IBM 9020 Data Processing System

Off-Line Maintenance Programs Manual

Fault Locating Tests

The purpose of this Manual is to provide a description and operating procedure for each type of Fault Locating, or Fault Detecting category of tests used in the maintenance of the CE and IOCE of the 9020 System. Specifically, the Manual includes a description of the utility program to maintain and update the test tapes, the purpose of the tests, the equipment required, the procedure for operating the tests, reference information, and preferred trouble-shooting techniques.

CONTENTS

FAULT LOCATION TEST UTILITY PROGRAM
(FLUT 9020)

1.0 PURPOSE

1.1 INTENT

The FLT Utility Program for the 9020 system provides a number of utility routines to merge records into the FLT tapes and to modify certain tests on the FLT 2 and FLT 5 tapes when hardware changes call for these modifications.

2.0 REQUIREMENTS

2.1 PROGRAM

FLUT 9020 is a stand-alone self-loaded program. As such, it requires no other program in core with it. It is IPL'd into the Compute Element and from then on handles its own I/O and interrupt conditions.

2.2 EQUIPMENT

The minimum machine configuration is a simplex system with a typewriter and at least two tape drives. However, since the program is tape-loaded and the purpose of an update operation is to modify an old master to produce a new master, a lot of tape mounting and dismounting would be involved with just two tape drives. A better working configuration should have a program tape, an old master, and update data tape, and one, two, or three new masters as output tapes. An on-line printer is also desirable to provide a printout of the records read and written on the various tapes. This information would otherwise be recorded on the typewriter.

3.0 OPERATING PROCEDURES

3.1 INITIALIZATION

(a) Configure a system in State zero with Test Switch On, having one IOCE, one CE and one SE. *

*Note: SE address must be placed in slot 1 of ATR so that Physical SE is logical SE1.

(b) Disable Interval Timer.

(c) Mount FLUT 9020 tape.

(d) IPL program into the assigned Storage Element. (The successful completion of the FLUT 9020 program load is terminated by the Wait State.)

(e) Enter system I/O definition on the 1052 after first pressing the Request button. (See section 3. 3.)

(f) Perform any of the functions (defined in section 3. 4).

3. 2 PROGRAM REINITIALIZATION

Once the program has been loaded into storage, it is not destroyed by running FLTs on the non-malfunctioning system. Therefore, the program may be reinitialized at either of the two starting addresses specified by the typeout after the Request button was depressed (see section 3. 1). This is done by pressing Reset, entering the desired address in the Address Keys and setting the Instruction Counter, followed by pressing Start.

The Restart Address is used within a phase of the program to continue executing a particular phase which was abnormally terminated.

The Update Start Address is the address usually used to get to the beginning of the program immediately following the I/O definition entry.

In case of an I/O error, a PSW Restart would skip over the bad record written or read, and continue. Using the Restart Address results in retrying the read or write operation in which the error occurred.

3.3 I/O DEVICE ADDRESS DEFINITION

(a) Command Entry Device -- This is defined by pressing the Request button on the 1052. Its address is also automatically used in the Record Summary Listing, or Failure Summary Listing, unless another printing device is assigned, or an LST command no-ops the printout.

(b) Summary Printing Device -- This is defined by typing PRT_ XXX,* where XXX is the device address. (If this device is the same as the 1052 used as command entry, this definition does not have to be given.)

(c) Source Entry Device -- This is defined by typing OLD_XXX, where XXX is the input tape address.

(d) Resultant Output Device -- This is defined by typing NEW_XXX, where XXX is the resultant output tape drive address. Up to three tape drives may be defined as the output devices. This is done by adding a comma immediately after the first three digit device address, followed by a new three digit device address, for the second output. Another comma and a three digit device address may be used for the third output.

Note: If any of the tape drives are not ready, or if the tape control unit is not configured to the subsystem IOCE, the program may hang up.

(e) Secondary Input Tape -- This may be defined by typing UPD_XXX, where XXX is the secondary input tape drive address for use either in merge-type operations as the second input tape, or in the Eliminate Stops command as the phase two input tape. (See section 5.3.)

*The underline (_) in this writeup is a space on the 1052.

3.4 FLT RECORD LABEL DEFINITION

The first two words on each FLT record constitute the record label. These two words are OR'ed together in the FLT Load operations.

In the record label, the first hex digit identifies the machine type for which the tests have been generated. This is a D for the IOCE and an E for the CE.

The second hex digit represents the test type where:

0 = Monitor or Loader
1 = MS hard core
2/3 = ROS bit tests
4 = ROS hard core
5 = Zero-cycle tests
6 = One-cycle tests
7 = Two-cycle tests
9 = Multi-cycle input record
A = Multi-cycle output record
D = Local Store tests
E = CROS Ripple Tests
F = Terminating Record.

The third and fourth hex digits are the segment number, or series number, or ROS plane number, depending on the type of test.

The following three hex digits are the EC level, and the last digit is a record number within the segment.

3.5 UTILITY COMMANDS

All commands are typed into the 1052 as three digit operation codes followed by a blank, followed by one or more operands or modifiers with positional significance, which are delimited by blanks, or commas in the fourth column, as required by the definition.

In data moving commands, the first set of modifiers refer to the OLD tape, and the second set to the UPDATE tape.

The Utility Program works in terms of test type and segment numbers, which are the second, third and fourth hex digits of the words stored at location zero after an FLT load operation has taken place; i. e., the record label. (See 3. 4.) For purposes of FLUT identification, only three digits are required, namely the test type, and the two digit segment number.

The table below summarizes all utility commands. Enclosed in brackets are optional modifiers. Capitalized codes must be typed as shown. Uncapitalized codes may be any hex digits. The | indicates a one-and-only one of many options. The underline is a space.

COMMAND CODE	OPERANDS/MODIFIERS
IDN_	[1-60 printable characters maximum]
REW_	{ OLD | NEW | UPD | ALL }
ADD_	{xxx_yyy | __ __ yyy | xxx_ }
DEL_	{xxx}
ERA_	{xxx}
DUP_	[{N__ | Ønn | E __}]
REP_	[{xxx_ Ønn | _____ Ønn | xxx_____}]
TRM_	
END_	
CES_	[{1 | 2 | 3 | xxx}]
IES_	[{1 | xxx}]
LST_	
NSV_	{E}
SVN	{E}

3.6 IDN_

The command code IDN_ specifies that the following 60 characters will be used as heading information by the summary printing device. Any alphanumeric characters available on the typewriter may be used.

3.7 REW_ { OLD | NEW | UPD | ALL }

The REW command is an explicit rewind command to the symbolically addressed tape drives presently assigned by the I/O device address definition table. When more than one tape has been defined by NEW, all defined tapes will be rewound. When the ALL operand is given all OLD, NEW, and UPD tape drives will be rewound. It is not necessary to give a REW command after completion of TRM, END, or CES_, or IES_. This is given automatically by those routines.

3.8 ADD_ { xxx_yyy | _ _ _ _yyy_ | xxx_ }

The ADD command duplicates one or more segments from the OLD tape to the NEW tape until it encounters the segment immediately following xxx. It then duplicates all segments found on the UPD tape from its present position up to, and including segment yyy.

If the xxx is blank, no duplication from the OLD tape takes place, and only the UPD tape is copied.

If yyy is blank, then only one segment, the one at which the read-head is positioned, is copied from the UPD tape.

3.9 DEL_xxx

The DEL command copies the OLD tape onto the NEW tape as long as it does not read segment xxx. When it finds segment xxx, it spaces over that segment without copying it onto the NEW tape.

3.10 ERA_xxx

The ERA command positions the OLD tape up to, and over, the segment described by xxx without copying anything onto the NEW tape.

3.11 DUP_ [{Ønn | E_ _ | N_ _ }]

The DUP command without any modifiers copies the OLD tape from its present position onto the NEW tape until it detects an end of file signal.

With the Ønn modifier, where nn are two hex digits, the file beginning at the present position of the OLD tape is duplicated nn hex times onto the NEW tape.

The E modifier specifies that the entire NEW tape is to be filled with as many files of the OLD tape as can be fitted on the NEW tape. (In all cases, no intervening file marks are placed on the NEW tape.)

The N modifier specifies that in the copying operation, all records within a segment are to be numbered and automatic rewind data be added to the beginning of each one and two-cycle tests. (This function is normally used only in the laboratory.)

3.12 REP_ [{xxx_Ønn | _ _ _ _ Onn | xxx_ _ _ _ }]

The REP command specifies that all records between the present position of the OLD tape up to and including the segment xxx should be repeatedly copied nn hex times onto the NEW tpae, where nn is a hexadecimal number.

If the xxx is blank, and the nn modifier is only used, only one segment from the OLD tape will be copied over nn times.

If the nn field is left blank, the entire NEW tape will be filled with data from the OLD tape up to and including segment xxx.

If the entire operand/modifier field is left blank, one segment from the OLD tape at its present position will be copied onto the NEW tape until the NEW tape is filled.

3.13 TRM_

The TRM command places an end of file mark on the NEW tape, rewinds all defined tapes, and causes a printout of the transactions that have taken place since the previous summary was printed.

3.14 END_

The END command copies all records from the OLD tape onto the NEW tape until it reaches the end of file mark on the OLD tape. Then it performs a TRM command automatically.

3.15 CES_[{1 | 2 | 3 | xxx}]

The CES command is used to modify and update the FLT 5 tape. Without modifiers, it causes a 3 phase operation to take place.

In phase 1, the one and two-cycle tests are extracted from the OLD tape (FLT 5) and written onto the UPD tape in a slightly modified form so that the tests may be executed under Diagnose instruction control.

In phase 2, the UPD tape is executed under Diagnose instruction control, and a printout of all failing tests is produced on the summary printing device.

In phase 3, the OLD tape is duplicated onto the NEW tape and in addition, all tests that failed in phase 2 have their expected responses changed to the opposite of what they were. Also, bit 6 of the affected test number stops will be set to a one so as to flag the changed tests. (The NEW tape produced in phase 3 should run without stops in the one and two-cycle tests area immediately after creation.)

The modifiers one, two and three, specify to the program which phase to start with. (The phase 1 UPD tapes may be saved so that additional runs can begin immediately in phase 2.)

The xxx modifier specifies to the program to stop copying segments onto the UPD tape in phase 1 immediately after having read over segment xxx on the OLD tape.

3.16 IES_[{1 | xxx}]

The IES command is used to modify and update the FLT 2 tape. It has exactly the same phases as the CES command, except that the phase 2 operation is performed on the IOCE rather than on the CE. All other phases are performed on the CE.

3.17 LST_

By typing LST before every TRM or END, the transaction summary is not listed. This command is not remembered between jobs and therefore must always precede a TRM or an END command.

3.18 NSV_{E}

Nine-to-seven will DUP a 9-track file mounted on the OLD tape drive onto a 7-track tape mounted on the NEW tape drive without a data converter in such a way that it seems that the data converter feature is present. For 7Ø9Ø compatibility, all NEW records are multiples of 360 bits.

With the E modifier, the resultant record is also a multiple of 64 bits. Input records exceeding 8000 hex bytes will be truncated.

3.19 SVN_{E}

Seven-to-nine will DUP a 7-track file mounted on the OLD tape drive without the data converter feature onto a 9-track tape mounted on the NEW tape drive as if the data converter feature is present. For 9Ø2Ø compatibility the records will be padded with zeros to end in a full word.

With the E modifier, the records will be padded and end in a double word. Output records exceeding 8000 hex bytes will be truncated.

4.0 PRINTOUTS

4.1 AFTER DEPRESSION OF REQUEST BUTTON:

ENTER UNIT ADDRESSES FOR OLD, NEW AND UPD START
START IBM 9020 FLT UTILITY
RESTART ADDR ____ UPDATE START ADDRESS ____
UPDATE PROGRAM

Note: Actual restart addresses change, depending on the assembly used. Capitalized words are computer response messages; uncapitalized words are operator input messages.

4.2 After abnormal termination and restart via the update start address:

UPDATE PROGRAM

4.3 After program completion, i.e., end of TRM, END:

UPDATE PROGRAM COMPLETED
UPDATE PROGRAM

4.4 After entering an unrecognizable message:

rew aal
INPUT MSG NOT RECOGNIZED
rew ale
INPUT MSG NOT RECOGNIZED
rew lal
INPUT MSG NOT RECOGNIZED
rew ail
INPUT MSG NOT RECOGNIZED

4.5 After an unresolvable I/O unit check (i.e., after 10 unsuccessful retries).

***** I-O ERROR
UNIT ADDR xxxx CSW xxx....

4.6 During a CES run:

Note: Uncapitalized data is operator-supplied. In this case the old FLT 5 tape is mounted on 522, while 523, 524, and 525 have scratch tapes mounted which will become the new FLT 5. 521 contains a scratch tape for use as an intermediate tape.

idn flt 5 7/15/66 ec256579/516 ver 3 to ec 257058/060 ver 4
old 522
new 524, 523, 525
upd 521
ces
STARTING PHASE 1
STARTING PHASE 2
SET UP TP ADDR 521 IN LOAD SW, FLT SW TO EXC POSITION_
CHECK CNTRL SW TO DISABLE _ _ _ PRESS PSW RESTART
FAILING TESTS -
FLT 5 7/15/66 EC256579/516VER 3 TO EC 257058/060 VER 4
141D2 141E1 15015 15018
STARTING PHASE 3
CES COMPLETE.

4.7 After completion of rewind or duplication jobs:

FUNCTION DEFINED HAS BEEN COMPLETED

4.8 Transaction summary after a TRM completion. Note that record counts are in hexadecimal.

CONTENTS OF NEW MASTER TAPE

E5305791	E5305792	E5305793	E5305794	E5305795	E5305796
E5305797	E5305798	E5305799	E530579A	E530579B	E530579C
E530579D	E530579E	E530579F	E5305790	E5305791	E5305792
E5305793					

CONTENTS OF OLD MASTER TAPE

E5305791	E5305792	E5305793	E5305794	E5305795	E5305796
E5305797	E5305798	E5305799	E530579A	E530579B	E530579C
E530579D	E530579E	E530579F	E5305790	E5305791	E5305792
E5305793					

RECORD COUNTS OLD UPDATE NEW
0013 0000 0013
UPDATE PROGRAM COMPLETED

5.0 COMMENTS

5.1 UPDATE PROGRAM CONCEPTS

The Update Program resides in storage locations 0 to 1FF, and 9000 and above. It is not relocatable, and must be loaded into logical SE1. It is assumed that this program runs on a malfunction-free machine and therefore should be run with the Check Control switch in NORMAL or STOP. The only exception to this rule is phase two of theES program, where a typed message brings attention to the fact that the Check Control switch should be changed to DISABLE.

This program is tape-loaded and ends in a Wait State. A request from a typewriter supplies the device address to the program with which it may communicate with the operator. The device may be the console typewriter or any of the other typewriters attached to the PAM. The program works in conversational mode, and either informs the operator of the completion of a command, or by waiting for more information to be typed in before it can start executing a command. Lengthy printouts, such as transaction summaries, and failing tests, may be diverted to a printer, if such is specified as being available to the program.

I/O addresses are defined to the program by means of the OLD, UPD, NEW, and PRT statements. The addresses of these devices are entered into an address table and may be modified any time the typewriter requests new information. This may be in the beginning, or in any other part of the program. The only exception is that in the ES program, all I/O device definitions have to be specified before entering the first phase, and cannot be modified thereafter without doing a restart.

The IDN statement begins with all blanks and is blanked out whenever a new IDN statement is issued. However, it is not blanked out between runs. Thus, unless changed by a new IDN type-in, the same IDN statement is printed before the transaction summary or failing test summary is printed in each run. IDN must therefore be changed for every run in which this information is of value. Of course, it may be left blank for hand-written entries.

All records read off the OLD tape are read into storage beginning at location 200. If manual intervention is ever necessary, it is possible to look at locations 200 and 204 and OR the words together to produce the record identification usually found in location 0 after FLT loading a record.

To make any manual changes to an individual word within a test within a record, it is only necessary to know the FLT loaded address of that word, multiply it by 2, and add 200 bytes to it. This leads to the first word address of the two-word data that comprises the one-word of FLT data. After the change, press RESET, force MS mode, and press START.

5.2 ELIMINATE STOPS (ES) PROGRAM

The Eliminate Stops Program is designed to modify individual tests on the FLT 2 and FLT 5 tapes when necessary, because of engineering changes. The program comes in three phases. (See figure 1.) The first phase generates an intermediate tape which can be run under DIAGNOSE instruction control in phase 2. A CES run generates an FLT 5 intermediate tape that can be run on a Compute Element in phase 2. The IES run generates an intermediate FLT 2 tape that can be run on an IOCE in phase 2. The phase 2 run is executed on the element in which the engineering change is being modeled. The execution is initiated with an FLT load of the intermediate tape (or a phase 2 PSW restart). In that phase, the tests are executed as usual, except that in case a test fails, an FLT stop is not executed, but instead the FLUT program records the failing test number and then proceeds to execute the next test in sequence.

The transaction summary printer will list 12 failures in any one line of print. The potential stop numbers are also saved for use in phase 3 to modify the NEW tape so that it can run stop-free when it is executed.

In phase 3 the OLD tape is read, and together with the information saved in the phase 2 run, the data is modified to produce a NEW tape which runs stop-free. (Naturally, intermittent failures occurring either in the phase 2 run or while testing the resulting NEW tape could cause stops on the NEW tape.)

The three phases may be run individually by specifying the appropriate phase number in the command modifier field. Since the FLT 2 and FLT 5 tapes have other than one and two-cycle tests on them, and the ES program only affects those one and two-cycle tests, it is possible to specify to the program the last segment number which should be included in the phase 2 tape by means of the 3-digit modifier.

5.3 ES PHASE 2 RUN DETAIL

In order for failing tests not to stop when being executed in phase 2, the stop address has been modified on the intermediate tape so as to execute an External Interrupt which causes the FLUT program to do the necessary recording and address manipulation in order to continue on the next consecutive test.

In order to run phase 2 on the IOCE, it is necessary to get the IOCE into Diagnose Mode. At the end of phase 2, the IOCE must be reconfigured into the sub-system to continue with phase 3. Figure 2 shows a schematic of the phase 2 FLUT program operation.

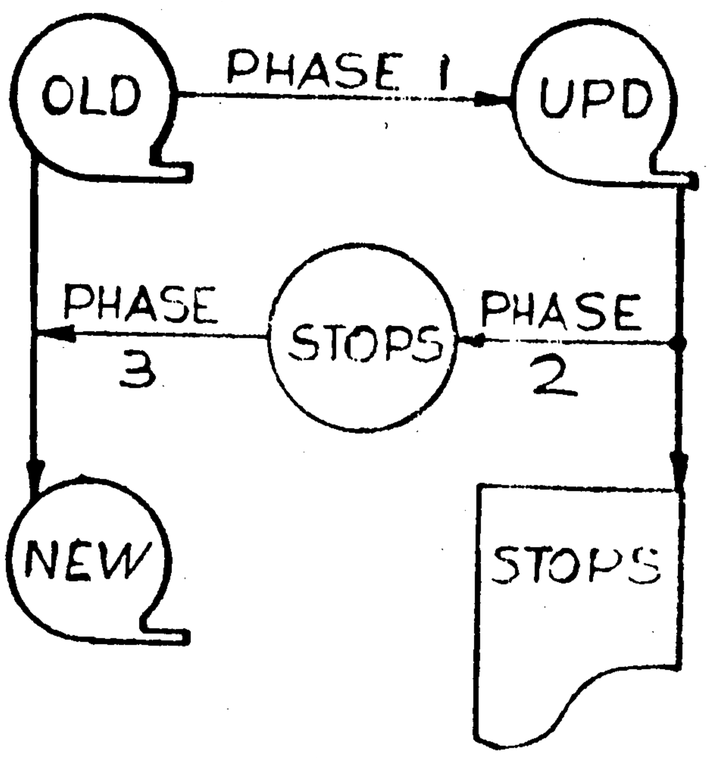

FIG 1- PHASES OF ES

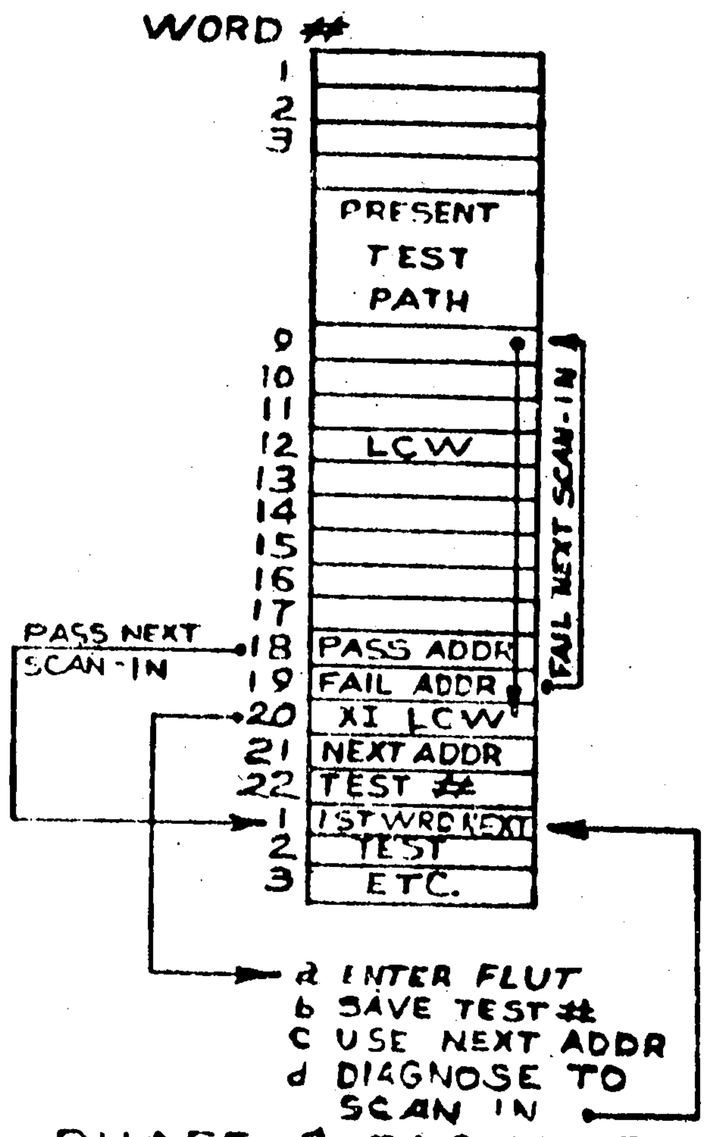

FIG 2 - PHASE 2 FLOW DETAIL

NOTES