |                  |
| 36   | 36 | 04512 | 00100 | R N    | read in numeric  |
| 48   | 15 | 04592 | 0000≠ | TDM    | set R M          |
| 60   | 34 |       | 00102 | K      |                  |
| 4272 | 41 |       |       | NOP    |                  |
| 84   | 31 | 04596 | 04512 | T R    |                  |
| 96   | 31 | 04692 | 04512 | T R    |                  |
| 4308 | 31 | 04772 | 04512 | T R    |                  |
| 20   | 49 | 04956 |       | B      |                  |

|             |    |       |       |              |
|-------------|----|-------|-------|--------------|
| 4332        | 41 | 53574 | 841   | Alpha        |
| 44          | 56 | 52 2  | 0     | o k -        |
| 5t          | 2  | 4568  | 4955  | key in       |
| 68          |    | 7870  | 5564  | 80 nu        |
| 80          | 54 | 45594 | 943   | meric        |
| 4392        | 43 | 48415 | 94143 | charac       |
| 4404        | 63 | 45596 | 2 63  | ters t       |
| 16          | 56 | 474   | 55545 | o gene       |
| 28          | 59 | 41634 | 5 59  | rate r       |
| 40          | 49 | 57575 | 345   | ipple        |
| 4452        | 44 | 45435 | 203   | deck.        |
| 64          | 0# |       |       | #            |
| 76          |    |       |       |              |
| 88          |    |       |       |              |
| <b>4500</b> |    |       |       |              |
| <b>4512</b> |    |       |       |              |
| 24          |    |       |       | keyed in     |
| 36          |    |       |       | numeric      |
| 48          |    |       |       | data         |
| 60          |    |       |       |              |
| <b>4572</b> |    |       |       |              |
| 84          |    | #     |       |              |
| 96          |    |       |       |              |
| <b>4608</b> |    |       |       |              |
| 20          |    |       |       |              |
| <b>4632</b> |    |       |       | xferred data |
| 44          |    |       |       |              |
| 56          |    |       |       |              |
| 68          |    | #     |       |              |
| 80          |    |       |       |              |
| <b>4692</b> |    |       |       |              |
| <b>4704</b> |    |       |       |              |
| 16          |    |       |       |              |
| 28          |    |       |       |              |
| 40          |    |       |       | table        |
| <b>4752</b> |    |       |       | area         |
| 64          |    |       |       |              |
| 76          |    |       |       |              |
| 88          |    |       |       |              |
| <b>4800</b> |    |       |       |              |

4812  
24  
36  
48  
60  
≠

4872  
84  
96  
4908  
20

4932  
44  
56 46 04968 00600 B I  
68 46 04980 00700 B I  
80 46 04992 00900 B I

4992 46 05004 01400 B I  
5004 46 05016 01600 B I  
16 46 05028 01700 B I  
28 46 06588 01900 B I  
40 46 06708 00900 B I

5052 38 04596 00400 W N punch ripple deck  
64 46 05232 00700 B I W/C error  
76 11 06443 01 A M  
88 14 06443 80 C M  
5100 47 05172 01200 BNI

5112 16 06443 00 TFM  
24 39 01669 00100 W A ripple deck punched etc  
36 34 00102 K  
48 48 H  
60 49 05304 B

5172 31 04595 04596 T R loop numeric work  
84 25 04675 04595 T D area for ripple deck  
96 49 05052 B

5208  
20

read in area

PN 2125684

EC 404675

|       |    |       |       |       |                                      |
|-------|----|-------|-------|-------|--------------------------------------|
| 5232  | 39 | 01765 | 00100 | W A   | W/C error etc                        |
| 44    | 34 |       | 00102 | K     |                                      |
| 56    | 48 |       |       | H     |                                      |
| 68    | 39 | 04357 | 00100 | W A   |                                      |
| 80    | 49 | 04248 |       | B     |                                      |
| 05292 |    |       |       |       |                                      |
| 05304 | 16 | 05528 | 00    | T F M | Reset Card Counter                   |
| 05316 | 16 | 05375 | 04691 | T F M | Set Compare Table Address            |
| 05328 | 36 | 04872 | 00500 | R N   | Read a Card                          |
| 05340 | 46 | 05712 | 00600 | B I   | Check for Read Check                 |
| 05352 | 11 | 05528 | 01    | A M   | Add 1 to Card Counter                |
| 05364 | 16 | 05435 | 04691 | T F M | Set Compare-to Table Address         |
| 05376 | 16 | 05480 | 00    | T F M | Reset                                |
| 05388 | 16 | 05411 | 04872 | T F M | Set Read Table Address               |
| 05400 | 25 | 05444 |       | T D   | Transmit Read Digit                  |
| 05412 | 11 | 05435 | 01    | A M   | Add 1 to Compare-to Table Address    |
| 05424 | 25 | 05447 |       | T D   | Transmit Compare-to Digit            |
| 05436 | 14 | 05444 | 00 00 | C M   | Compare Digits                       |
| 05448 | 47 | 05556 | 01200 | B N I |                                      |
| 05460 | 11 | 05480 | 01    | A M   | Add 1 to successful Compare Counter  |
| 05472 | 14 | 05480 | 00 80 | C M   | 80th Consecutive Successful Compare? |
| 05484 | 46 | 05520 | 01200 | B I   |                                      |
| 05496 | 11 | 05411 | 01    | A M   | Add 1 to Read Digit Address          |
| 05508 | 49 | 05400 |       | B     |                                      |
| 05520 | 14 | 05528 | 00 80 | C M   | 80th Card?                           |
| 05532 | 47 | 05316 | 01200 | B N I |                                      |
| 05544 | 49 | 05892 |       | B     |                                      |
| 05556 | 14 | 05435 | 04772 | C M   | Can Card be Compared?                |
| 05568 | 46 | 06048 | 01100 | B I   |                                      |
| 05580 | 11 | 05375 | 01    | A M   | Add 1 to Compare-to Table Address    |

|          |    |       |       |     |                            |
|----------|----|-------|-------|-----|----------------------------|
| 5592     | 49 | 05364 | B     |     |                            |
| 5604     |    |       |       |     |                            |
| 16       |    |       |       |     |                            |
| 28       |    |       |       |     |                            |
| 40       |    |       |       |     |                            |
| <br>5652 |    |       |       |     |                            |
| 64       |    |       |       |     |                            |
| 76       |    |       |       |     |                            |
| 88       |    |       |       |     |                            |
| 5700     |    |       |       |     |                            |
| 5712     | 36 | 04872 | 00500 | R N | read card 2st try          |
| 24       | 46 | 05772 | 00600 | B I |                            |
| 36       | 39 | 03313 | 00100 | W A |                            |
| 48       | 34 |       | 00102 | K   |                            |
| 60       | 49 | 05352 |       | B   |                            |
| <br>5772 | 36 | 04872 | 00500 | R N | read card 3rd tr.          |
| 84       | 46 | 05832 | 00600 | B I |                            |
| 96       | 39 | 03373 | 00100 | W A |                            |
| 5808     | 34 |       | 00102 | K   |                            |
| 20       | 49 | 05352 |       | B   |                            |
| 5832     | 39 | 03457 | 00100 | W A | R/C on 3rd try reload etc. |
| 44       | 49 | 05136 |       | B   |                            |
| 56       |    |       |       |     |                            |
| 68       |    |       |       |     |                            |
| 80       |    |       |       |     |                            |
| 5892     | 46 | 05916 | 00900 | B I | Check L/C ind              |
| 5904     | 49 | 05952 |       | B   |                            |
| 16       | 46 | 06192 | 00900 | B I | Check L/C ind off          |
| 28       | 49 | 06288 |       | B   |                            |
| 40       |    |       |       |     |                            |
| 5952     | 46 | 05976 | 00100 | B I |                            |
| 64       | 39 | 05989 | 00100 | W A |                            |
| 76       | 47 | 06000 | 00300 | BNI |                            |
| 88       | 48 | 70707 | 5 0   | H   |                            |
| 6000     | 47 | 06288 | 00200 | BNI |                            |
| 6012     | 39 | 03925 | 00100 | W A |                            |
| 24       | 34 |       | 00102 | K   |                            |
| 36       | 49 | 05892 |       | B   |                            |
| 48       | 46 | 06168 | 00100 | B I |                            |
| 60       | 39 | 06181 | 00100 | W A | type out H004              |

|      |    |       |       |       |                                    |
|------|----|-------|-------|-------|------------------------------------|
| 6072 | 34 |       | 00102 | K     |                                    |
| 84   | 38 | 04872 | 00100 | W N   | type out card contents             |
| 96   | 34 |       | 00102 | K     |                                    |
| 6108 | 38 | 04692 | 00100 | W N   | Type out table contents            |
| 20   | 34 |       | 00102 | K     |                                    |
| 6132 | 48 |       |       | H     |                                    |
| 44   | 46 | 05436 | 00200 | B I   |                                    |
| 56   | 49 | 05520 |       | B     |                                    |
| 68   | 47 | 06144 | 00300 | B I   |                                    |
| 80   | 48 | 70707 | 4 0*  | H     |                                    |
| 6192 | 46 | 06116 | 00100 | B I   |                                    |
| 6204 | 39 | 06229 | 00100 | W A   |                                    |
| 16   | 47 | 06240 | 00300 | BNI   |                                    |
| 28   | 48 | 70707 | 6 0*  | H     |                                    |
| 40   | 47 | 06288 | 00200 | B N I |                                    |
| 6252 | 39 | 04093 | 00100 | W A   |                                    |
| 64   | 34 |       | 00102 | K     |                                    |
| 76   | 49 | 05892 |       | B     |                                    |
| 88   | 39 | 06529 | 00100 | W A   |                                    |
| 6300 | 34 |       | 00102 | K     |                                    |
| 6312 | 48 |       |       | H     |                                    |
| 24   |    |       |       |       |                                    |
| 36   |    |       | 00    |       | alpha punched card counter         |
| 48   |    |       |       |       |                                    |
| 60   |    |       | 00    |       | alpha read card counter            |
| 6372 |    |       | 02472 |       | 1st mem pos of alpha table look up |
| 84   |    |       | 02472 |       |                                    |
| 96   |    |       | 00    |       | alpha comp attempted               |
| 6408 |    |       | 02631 |       | 1st comp area alpha                |
| 20   |    |       |       |       |                                    |
| 6432 |    |       | 00    |       | card count for num punch cards     |
| 44   |    |       | 04692 |       | 1st mem pos num of table look up   |
| 56   |    |       | 04692 |       |                                    |
| 68   |    |       | 04771 |       | 1st num comp area                  |
| 6492 |    |       | 00    |       | counter num for comp attempts      |
| 6504 |    |       | 00    |       | card read num counter              |
| 16   |    |       |       |       |                                    |
| 28   | 49 | 46 5  | 556   |       | if no                              |
| 40   | 45 | 63566 | 2 49  |       | etos I                             |
| 6552 | 56 | 7072  | 6264  |       | 0 0 2 su                           |
| 64   | 43 | 43456 | 26246 |       | c c e s s f                        |
| 76   | 64 | 5303  | 0*    |       | u l. *                             |
| 6588 | 39 | 06723 | 00100 |       |                                    |
| 6600 | 47 | 06624 | 00600 |       |                                    |

|      |    |       |        |         |
|------|----|-------|--------|---------|
| 6612 | 39 | 06753 | 00100  | W A     |
| 24   | 47 | 06648 | 00700  | B N I   |
| 36   | 39 | 06771 | 00100  | W A     |
| 48   | 47 | 06672 | 01600  | B N I   |
| 60   | 39 | 06789 | 00100  | W A     |
| 6672 | 47 | 06696 | 01700  | B N I   |
| 84   | 39 | 06813 | 00100  | W A     |
| 96   | 48 |       |        | H       |
| 6708 | 39 | 06837 | 00100  | W A     |
| 20   | 48 | 41556 | 80044  | H       |
|      |    |       |        | Any D   |
| 6732 | 41 | 63410 | 04348  | ATA CH  |
| 44   | 52 | 03000 | #5944  | K. # RD |
| 56   | 00 | 43485 | 20300  | CHK.    |
| 68   | 0# | 66590 | 04348  | # WR CH |
| 80   | 52 | 03000 | #54442 | K. # MB |
| 6792 | 59 | 20450 | 04348  | R-E CH  |
| 6804 | 52 | 03000 | #5442  | K. # MB |
| 16   | 59 | 20560 | 04348  | R-O CH  |
| 28   | 52 | 03000 | #5321  | K. # L/ |
| 40   | 43 | 00565 | 5030#  | C ON.#  |

|      |    |       |       |              |
|------|----|-------|-------|--------------|
| 6852 | 41 | 42434 | 44546 |              |
| 64   | 47 | 48495 | 15253 |              |
| 76   | 54 | 55565 | 75859 |              |
| 88   | 62 | 63646 | 56667 | Dummy alpha  |
| 6900 | 68 | 69 7  | 07172 | read in data |

|      |    |       |       |  |
|------|----|-------|-------|--|
| 6912 | 73 | 74757 | 67778 |  |
| 24   | 79 | 03041 | 01314 |  |
| 36   | 20 | 21232 | 43334 |  |
| 48   | 41 | 42434 | 44546 |  |
| 60   | 47 | 48495 | 15253 |  |

|      |    |       |       |  |
|------|----|-------|-------|--|
| 6972 | 54 | 55565 | 75859 |  |
| 84   | 62 | 63646 | 56667 |  |
| 96   | 68 | 69 5  | 07172 |  |
| 7008 | 73 | 740#  |       |  |
| 20   |    |       |       |  |

|       |    |       |       |  |
|-------|----|-------|-------|--|
| 07032 | 01 | 23456 | 78901 |  |
| 44    | 23 | 45678 | 90123 |  |
| 56    | 45 | 67890 | 12345 |  |
| 68    | 67 | 89012 | 34567 |  |
| 80    | 89 | 01234 | 56789 |  |

dummy numeric  
read in data

|       |    |       |       |  |
|-------|----|-------|-------|--|
| 07092 | 01 | 23456 | 78901 |  |
| 7104  | 23 | 45678 | 9#    |  |

16  
28  
40

|       |    |       |       |     |
|-------|----|-------|-------|-----|
| 07152 | 31 | 01932 | 06852 | T R |
| 64    | 49 | 01140 |       | B   |
| 76    |    |       |       |     |
| 88    | 31 | 04512 | 07032 | T R |
| 07200 | 49 | 04248 |       | B   |

## **IO03 - Card I/O Reliability Diagnostic**



```
//=====
//  
// IO03 - Card I/O Reliability Diagnostic  
//  
// Program Switch settings:  
//  
// PS1:   ON - Punch only  
//         OFF - Read and punch  
// PS2:   ON - Read only  
//         OFF - Read and punch  
// PS3:   ON - Don't print errors  
//         OFF - Print errors  
// PS4:   ON - Delay constant  
//         OFF - Delay changes  
//  
// Check switches settings:  
//  
// DISK I/O - STOP  
// PARITY   - STOP  
// I/O       - PROGRAM  
// O'FLOW    - PROGRAM  
//  
// Start addresses:  
//  
// 00652 - Full test  
//  
// Directions:  
//  
// 1. Load IO03 diagnostic  
// 2. Turn on PROGRAM SWITCH 1  
// 3. Press START  
// 4. Press START  
// 5. Verify that PUNCH NO FEED light is lit  
// 6. Insert empty card deck into punch  
// 7. After ~ 1 minute press STOP  
// 8. Remove cards from punch  
// 9. Turn off PROGRAM SWITCH 1  
// 10. Press RESET  
// 11. Press INSERT  
// 12. Type 4900652  
// 13. Press RELEASE  
// 14. Press START  
// 15. Verify that READER NO FEED light is lit  
// 16. Insert newly punched cards in reader  
// 17. Verify that PUNCH NO FEED light is lit  
// 18. Insert empty card deck into punch  
//=====
```



## Sample Output – IO03

1622 CARD READER-PUNCH DELAY IO03.  
SW 1 ON= PUNCH ONLY. SW 2 ON= READ AND COMPARE ONLY.  
SW 3 ON= BY-PASS ETOS. SW 4 ON= STOP CHO-CHO DELAY CHANGE.  
**4900652**

READER CARD COUNTER = ~~00000190~~  
PUNCH CARD COUNTER = ~~00000283~~



NO. 2125682  
SHEET 0  
OF 20

# DIAGNOSTIC TEST

TITLE 1622 CARD INPUT/OUTPUT DIAGNOSTIC TEST (INTERLEAVING) - 1003  
MACH. TYPE 1620 BY JHM APPR. G.I.A. DATE 4-11-62

## ENGINEERING CHANGE HISTORY

| E/C NO. | DATE    | SHEETS AFFECTED                   |
|---------|---------|-----------------------------------|
| 404674  | 11-4-61 | 1-20                              |
| 404675  | 4-11-62 | 1,2,3,4,5,6,11,12,13,<br>16,17,18 |
|         |         |                                   |
|         |         |                                   |
|         |         |                                   |
|         |         |                                   |
|         |         |                                   |
|         |         |                                   |
|         |         |                                   |
|         |         |                                   |

|         |         |         |  |  |  |  |  |
|---------|---------|---------|--|--|--|--|--|
| E/C NO. | 404674  | 404675  |  |  |  |  |  |
| DATE    | 11-4-61 | 4-11-62 |  |  |  |  |  |

A. SCOPE

This is a Reliability Test Program for the 1620 - 1622 System. Cards are punched with a ripple pattern using alphanumeric characters which are read back in and compared to stored data.

Basically, the program operates in the following sequence:

- a) Check for Any Data Checks.
- b) Read a card.
- c) Check 1st character.
- d) Compare card information.
- e) Same as (a) through (d) above.
- f) Punch card.
- g) Loops back to (a).

There is a delay routine (cho-cho) designed to create every possible timing condition between reading and punching. The delay starts at approximately ten seconds between cards and progresses to zero delay (maximum reading and punching speed). One complete cycle of the delay (maximum delay to zero and back to maximum) takes approximately 30 minutes.

B. OPERATING INSTRUCTIONS

1. Reset 1620.
2. Place Program Deck in Card Reader Hopper.
3. Push "Load" P. B. on 1622.
4. 1620 will HALT after typing out Heading.
5.
  - a. Set Program SWS for desired options.
  - b. Ready the punch.  
(Note: To punch the initial ripple deck, place SW 1 ON and Start. After punching about 200 cards, press the SIE Key. Insert 4900652, Release, place SW 1 OFF and proceed.)
  - c. Place punched ripple cards in card reader hopper. Ready the reader.
6. Push START on 1620 to begin Program.
7. Place punched cards in reader hopper to be read and checked.

Switch Settings (suggested)

Data Check = Program  
I/O Check = Program  
Arith Check = Must be Program

PN 2125632  
EC 404675

SW 1 = OFF (After punching ripple deck)

SW 2 = OFF

SW 3 = OFF

SW 4 = OFF

SW 1 OFF Read and punch  
ON Punch only

SW 2 OFF Read and Punch  
ON Read only

SW 3 OFF Errors typed out  
ON Bypass E'TO (for trouble shooting)

SW 4 OFF Delay changes  
ON Delay remains constant

Error Type-Outs (ETOs):

There are several Data Checks made throughout the program. When an error has been detected, a type-out (if program SW 3 is OFF) will give the following information about the error:

- a) The memory location of the instruction that detected the error.
- b) Where possible the correct information will be typed out followed by the information containing the error.

0724 READ CHECK  
00736 WRITE CHECK  
00748 O/F INDICATOR ON  
00760 MBR - E CHECK  
00772 MBR - O CHECK  
00784 MAR CHECK

Error Type-Outs (ETOs) (cont'd)

The above type-outs are due to a data check condition at the start of the read routine. All of these indicators should be OFF at the start of each Program pass.

00976 READ CHECK 1ST READ  
01012 " " 2ND "  
01048 " " 3RD "

These ET0s are due to a read check when the 1622 transfers the card information to the 1620. Three attempts are made to transfer each card if necessary. Check 1620 I/O translation circuit and check buffer (1622) for correct data.

01096 MBR - E CHECK AFTER CARD READ  
01108 MBR - O CHECK AFTER CARD READ

These ET0s are due to an MBR check and indicate trouble in the I/O translator or memory circuit (1620). The checks are made directly after a card is read by the 1620.

01120 READ-IN AREA 0/F

The 1620 received more than 80 alpha characters from the 1622.

01204 NO 1ST COMPARE

The first character in the card Read-In was not one of the 48 alpha characters used by this program. Check to see if card contains correct data.

01360 MBR - E CHECK AFTER 1ST COMPARE  
01372 MBR - O CHECK AFTER 1ST COMPARE

01564 MBR - E CK BEFORE COMPARE.  
01576 MBR - O CK BEFORE COMPARE.

Due to data check while performing 1st compare routine.  
Check 1620 for correct internal transfer operation.

01624 E/Z TGR OFF COMPARE DATA FOLLOWS.

The correct card data will be typed from STORED DATA followed by the data read-in from the card.

This ET0 is due to the information read-in not corresponding to the stored data. Check card and buffer (1622) for correct data.

01636 MBR - E CHECK AFTER COMPARE, DATA FOLLOWS.  
01648 MBR - O CHECK AFTER COMPARE,DATA FOLLOWS.

Data typed-out is same as for E/Z TGR OFF (above). Caused during card compare routine by internal transfer operation (1620)

OPERATING INSTRUCTIONS (cont'd)

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Error Type-Outs (ETOs) (cont'd)

**01960 WRITE CHECK AFTER PUNCH.**

Checked after each punch routine, Check punched card for correct data.

The complete normal typeout information will be as follows:

1622 CARD READER-PUNCH DELAY 1003.  
SW 1 ON= PUNCH ONLY. SW 2 ON= READ AND COMPARE ONLY.  
SW 3 ON= BY-PASS ETOs. SW 4 ON= STOP CHO-CHO DELAY CHANGE.

MEMORY ADDRESS ALLOCATIONS

|           |   |                  |                                   |
|-----------|---|------------------|-----------------------------------|
| 0 0 0 0 0 | → | 0 0 0 <b>9 6</b> | Load Card and Branch Instructions |
| 1 0 0     | → | 3 9 9            | Math. Tables                      |
| 4 1 2     | → | 5 9 1            | Load Program                      |
| 6 5 2     | → | 2 3 8 0          | Main Program                      |
| 2 5 1 2   | → | 3 8 0 7          | <b>ETO Routines</b>               |
| 3 8 0 9   | → | 5 0 6 5          | <b>ETO Data</b>                   |
| 5 1 0 1   | → | 5 2 5 9          | Card Counter T. O. Data           |
| 5 2 6 1   | → | 5 5 9 9          | <b>Heading TO Data</b>            |
| 5 6 0 5   | → | 5 9 2 5          | Card Compare Data                 |
| 5 9 3 5   | → | 6 1 6 5          | Read-In Clear Data                |
| 6 1 7 5   | → | 6 4 0 5          | 1st Character Compare Data        |
| 6 4 1 5   | → | 6 7 3 5          | Compare Working Area              |
| 6 7 4 5   | → | 6 9 7 5          | Read-In Area                      |

1003 LOAD PROGRAM

00000 to 00059

|    |       |       |
|----|-------|-------|
| 36 | 00060 | 00500 |
| 36 | 00100 | 00500 |
| 36 | 00160 | 00500 |
| 36 | 00220 | 00500 |
| 36 | 00280 | 00500 |

Card  
#1

00060 to 00095

|    |       |       |
|----|-------|-------|
| 36 | 00340 | 00500 |
| 36 | 00000 | 00500 |
| 49 | 00000 | 00000 |

Card  
#2

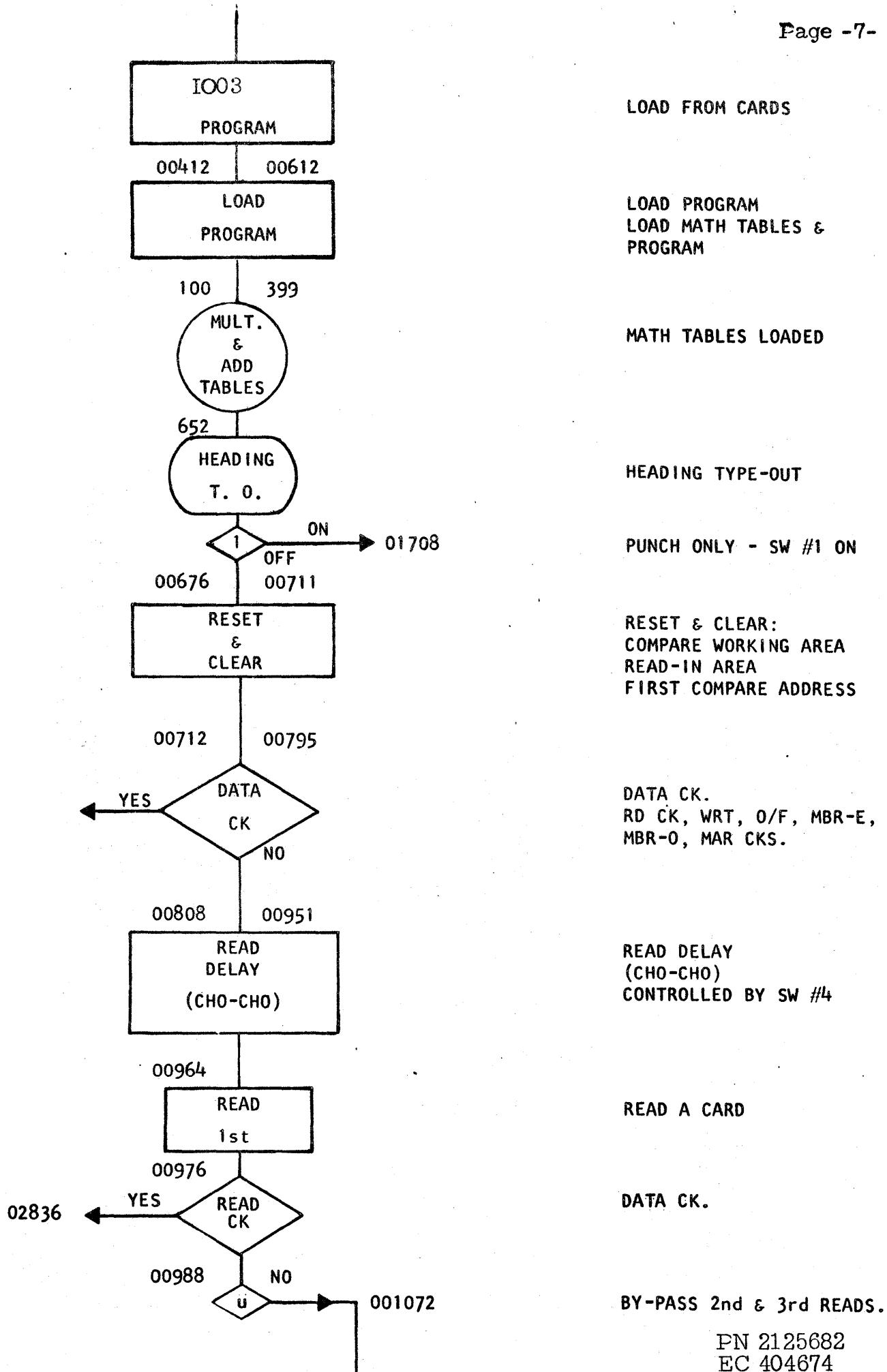
00000 to 00059

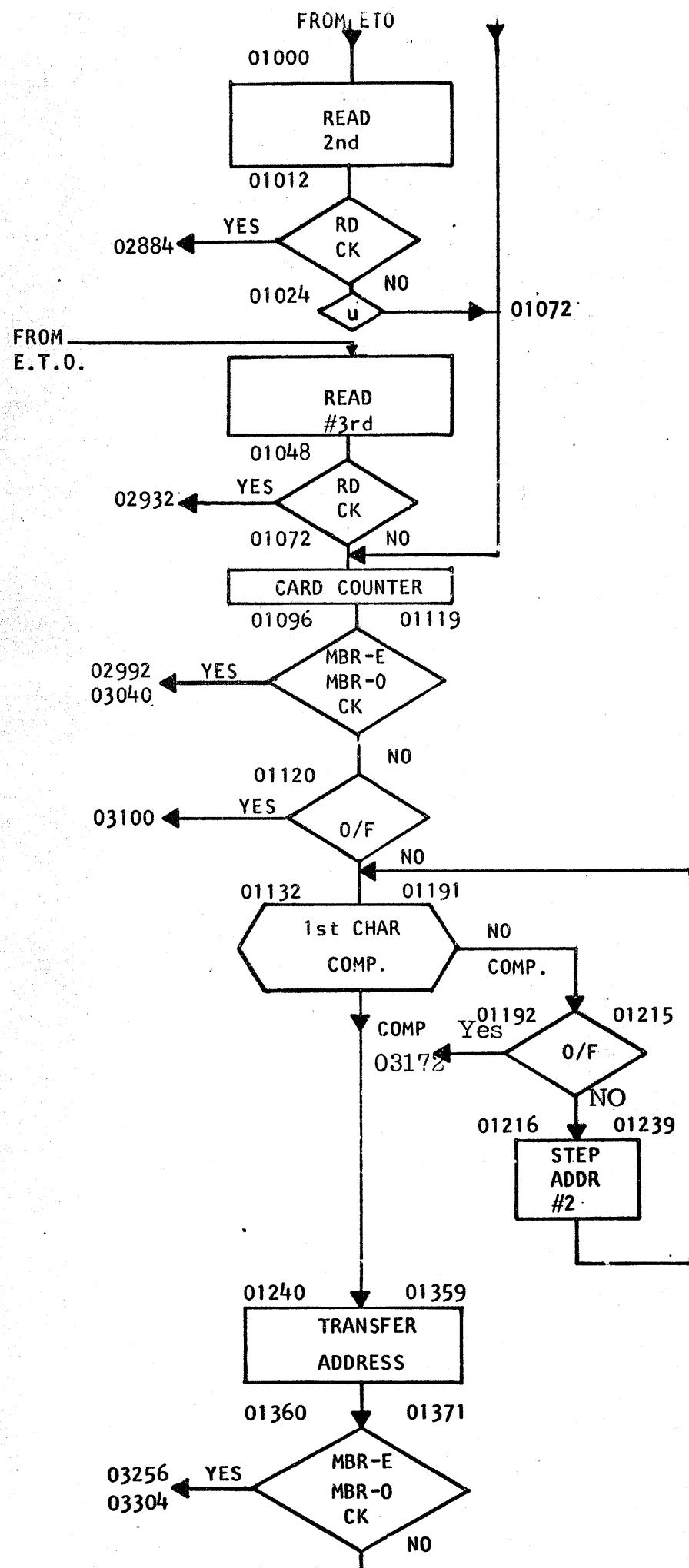
|    |       |       |
|----|-------|-------|
| 36 | 00652 | 00500 |
| 11 | 00006 | 00060 |
| 14 | 00006 | 06772 |
| 46 | 00652 | 01200 |
| 49 | 00000 |       |

Card  
#8

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

Eighth Load Card contains instructions for loading core storage.



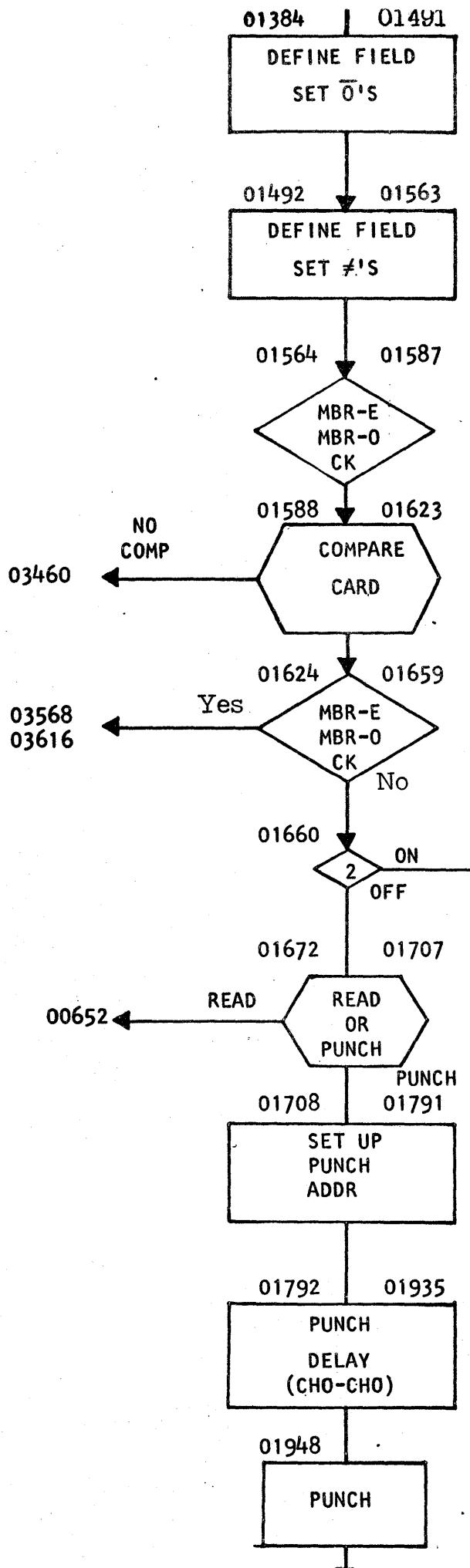


BY-PASS 3rd READ

STEP READER CARD COUNTER

DATA CK.

O/F IF MORE THAN 80  
CHARACTERS READ1st CHARACTER IS CHECK  
WITH DATA IN MEMORY TO  
SET UP AN ADDRESS TO  
COMPARE THE CARD READ  
IN FOR CORRECT DATA



SET 0's IN COMPARE WORKING AREA TO DEFINE FIELD FOR "CARD COMPARE"

SET #'S IN COMPARE WORKING AREA TO DEFINE FIELD FOR "CARD COMPARE"

DATA CK.

COMPARE CARD READ WITH KNOWN DATA IN MEMORY

DATA CK

READ ONLY (SW #2 ON)

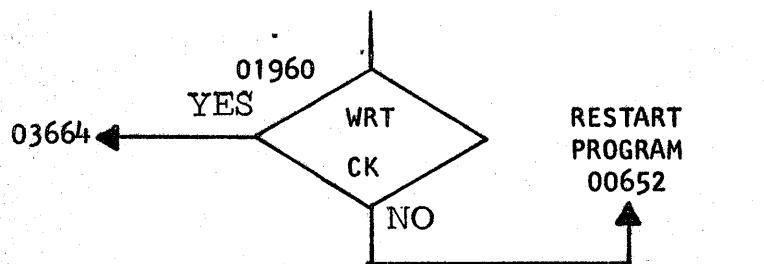
DETERMINE IF READ OR PUNCH OPERATION IS NEXT

STEP PUNCH ADDRESS TO PRODUCE RIPPLE DECK

PUNCH DELAY

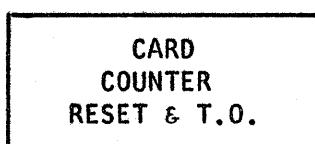
(CONTROLLED BY SW #4)

PUNCH RIPPLE DECK FROM DATA STORED IN MEMORY  
PN 2125682  
EC 404674

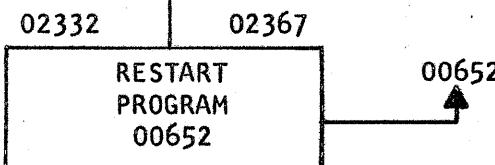


DATA CK.

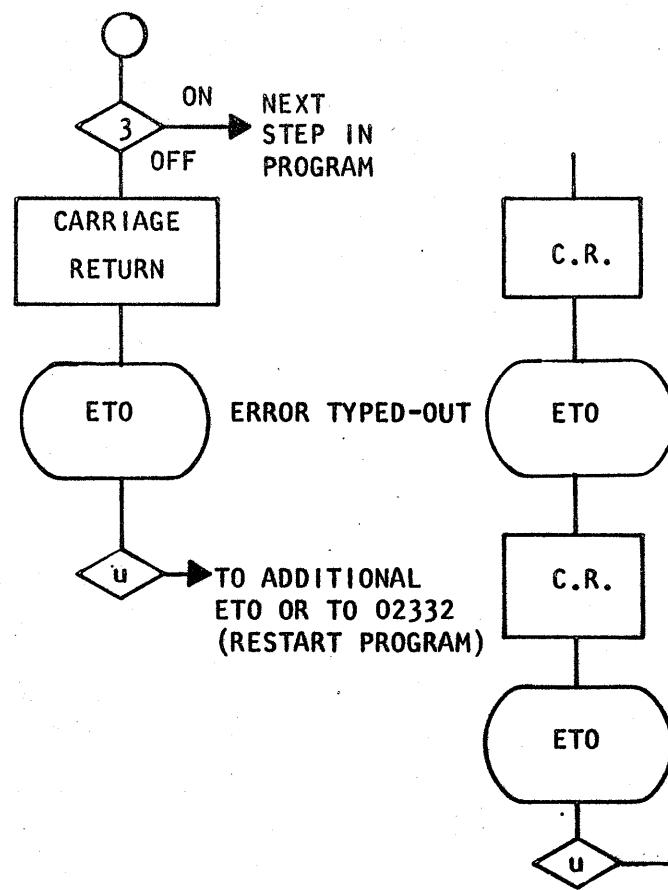
01984 02295



MAINTAINS COUNT OF CARDS  
READ & PUNCHED.  
COUNTER READ-OUT=02212  
COUNTER RESET =02056



ALL ETO ROUTINES  
BRANCH TO HERE TO RE-  
START THE PROGRAM



PN 2125682  
EC 101671

|       |    |       |       |     |                           |
|-------|----|-------|-------|-----|---------------------------|
| 00652 | 49 | 03712 | 00000 | NOP |                           |
| 00664 | 46 | 01708 | 00100 | BI  | CHECK SW #1               |
| 00676 | 26 | 06735 | 05925 | TF  | RESET COMPARE AREA        |
| 00688 | 26 | 06975 | 06165 | TF  | CLEAR READ-IN AREA        |
| 00700 | 16 | 01167 | 06175 | TFM | RESET FIRST COMP. ADDRESS |
| 00712 | 41 | 00000 | 00000 | NOP |                           |
| 00724 | 46 | 02512 | 00600 | BI  | READ CHK                  |
| 00736 | 46 | 02572 | 00700 | BI  | WR CHK                    |
| 00748 | 46 | 02620 | 01400 | BI  | OVERFLOW                  |
| 00760 | 46 | 02668 | 01600 | BI  | MBR-EVEN                  |
| 00772 | 46 | 02728 | 01700 | BI  | MBR-ODD                   |
| 00784 | 46 | 02776 | 00800 | BI  | MAR                       |
| 00796 | 41 | 00000 | 00000 | NOP |                           |
| 00808 | 41 | 00852 | 00000 | NOP |                           |
| 00820 | 11 | 00949 | 00101 | AM  | ADD TO DELAY COUNTER      |
| 00832 | 46 | 00856 | 01400 | BI  | OVERFLOW?                 |
| 00844 | 49 | 00820 | 00000 | B   |                           |
| 00856 | 16 | 00949 | 00000 | TFM | RESET DELAY COUNTER       |
| 00868 | 46 | 00952 | 00400 | BI  | CHECK SW #4               |
| 00880 | 11 | 00831 | 00002 | AM  | SHORTEN DELAY             |
| 00892 | 46 | 00916 | 01400 | BI  | OVERFLOW?                 |
| 00904 | 49 | 00952 | 00000 | B   |                           |
| 00916 | 16 | 00831 | 00101 | TFM | RESTORE LONG DELAY        |
| 00928 | 49 | 00952 | 00000 | B   |                           |
| 00940 | 41 | 00000 | 00000 | NOP |                           |
| 00952 | 41 | 00000 | 00000 | NOP |                           |
| 00964 | 37 | 06745 | 00500 | RA  | READ A CARD               |
| 00976 | 46 | 02836 | 00600 | BI  | READ CHK?                 |
| 00988 | 49 | 01072 | 00000 | B   | BYPASS 2nd & 3rd tries    |
| 01000 | 37 | 06745 | 00500 | RA  | READ 2nd ATTEMPT          |
| 01012 | 46 | 02884 | 00600 | BI  | READ CHK?                 |
| 01024 | 49 | 01072 | 00000 | B   | BYPASS 3rd try            |
| 01036 | 37 | 06745 | 00500 | RA  | READ 3rd ATTEMPT          |
| 01048 | 46 | 02932 | 00600 | BI  | READ CHK?                 |
| 01060 | 49 | 01072 | 00000 | B   |                           |
| 01072 | 11 | 02030 | 00001 | AM  | STEP CARD RD COUNTER      |
| 01084 | 43 | 02044 | 02023 | BD  |                           |
| 01096 | 46 | 02992 | 01600 | BI  | MBR-EVEN CHK?             |
| 01108 | 46 | 03040 | 01700 | BI  | MBR-ODD CHK?              |
| 01120 | 45 | 03100 | 06909 | BNR |                           |
| 01132 | 41 | 00000 | 00000 | NOP |                           |
| 01144 | 32 | 06744 | 00000 | SF  |                           |
| 01156 | 24 | 06745 | 06175 | C   | COMPARE 1st CHARACTER     |
| 01168 | 47 | 01192 | 01200 | BNI |                           |
| 01180 | 49 | 01240 | 00000 | B   |                           |
| 01192 | 14 | 01167 | 06275 | CM  |                           |
| 01204 | 46 | 03172 | 01200 | BI  |                           |
| 01216 | 11 | 01167 | 00002 | AM  | STEP COMPARE ADDRESS      |
| 01228 | 49 | 01156 | 00000 | B   |                           |
| 01240 | 41 | 00000 | 00000 | NOP |                           |
| 01252 | 25 | 01320 | 01167 | TD  |                           |
| 01264 | 25 | 01319 | 01166 | TD  | TRANSFER ADDRESS          |
| 01276 | 25 | 01318 | 01165 | TD  |                           |
| 01288 | 11 | 01320 | 00240 | AM  | STEP TO COMPARE DATA ADD. |
| 01300 | 49 | 01336 | 00000 | B   |                           |

|       |    |       |       |     |                         |
|-------|----|-------|-------|-----|-------------------------|
| 01312 | 41 | 00060 | 00000 | NOP |                         |
| 01324 | 41 | 00060 | 00000 | NOP |                         |
| 01336 | 26 | 01332 | 01320 | TF  |                         |
| 01348 | 26 | 03514 | 01320 | TF  |                         |
| 01360 | 46 | 03256 | 01600 | BI  | MBR-EVEN CHK?           |
| 01372 | 46 | 03304 | 01700 | BI  | MBR-ODD CHK?            |
| 01384 | 41 | 00000 | 00000 | NOP |                         |
| 01396 | 12 | 01320 | 00001 | SM  |                         |
| 01408 | 26 | 01426 | 01320 | TF  |                         |
| 01420 | 32 | 00000 | 00000 | SF  |                         |
| 01432 | 12 | 01320 | 00001 | SM  |                         |
| 01444 | 26 | 01462 | 01320 | TF  |                         |
| 01456 | 32 | 00000 | 00000 | SF  |                         |
| 01468 | 41 | 00000 | 00000 | NOP |                         |
| 01480 | 11 | 01332 | 00159 | AM  |                         |
| 01492 | 26 | 01510 | 01332 | TF  |                         |
| 01504 | 15 | 00000 | 00007 | TDM |                         |
| 01516 | 11 | 01332 | 00001 | AM  |                         |
| 01528 | 26 | 01546 | 01332 | TF  |                         |
| 01540 | 15 | 00000 | 00007 | TDM |                         |
| 01552 | 12 | 01332 | 00002 | SM  |                         |
| 01564 | 46 | 03352 | 01600 | BI  |                         |
| 01576 | 46 | 03400 | 01700 | BI  |                         |
| 01588 | 41 | 00000 | 00000 | NOP |                         |
| 01600 | 26 | 01618 | 01332 | TF  |                         |
| 01612 | 24 | 06611 | 06903 | C   | COMPARE                 |
| 01624 | 47 | 03460 | 01200 | BNI |                         |
| 01636 | 46 | 03563 | 01600 | BI  |                         |
| 01648 | 46 | 03616 | 01700 | BI  |                         |
| 01660 | 46 | 00652 | 00200 | BI  | CHECK SW #2             |
| 01672 | 11 | 01706 | 00050 | AM  |                         |
| 01684 | 43 | 01703 | 01704 | BD  | READ-READ-PUNCH         |
| 01696 | 49 | 00652 | 00000 | B   | COUNTER                 |
| 01708 | 41 | 00000 | 00000 | NOP |                         |
| 01720 | 11 | 01954 | 00002 | AM  | STEP PUNCH ADDRESS      |
| 01732 | 14 | 01954 | 05705 | CM  |                         |
| 01744 | 46 | 01768 | 01200 | BI  |                         |
| 01756 | 49 | 01780 | 00000 | B   |                         |
| 01768 | 16 | 01954 | 05605 | TFM | RESTORE PUNCH ADDRESS   |
| 01780 | 16 | 01707 | 00000 | TFM | RESET RD-RD-PCH COUNTER |
| 01792 | 41 | 01936 | 00000 | NOP |                         |
| 01804 | 11 | 01933 | 00101 | AM  | ADD TO DELAY COUNTER    |
| 01816 | 46 | 01840 | 01400 | BI  | OVERFLOW?               |
| 01828 | 49 | 91804 | 00000 | B   |                         |
| 01840 | 16 | 01933 | 00000 | TFM | RESET DELAY COUNTER     |
| 01852 | 46 | 01936 | 00400 | BI  | CHECK SW #4             |
| 01864 | 11 | 01815 | 00004 | AM  | SHORTEN DELAY           |
| 01876 | 46 | 01900 | 01400 | BI  | OVERFLOW?               |
| 01888 | 49 | 01936 | 00000 | B   |                         |
| 01900 | 16 | 01815 | 00101 | TFM | RESTORE LONG DELAY      |
| 01912 | 49 | 01936 | 00000 | B   |                         |
| 01924 | 41 | 00000 | 00000 | NOP |                         |
| 01936 | 41 | 00000 | 00000 | NOP |                         |
| 01948 | 39 | 05605 | 00400 | WA  | PUNCH A CARD            |
| 01960 | 46 | 03664 | 00700 | BI  | WRITE CHK?              |
| 01972 | 11 | 02042 | 00001 | AM  | STEP CARD PCH COUNTER   |
| 01984 | 43 | 02044 | 02035 | BD  |                         |

|       |    |       |       |     |
|-------|----|-------|-------|-----|
| 01996 | 41 | 00000 | 00000 | NOP |
| 02008 | 49 | 00652 | 00000 | B   |
| 02020 | 41 | 00000 | 0000# | NOP |
| 02032 | 41 | 00000 | 0000# | NOP |
| 02044 | 41 | 00000 | 00000 | NOP |
| 02056 | 34 | 00000 | 00102 | K   |
| 02068 | 39 | 05101 | 00100 | WA  |
| 02080 | 38 | 02023 | 00100 | WN  |
| 02092 | 34 | 00000 | 00102 | K   |
| 02104 | 39 | 05151 | 00100 | WA  |
| 02116 | 38 | 02035 | 00100 | WN  |
| 02128 | 34 | 00000 | 00102 | K   |
| 02140 | 39 | 05201 | 00100 | WA  |
| 02152 | 41 | 00000 | 00000 | NOP |
| 02164 | 26 | 02030 | 02210 | TF  |
| 02176 | 26 | 02042 | 02210 | TF  |
| 02188 | 49 | 02212 | 00000 | B   |
| 02200 | 41 | 00000 | 0000# | NOP |
| 02212 | 41 | 00000 | 00000 | NOP |
| 02224 | 34 | 00000 | 00102 | K   |
| 02236 | 39 | 05101 | 00100 | WA  |
| 02248 | 38 | 02023 | 00100 | WN  |
| 02260 | 34 | 00000 | 00102 | K   |
| 02272 | 39 | 05151 | 00100 | WA  |
| 02284 | 38 | 02035 | 00100 | WN  |
| 02296 | 41 | 00000 | 00000 | NOP |
| 02308 | 41 | 00000 | 00000 | NOP |
| 02320 | 41 | 00000 | 00000 | NOP |
| 02332 | 49 | 02356 | 00100 | B   |
| 02344 | 48 | 00000 | 00000 | H   |
| 02356 | 49 | 00652 | 00000 | B   |
| 02368 | 41 | 00000 | 00000 | NOP |

## ERROR ROUTINES

|       |    |       |       |     |
|-------|----|-------|-------|-----|
| 02512 | 46 | 00736 | 00300 | BI  |
| 02524 | 34 | 00000 | 00102 | K   |
| 02536 | 39 | 03809 | 00100 | WA  |
| 02548 | 49 | 02332 | 00000 | B   |
| 02560 | 41 | 00000 | 00000 | NOP |
| 02572 | 46 | 00748 | 00300 | BI  |
| 02584 | 34 | 00000 | 00102 | K   |
| 02596 | 39 | 03849 | 00100 | WA  |
| 02608 | 49 | 02332 | 00000 | B   |
| 02620 | 46 | 00760 | 00300 | BI  |
| 02632 | 34 | 00000 | 00102 | K   |
| 02644 | 39 | 03891 | 00100 | WA  |
| 02656 | 49 | 00000 | 00000 | B   |
| 02668 | 46 | 00772 | 00300 | BI  |
| 02680 | 34 | 00000 | 00102 | K   |
| 02692 | 39 | 03943 | 00100 | WA  |
| 02704 | 49 | 02332 | 00000 | B   |

|       |    |       |       |     |
|-------|----|-------|-------|-----|
| 02716 | 41 | 00000 | 00000 | NOP |
| 02728 | 46 | 00784 | 00300 | BI  |
| 02740 | 34 | 00000 | 00102 | K   |
| 02752 | 39 | 03985 | 00100 | WA  |
| 02764 | 49 | 02332 | 00000 | B   |
| 02776 | 46 | 00796 | 00300 | BI  |
| 02788 | 34 | 00000 | 00102 | K   |
| 02800 | 39 | 04027 | 00100 | WA  |
| 02812 | 49 | 02332 | 00000 | B   |
| 02824 | 41 | 00000 | 00000 | NOP |
| 02836 | 46 | 01000 | 00300 | BI  |
| 02848 | 34 | 00000 | 00102 | K   |
| 02860 | 39 | 04065 | 00100 | WA  |
| 02872 | 49 | 02332 | 00000 | B   |
| 02884 | 46 | 01036 | 00300 | BI  |
| 02896 | 34 | 00000 | 00102 | K   |
| 02908 | 39 | 04117 | 00100 | WA  |
| 02920 | 49 | 02332 | 00000 | B   |
| 02932 | 46 | 01072 | 00300 | BI  |
| 02944 | 34 | 00000 | 00102 | K   |
| 02956 | 39 | 04169 | 00100 | WA  |
| 02968 | 49 | 02332 | 00000 | B   |
| 02980 | 41 | 00000 | 00000 | NOP |
| 02992 | 46 | 01108 | 00300 | BI  |
| 03004 | 34 | 00000 | 00102 | K   |
| 03016 | 39 | 04221 | 00100 | WA  |
| 03028 | 49 | 02332 | 00000 | B   |
| 03040 | 46 | 01120 | 00300 | BI  |
| 03052 | 34 | 00000 | 00102 | K   |
| 03064 | 39 | 04289 | 00100 | WA  |
| 03076 | 49 | 02332 | 00000 | B   |
| 03088 | 41 | 00000 | 00000 | NOP |
| 03100 | 46 | 01132 | 00300 | BI  |
| 03112 | 34 | 00000 | 00102 | K   |
| 03124 | 39 | 04357 | 00100 | WA  |
| 03136 | 34 | 00000 | 00102 | K   |
| 03148 | 39 | 06745 | 00100 | WA  |
| 03160 | 49 | 02332 | 00000 | B   |
| 03172 | 46 | 01300 | 00300 | BI  |
| 03184 | 34 | 00000 | 00102 | K   |
| 03196 | 39 | 04409 | 00100 | WA  |
| 03208 | 34 | 00000 | 00102 | K   |
| 03220 | 39 | 06745 | 00100 | WA  |
| 03232 | 49 | 02332 | 00000 | B   |
| 03244 | 41 | 00000 | 00000 | NOP |
| 03256 | 46 | 01372 | 00300 | BI  |
| 03268 | 34 | 00000 | 00102 | K   |
| 03280 | 39 | 04457 | 00100 | WA  |
| 03292 | 49 | 02332 | 00000 | B   |
| 03304 | 46 | 01384 | 00300 | BI  |
| 03316 | 34 | 00000 | 00102 | K   |

|       |    |       |       |     |
|-------|----|-------|-------|-----|
| 03328 | 39 | 04529 | 00100 | WA  |
| 03340 | 49 | 02332 | 00000 | B   |
| 03352 | 46 | 01576 | 00300 | BI  |
| 03364 | 34 | 00000 | 00102 | K   |
| 03376 | 39 | 04601 | 00100 | WA  |
| 03388 | 49 | 02332 | 00000 | B   |
| 03400 | 46 | 01588 | 00300 | BI  |
| 03412 | 34 | 00000 | 00102 | K   |
| 03424 | 39 | 04667 | 00100 | WA  |
| 03436 | 49 | 02332 | 00000 | B   |
| 03448 | 41 | 00000 | 00000 | NOP |
| 03460 | 46 | 01636 | 00300 | BI  |
| 03472 | 34 | 00000 | 00102 | K   |
| 03484 | 39 | 04733 | 00100 | WA  |
| 03496 | 34 | 00000 | 00102 | K   |
| 03508 | 39 | 06453 | 00100 | WA  |
| 03520 | 34 | 00000 | 00102 | K   |
| 03532 | 39 | 06745 | 00100 | WA  |
| 03544 | 49 | 02332 | 00000 | B   |
| 03556 | 41 | 00000 | 00000 | NOP |
| 03568 | 46 | 01648 | 00300 | BI  |
| 03580 | 34 | 00000 | 00102 | K   |
| 03592 | 39 | 04819 | 00100 | WA  |
| 03604 | 49 | 03496 | 00000 | B   |
| 03616 | 46 | 01660 | 00300 | BI  |
| 03628 | 34 | 00000 | 00102 | K   |
| 03640 | 39 | 04913 | 00100 | WA  |
| 03652 | 49 | 03496 | 00000 | B   |
| 03664 | 46 | 01972 | 00300 | BI  |
| 03676 | 34 | 00000 | 00102 | K   |
| 03688 | 39 | 05009 | 00100 | WA  |
| 03700 | 49 | 02332 | 00000 | B   |
| 03712 | 15 | 00653 | 00001 | TDM |
| 03724 | 34 | 00000 | 00102 | K   |
| 03736 | 39 | 05259 | 00100 | WA  |
| 03748 | 34 | 00000 | 00102 | K   |
| 03760 | 39 | 05343 | 00100 | WA  |
| 03772 | 34 | 00000 | 00102 | K   |
| 03784 | 39 | 05459 | 00100 | WA  |
| 03796 | 49 | 02344 | 00000 | B   |

## ERROR TYPEOUT DATA

|       |    |              |        |  |   |   |   |   |   |   |  |
|-------|----|--------------|--------|--|---|---|---|---|---|---|--|
| 03808 | 00 | 70777        | 27400  |  | O | 7 | 2 | 4 | D | # |  |
| 03820 | 00 | 59454        | 14400  |  | R | E | A | K | 7 | 3 |  |
| 03832 | 43 | 48454        | 3520#  |  | H | E | C | 7 | R | H |  |
| 03844 | 0# | 00707        | 07773  |  | O | 0 | O | W | R | H |  |
| 03856 | 76 | 00006        | 65949  |  | T | E | C | W | C | # |  |
| 03868 | 63 | 45004        | 34845  |  | C | K | # | # | 8 | I |  |
| 03880 | 43 | 520#0        | #0070  |  | O | / | F | C | A | T |  |
| 03892 | 70 | 77747        | 80000  |  | T | C | O | O | N | # |  |
| 03904 | 56 | 21460        | 04955  |  | K | 7 | 4 | F | 7 | 6 |  |
| 03916 | 44 | 49434        | 16356  |  | I | / | C | A | R | T |  |
| 03928 | 59 | 00565        | 50#0#  |  | D | I | O | N | E | # |  |
| 03940 | 00 | 70707        | 77670  |  | R | 0 | M | B | E | 0 |  |
| 03952 | 00 | 00544        | 25920  |  | E | C | C | H | R | - |  |
| 03964 | 45 | 00434        | 84543  |  | K | # | # | H | C | 0 |  |
| 03976 | 52 | 0#0#0        | 07070  |  | 7 | 7 | 2 | O | M | C |  |
| 03988 | 77 | 77720        | 00054  |  | B | R | - | C | A | K |  |
| 04000 | 42 | 59205        | 60043  |  | H | E | 0 | O | 7 | 8 |  |
| 04012 | 48 | 45435        | 20#0#  |  | C | H | M | C | A | R |  |
| 04024 | 00 | 70707        | 77874  |  | # | E | E | 0 | K | 9 |  |
| 04036 | 00 | 00544        | 15900  |  | 6 | D | O | R | E | A |  |
| 04048 | 43 | 48454        | 3520#  |  | S | T | # | C | K | 1 |  |
| 04060 | 0# | 00707        | 07977  |  | D | D | 2 | D | R | A |  |
| 04072 | 76 | 00005        | 94541  |  | O | 0 | 1 | N | D | 0 |  |
| 04084 | 44 | 00435        | 20071  |  | D | E | A | D | # | 8 |  |
| 04096 | 62 | 63005        | 94541  |  | S | D | # | A | O | D |  |
| 04108 | 44 | 0#0#0        | 07071  |  | O | 0 | 1 | R | E | A |  |
| 04120 | 70 | 71720        | 00059  |  | D | T | 2 | D | 3 | A |  |
| 04132 | 45 | 41440        | 04352  |  | O | D | 0 | A | 1 | R |  |
| 04144 | 00 | 72554        | 40059  |  | E | A | 2 | N | D | 0 |  |
| 04156 | 45 | 41440        | #0#0#0 |  | O | 1 | A | D | # | 9 |  |
| 04168 | 70 | 71707        | 47800  |  | D | E | 1 | O | 4 | R |  |
| 04180 | 00 | 59454        | 14400  |  | C | K | R | E | A | D |  |
| 04192 | 43 | 52007        | 35944  |  | # | 6 | 0 | 1 | 3 | A |  |
| 04204 | 00 | 59454        | 1440#  |  | A | E | T | D | 1 | 0 |  |
| 04216 | 0# | 00707        | 17079  |  | F | A | R | D | 0 | B |  |
| 04228 | 76 | 00005        | 44259  |  | A | C | D | # | 0 | K |  |
| 04240 | 20 | 45004        | 35200  |  | 0 | 1 | A | 1 | 1 | B |  |
| 04252 | 41 | 46634        | 55900  |  | T | E | D | 0 | 0 | K |  |
| 04264 | 43 | 41594        | 40059  |  | R | D | # | 1 | 1 | R |  |
| 04276 | 45 | 41440        | #0#0#0 |  | D | A | 2 | 0 | 0 | O |  |
| 04288 | 70 | 71717        | 07800  |  | E | A | 1 | 1 | 1 | A |  |
| 04300 | 00 | 54425        | 92056  |  | O | M | B | R | - | C |  |
| 04312 | 00 | 43520        | 04146  |  | T | C | K | R | R | E |  |
| 04324 | 63 | 45590        | 04341  |  | R | D | # | 1 | 1 | A |  |
| 04336 | 59 | 44005        | 94541  |  | D | A | 2 | 0 | 0 | C |  |
| 04348 | 44 | 0#0#0        | 07071  |  | 1 | E | A | D | - | A |  |
| 04360 | 71 | 72700        | 00059  |  | 1 | A | A | R | E | I |  |
| 04372 | 45 | 41442        | 04955  |  | E | O | / | F | # | A |  |
| 04384 | 00 | 41594        | 54100  |  | O | 1 | 2 | 0 | 0 | # |  |
| 04396 | 56 | 21460        | #0#0#0 |  | T | N | O | C | 1 | S |  |
| 04408 | 70 | 71727        | 07400  |  | A | R | E | O | M | P |  |
| 04420 | 00 | <b>55560</b> | 07162  |  | 0 | 1 | 3 | 6 | # | # |  |
| 04432 | 63 | 00435        | 65457  |  | M | B | R | R | 0 | 0 |  |
| 04444 | 41 | 59450        | 30#0#  |  |   |   |   |   |   |   |  |
| 04456 | 70 | 71737        | 67000  |  |   |   |   |   |   |   |  |
| 04468 | 00 | 54425        | 92045  |  |   |   |   |   |   |   |  |

|       |    |       |       |  |   |   |           |         |
|-------|----|-------|-------|--|---|---|-----------|---------|
| 04480 | 00 | 43520 | 04146 |  | C | K | A         | F       |
| 04492 | 63 | 45590 | 07162 |  | E | R | 1         | S P     |
| 04504 | 63 | 00435 | 65457 |  | T | C | M         |         |
| 04516 | 41 | 59450 | 7000  |  | T | O | #         |         |
| 04528 | 70 | 71737 | 77200 |  | A | 7 | 2         | -       |
| 04540 | 00 | 54425 | 92056 |  | T | R | -         | A       |
| 04552 | 00 | 43520 | 04146 |  | A | E | 1         | O F S P |
| 04564 | 63 | 45590 | 07162 |  | T | R | CE        |         |
| 04576 | 63 | 00435 | 65457 |  | A | C | O         |         |
| 04588 | 41 | 59450 | 7000  |  | T | E | #         |         |
| 04600 | 70 | 71757 | 67400 |  | A | 5 | 6         |         |
| 04612 | 00 | 54425 | 92045 |  | T | B | R         | E E C E |
| 04624 | 00 | 43520 | 04245 |  | A | K | E         |         |
| 04636 | 46 | 56594 | 50043 |  | T | M | C O M P   |         |
| 04648 | 56 | 54574 | 15945 |  | A | C | R         |         |
| 04660 | 03 | 07007 | 07175 |  | T | O | A         |         |
| 04672 | 77 | 76000 | 05442 |  | A | M | 1         |         |
| 04684 | 59 | 20560 | 04352 |  | T | C | M C O M P |         |
| 04696 | 00 | 42454 | 65659 |  | A | R | K R       |         |
| 04708 | 45 | 00435 | 65457 |  | T | E | E         |         |
| 04720 | 41 | 59450 | 3000  |  | A | C | 5         |         |
| 04732 | 70 | 71767 | 27400 |  | T | E | B         |         |
| 04744 | 00 | 45216 | 90063 |  | A | E | 4         |         |
| 04756 | 47 | 59005 | 64646 |  | T | R | Z         |         |
| 04768 | 23 | 00435 | 65457 |  | A | C | O O       |         |
| 04780 | 41 | 59450 | 04441 |  | T | E | F M       |         |
| 04792 | 63 | 41004 | 65653 |  | A | R | D O       |         |
| 04804 | 53 | 56666 | 2030  |  | T | A | C         |         |
| 04816 | 00 | 70717 | 67376 |  | A | W | S . 3     |         |
| 04828 | 00 | 00544 | 25920 |  | T | 6 | R         |         |
| 04840 | 45 | 00435 | 20041 |  | A | M | B K       |         |
| 04852 | 46 | 63455 | 90043 |  | T | C | R A       |         |
| 04864 | 56 | 54574 | 15945 |  | F | E | R D O     |         |
| 04876 | 23 | 00000 | 04441 |  | O | M | P A       |         |
| 04888 | 63 | 41004 | 65653 |  | T | A | T C K     |         |
| 04900 | 53 | 56666 | 2030  |  | L | O | 6 B R     |         |
| 04912 | 00 | 70717 | 67478 |  | O | 1 | 4 R       |         |
| 04924 | 00 | 00544 | 25920 |  | F | T | A C E     |         |
| 04936 | 56 | 00435 | 20041 |  | O | M | R D O     |         |
| 04948 | 46 | 63455 | 90043 |  | F | T | T A L O   |         |
| 04960 | 56 | 54574 | 15945 |  | O | M | A T A L O |         |
| 04972 | 23 | 44416 | 34100 |  | T | P | C E O     |         |
| 04984 | 00 | 46565 | 35356 |  | , | D | A T A L O |         |
| 04996 | 66 | 62030 | 70000 |  | W | F | I         |         |
| 05008 | 70 | 71797 | 67000 |  | S | 9 | 6         |         |
| 05020 | 00 | 66594 | 96345 |  | 0 | 1 | 0         |         |
| 05032 | 00 | 43520 | 04146 |  | W | W | T E       |         |
| 05044 | 63 | 45590 | 05764 |  | C | K | A P       |         |
| 05056 | 55 | 43480 | 30    |  | T | E | F U       |         |
|       |    |       |       |  | N | C | H .       |         |

## CARD COUNTER TYPEOUT DATA

|       |    |       |       |
|-------|----|-------|-------|
| 05068 |    |       |       |
| 05080 |    |       |       |
| 05092 |    | 5945  |       |
| 05104 | 41 | 44455 | 90043 |
| 05116 | 41 | 59440 | 04356 |
| 05128 | 64 | 55634 | 55900 |
| 05140 | 00 | 33000 | £0057 |
| 05152 | 64 | 55434 | 80043 |
| 05164 | 41 | 59440 | 04356 |
| 05176 | 64 | 55634 | 55900 |
| 05188 | 00 | 00330 | 00£00 |
| 05200 | 43 | 41594 | 40043 |
| 05212 | 56 | 64556 | 34559 |
| 05224 | 00 | 59456 | 24563 |
| 05236 | 00 | 63560 | 06945 |
| 05248 | 59 | 56030 | £     |

| R | E |   |   |   |   |
|---|---|---|---|---|---|
| C | O |   |   |   |   |
| A | D | E | R | R | C |
| A | R | D | E | R | C |
| U | N | T | E | R | P |
| U | N | = | £ | £ | C |
| U | N | C | H | C | O |
| A | R | D | E | R | C |
| U | N | T | E | R | O |
| C | A | R | D | E | C |
| O | A | U | N | T | R |
| O | U | N | E | S | E |
| R | T | O | O | Z | E |
| R | O | . | £ | £ |   |

## HEADING TYPEOUT DATA

|       |    |       |              |                 |
|-------|----|-------|--------------|-----------------|
|       |    | 0071  |              | 1               |
| 05260 | 76 | 72720 | 04341        | C A             |
| 05272 | 59 | 44005 | 94541        | R E A U E O     |
| 05284 | 44 | 45592 | 05764        | D E R - P D I   |
| 05296 | 55 | 43480 | 04445        | N C H Y = U N L |
| 05303 | 53 | 41680 | <b>04956</b> | L A Y . O N     |
| 05320 | 70 | 73030 | £0000        | O 3 . 1 O       |
| 05344 | 62 | 66007 | 10056        | S W = P O N L   |
| 05356 | 55 | 33005 | 76455        | N = P O N L     |
| 05368 | 43 | 48005 | 65553        | C H . O N L     |
| 05380 | 68 | 03000 | 00000        | Y . S W = 2 R E |
| 05392 | 00 | 62660 | 07200        | O N = A N D     |
| 05404 | 56 | 55330 | 05945        | A D C O M P A   |
| 05416 | 41 | 44004 | 15544        | R E . £ O N L   |
| 05428 | 00 | 43565 | 45741        | Y . 3 Y - P A   |
| 05440 | 59 | 45005 | 65553        | S S . E T O     |
| 05452 | 68 | 030£0 | 06266        | S S . W = 4 S T |
| 05464 | 00 | 73005 | 65533        | O N = C H O D C |
| 05476 | 00 | 42682 | 05741        | O P C H O D C   |
| 05488 | 62 | 62004 | 56356        | - C H O D C     |
| 05500 | 62 | 03000 | 00000        | E L A Y E .     |
| 05512 | 62 | 66007 | 40000        | H A N G E .     |
| 05524 | 56 | 55330 | 06263        | £ £ £           |
| 05536 | 56 | 57004 | 34856        |                 |
| 05548 | 20 | 43485 | 60044        |                 |
| 05560 | 45 | 53416 | 80043        |                 |
| 05572 | 48 | 41554 | 74503        |                 |
| 05584 | 0£ | 0£0£0 | 00000        |                 |

## CARD COMPARE DATA

|       |    |       |       |   |   |   |   |   |    |
|-------|----|-------|-------|---|---|---|---|---|----|
| 05596 | 00 | 00000 | 04142 | A | B |   |   |   |    |
| 05608 | 43 | 44454 | 64748 | I | J | K | L | M | N  |
| 05620 | 49 | 51525 | 35455 | O | P | Q | R | S | T  |
| 05632 | 56 | 57585 | 96263 | U | V | W | X | Y | Z  |
| 05644 | 64 | 65666 | 76869 | O | 1 | 2 | 3 | 4 | 5  |
| 05656 | 70 | 71727 | 37475 | 6 | 7 | 8 | 9 | @ | \$ |
| 05668 | 76 | 77787 | 93424 | ) | = | * | - | + | B  |
| 05680 | 04 | 33142 | 01013 | / | . | , | A | G | H  |
| 05692 | 21 | 03230 | 04142 | C | D | E | F | M | N  |
| 05704 | 43 | 44454 | 64748 | I | J | K | L | S | T  |
| 05716 | 49 | 51525 | 35455 | O | P | Q | R | Y | Z  |
| 05728 | 56 | 57585 | 96263 | U | V | W | X | 4 | @  |
| 05740 | 64 | 65666 | 76869 | O | 1 | 2 | 3 | 5 | \$ |
| 05752 | 70 | 71727 | 37475 | 6 | 7 | 8 | 9 | + | A  |
| 05764 | 76 | 77787 | 93424 | ) | = | * | - | + | B  |
| 05776 | 04 | 33142 | 01013 | / | . | , | F | G | H  |
| 05788 | 21 | 03230 | 04142 | C | D | E | L | M | N  |
| 05800 | 43 | 44454 | 64748 | I | J | K | R | S | T  |
| 05812 | 49 | 51525 | 35455 | O | P | Q | X | Y | Z  |
| 05824 | 56 | 57585 | 96263 | U | V | W | 3 | 4 | 5  |
| 05836 | 64 | 65666 | 76869 | O | 1 | 2 | 9 | @ | \$ |
| 05848 | 70 | 71727 | 37475 | 6 | 7 | 8 | - | + | A  |
| 05860 | 76 | 77787 | 93424 | ) | = | * | + | + | B  |
| 05872 | 04 | 33142 | 01013 | / | . | , | F | G | H  |
| 05884 | 21 | 03230 | 04142 | C | D | E | L | M | N  |
| 05896 | 43 | 44454 | 64748 | I | J | K |   |   |    |
| 05908 | 49 | 51525 | 35455 | O | P | # |   |   |    |
| 05920 | 56 | 570## | 70000 |   |   |   |   |   |    |

## READ-IN CLEAR DATA

|       |    |       |       |   |       |
|-------|----|-------|-------|---|-------|
| 06088 | 00 | 00000 | 00#0# | # | #     |
| 06100 | 00 | 00000 | 00#00 | # |       |
| 06112 | 00 | 00000 | #0000 |   | #     |
| 06124 | 00 | 000#0 | 00000 |   | #     |
| 06136 | 00 | 0#000 | 00000 | # |       |
| 06148 | 0# | 00000 | 0000# |   | #     |
| 06160 | 00 | 000#0 | #0#00 | # | # # # |

## FIRST CHARACTER COMPARE DATA

|       |    |       |       |   |   |     |   |   |   |
|-------|----|-------|-------|---|---|-----|---|---|---|
| 06172 | 00 | 41424 | 34445 | F | A | B   | C | D | E |
| 06184 | 46 | 47484 | 95152 | L | G | H   | I | J | K |
| 06196 | 53 | 54555 | 65758 | R | M | N   | O | P | Q |
| 06203 | 59 | 62636 | 46566 | S | T | U   | V | W | 2 |
| 06220 | 67 | 68697 | 07172 | X | Y | Z   | 0 | 1 | * |
| 06232 | 73 | 74757 | 67778 | 3 | 4 | 5   | 6 | 7 | = |
| 06244 | 79 | 34240 | 43314 | 9 | @ | (\$ | ) | . | , |
| 06256 | 20 | 10132 | 10323 | - | + | A   | B | D | K |
| 06268 | 00 | 41424 | 34445 | F | G | H   | I | J | Q |
| 06280 | 46 | 47484 | 95152 | L | M | N   | O | P | W |
| 06292 | 53 | 54555 | 65758 | R | S | T   | U | V | 2 |
| 06304 | 59 | 62636 | 46566 | X | Y | Z   | 0 | 1 | * |
| 06316 | 67 | 68697 | 07172 | 3 | 4 | 5   | 6 | 7 | = |
| 06328 | 73 | 74757 | 67778 | 9 | @ | (\$ | ) | . | , |
| 06340 | 79 | 34240 | 43314 | - | + | A   | B | D | K |
| 06352 | 20 | 10132 | 10323 | F | G | H   | I | J | Q |
| 06364 | 00 | 41424 | 34445 | L | M | N   | O | P | W |
| 06376 | 46 | 47484 | 95152 | R | S | T   | U | V | 2 |
| 06388 | 53 | 54555 | 65758 | X | Y | Z   | 0 | 1 | * |
| 06400 | 59 | 62636 | 46566 | 3 | 4 | 5   | 6 | 7 | = |
| 06412 | 60 |       |       | 9 | @ | (\$ | ) | . | , |

## COMPARE WORKING AREA

|       |    |       |       |   |   |     |   |   |   |
|-------|----|-------|-------|---|---|-----|---|---|---|
| 06424 |    | 41424 | 34445 | F | A | B   | C | D | E |
| 06436 | 46 | 47484 | 95152 | L | G | H   | I | J | K |
| 06448 | 53 | 54555 | 65758 | R | M | N   | O | P | Q |
| 06460 | 59 | 62636 | 46566 | S | T | U   | V | W | 2 |
| 06472 | 67 | 68697 | 07172 | X | Y | Z   | 0 | 1 | * |
| 06484 | 73 | 74757 | 67778 | 3 | 4 | 5   | 6 | 7 | = |
| 06496 | 79 | 34240 | 43314 | 9 | @ | (\$ | ) | . | , |
| 06503 | 20 | 10132 | 10323 | - | + | A   | B | D | K |
| 06520 | 00 | 41424 | 34445 | F | G | H   | I | J | Q |
| 06532 | 46 | 47484 | 95152 | L | M | N   | O | P | W |
| 06544 | 53 | 54555 | 65758 | R | S | T   | U | V | 2 |
| 06556 | 59 | 62636 | 46566 | X | Y | Z   | 0 | 1 | * |
| 06568 | 67 | 68697 | 07172 | 3 | 4 | 5   | 6 | 7 | = |
| 06580 | 73 | 74757 | 67778 | 9 | @ | (\$ | ) | . | , |
| 06592 | 79 | 34240 | 43314 | - | + | A   | B | D | K |
| 06604 | 20 | 10132 | 10323 | F | G | H   | I | J | Q |
| 06616 | 00 | 41424 | 34445 | L | M | N   | O | P | W |
| 06628 | 46 | 47484 | 95152 | R | S | T   | U | V | 2 |
| 06640 | 53 | 54555 | 65758 | X | Y | Z   | 0 | 1 | * |
| 06652 | 59 | 62636 | 46566 | 3 | 4 | 5   | 6 | 7 | = |
| 06664 | 67 | 68697 | 07172 | 9 | @ | (\$ | ) | . | , |
| 06676 | 73 | 74757 | 67778 | - | + | A   | B | D | K |
| 06688 | 79 | 34240 | 43314 | F | G | H   | I | J | Q |
| 06700 | 20 | 10132 | 10323 | L | M | N   | O | P | W |
| 06712 | 00 | 41424 | 34445 | R | S | T   | U | V | 2 |
| 06724 | 46 | 47484 | 95152 | X | Y | Z   | 0 | 1 | * |
| 06736 | 53 | 54555 | 6570  | 3 | 4 | 5   | 6 | 7 | = |
|       | 60 | 77000 | 00000 | 9 | @ | (\$ | ) | . | , |

