OFF-LINE OPERATIONS

2-WIRE NO. 1 ELECTRONIC SWITCHING SYSTEM

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1. GENERAL

1.01 This section describes the procedures for using the off-line mode of operation in the 2-Wire No. 1 Electronic Switching System (ESS) offices.

Note: Effective with what would have been Centrex 8 Issue 4 of No. 1 ESS, the equivalent generic program designation is 1E4.

1.02 This section is reissued for the following reasons:

(a) To incorporate changes in message formats and off line programs effective for offices with CTX 7 Issue 9, 1E4 and later generic programs

(b) To incorporate previous addendum

(c) To make minor changes and corrections as required. Since this is a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 Abbreviations used in this section are explained in Part 9.

1.04 On-line procedures should be used before trying off-line operation. The off-line mode is used when all available automatic tests have failed to isolate a trouble. This mode is most useful when a marginal or an intermittent problem exists. For these problems, a program test of the suspected cicuit or circuits can be made to loop continuously so that a series of test results may

be compared. Off-line operation is also useful when locating a trouble which may be frequency- or configuration-dependent. For instance, a high-error count may be experienced only with a particular central control-bus-program store combination. The source, or errors in this case, cannot be isolated by on-line methods because switching out any of the units involved causes the errors to stop. An oscilloscope or similar device must be used to aid in isolating trouble in most cases of off-line operation.

Caution: System is operating in simplex during off-line operation. Off-line operation should be done during a period of light traffic, if possible. A phase may be required to reestablish full duplex operation.

1.05 The off-line mode of operation is a manually requested mode in which certain units of the system are divorced from the remainder of the working system in order to perform tests. The units that can be placed in the off-line mode are the standby central control (CC), a program store (PS), a PS bus, a call store (CS), a CS bus, the standby signal processor (SP), a signal processor call store (SPCS), and an SPCS bus. A teletypewriter (TTY) communicates with the active CC to establish and control off-line operations; however, the TTY does not print out test results from all off-line operations (only those providing memory dumps).

1.06 When in the off-line mode, the active CC handles the normal call processing and limited maintenance work of the system while the standby CC is used for the off-line operations.

1.07 The types of operations which can be performed in the off-line mode include the following:

(a) Looping around a section of program

(b) Control-writing into the registers of the standby CC

(c) Control-writing into a CS or SPCS

(d) Writing repeatedly into a CS or SPCS memory block or address

(e) Reading repeatedly from a CS or SPCS memory block or address

(f) Repeatedly executing certain programs in an off-line configuration

(g) Storing programs in an off-line CS or SPCS and executing them on an off-line basis

(h) Control-writing into the registers of the standby SP

(i) Generating a pulse for oscilloscope syncing upon a specified PS, CS, or SPCS address match.

1.08 The off-line mode of operation is normally discontinued by manual means; however, if one or more off-line units are required by the active system in order to preserve normal call processing, they will be automatically removed from the off-line configuration and restored to normal.

Note: The maintenance personnel should be alert for TTY messages indicating a change in off-line status. The system, when it has to manipulate off-line units, does not always extinguish the OFF LINE lamp at the MCC. Thus, if the system takes an interrupt and switches CCs, to the casual observer it looks as though the now active CC is off-line when in fact the system knocked down the off-line but left the lamp lighted at the MCC. (In this example, in order to extinguish the OFF LINE lamp, the now standby CC would have to pass diagnostics and be switched back to active. Then an ØFL-MODE-02. and ØFL-MODE-03. would be entered to turn off the lamp, plus appropriate restoral messages used to return the system to normal.)

1.09 When the system is in the off-line mode, diagnostic and routine exercise programs, except those requested from the maintenance TTY or master control center (MCC), are not run by the system. Therefore, the system should not be left in the off-line configuration for any longer than necessary.

1.10 Maintenance requests made from the TTY, MCC, or frame control panels while an off-line configuration exists may disrupt off-line operations by disturbing match registers or removing units from the off-line configuration.

1.11 Reference should be made to PD-, PR-, and PF-1A013-XX for details as to how off-line

operations are carried out by the off-line program. PK-1A016 and PK-1A021 also contain information on specific applications of the off-line program.

1.12 References to an SP should be disregarded in offices not containing an SP community.

1.13 Reference should be made to Section 231-001-102 for CC program instructions and to Section 231-100-102 for SP program instructions.

2. TELETYPEWRITER MESSAGES AND SYSTEM INDICATIONS ASSOCIATED WITH OFF-LINE OPERATION

2.01 Off-line actions are initiated by a combination of input messages typed on the TTY. When maintenance personnel type in any of the messages, the active CC responds; it establishes the off-line configuration, starts or stops the standby CC, etc, as directed by the message. The standby CC does not report on off-line operation via the TTY; however, the active CC reports on actions taken to effect off-line operations by issuing appropriate output messages.

2.02 Input and output TTY messages relating to off-line operations are introduced briefly in 2.03 through 2.06. Subsequent paragraphs of this section give a more complete description of each message.

2.03 The following four input messages are used to establish and control off-line operations:

(a) *ØFL-CØNFIG:* This message is used to establish an off-line configuration of the standby CC with or without a PS, CS, SPCS, or SP.

(b) *ØFL-MØDE:* This message is used to start or stop the standby CC or SP, to clear the memory associated with off-line operations after the off-line configuration has been achieved, and to release the maintenance control (MAC) scratch pad.

(c) *ØFL-EXEC:* This message is used to specify one of a number of actions to be performed. For example, a designated system program can be run off-line by the standby CC. The majority of off-line actions are requested by means of this message. (Most of the actions that can be specified require an off-line

configuration, although some actions require that the CCs be in step and matching.)

(d) *ØFL-PRØG:* This message is used to place a special program (that is, a sequence of program instructions) into the CS and to cause the standby CC to execute this program on an off-line basis.

2.04 Five basic input messages [in addition to the ØFL-MØDE message discussed in 2.03(b)] are used to terminate off-line operations:

> CS-RESTØRE-
> PS-RESTØRE-
> CC-DGN-
> SP-DGN-
> PS-NØRMAL-

These messages diagnose and return the indicated system unit to service and restore the system to normal after off-line operations are completed if the tests pass.

2.05 A common output message format is used by the off-line control program to inform maintenance personnel of the actions resulting from off-line configuration requests. The basic format of the response is ØL01 followed by a code specifying a completed action. Reference should be made to the output message manual for specific information.

> *Caution: If the ØL01 ABTD output message is received, the off-line configuration should be terminated by typing in the ØFL-MØDE-03 and the CS-, PS-, and SP-DGN input messages given in Part 7. A new off-line configuration must be established to do further testing.*

2.06 In addition to output messages, system actions are signified by lamps at the MCC. A white lamp labeled OFF LINE and a red lamp labeled STOPPED in the EMERGENCY ACTION section of the alarm, display, and control panel reflect the system configuration. There are two sets of these lamps: one for CC 0 and the other for CC 1.

3. ESTABLISHING AN OFF-LINE CONFIGURATION

3.01 All possible off-line configurations are for:

(a) Standby CC

(b) Standby CC with PS and PS bus

(c) Standby CC with CS and CS bus

(d) Standby CC with PS, PS bus, CS, and CS bus

(e) Standby CC with CS, CS bus, standby SP, SPCS, and SPCS bus

(f) Standby CC with PS, PS bus, CS, CS bus, standby SP, SPCS, and SPCS bus.

3.02 The ØFL-CØNFIG message is used to request an off-line configuration. This is normally the first message typed into the system to initiate off-line procedures. The format of the message is as follows:

IN OFFICES WITHOUT AN SP
ØFL-CØNFIG-aa b cc d.

IN OFFICES WITH AN SP
ØFL-CØNFIG-aa b cc d ee f.

aa = Number (00 through 11) representing the PS to be placed off-line. If a PS is not desired, type in 99.

b = Number (0 or 1) representing the PS bus to be placed off-line. If a PS is not desired, a PS bus is not required; therefore, type in 0.

cc = Number (00 through 38) representing the CS to be placed off-line. If a CS is not desired, type in 99.

d = Number (0 or 1) representing the CS bus to be placed off-line. If a CS is not desired, a CS bus is not required; therefore, type in 0.

ee = Number (00 through 07) representing the SPCS to be placed off-line. If an SPCS is not desired, type in 99. A CS (cc above) must be included in all configurations with an SPCS (used only in SP offices). An SPCS must be requested if an SP is to be included in an off-line configuration.

f = Number (0 or 1) representing the SPCS bus to be placed off-line. If an SPCS

is not desired, an SPCS bus is not required; therefore, type in 0.

3.03 The standby CC is automatically included in any off-line configuration. The standby SP is included in any off-line configuration which includes an SPCS and a CS. Since there is no provision for explicitly stating the desired CC or SP, prior use of CC-SWCC-. and/or SP-SWITCH-A. may be necessary to make the desired unit(s) standby before entering the ØFL-CØNFIG message.

Caution: A second ØFL-CØNFIG message should never be typed in until the previously requested configuration has been terminated by the procedure given in Part 7.

3.04 The ØFL-CØNFIG message also stops the standby CC after placing it off-line.

3.05 The system determines whether or not the requested configuration can be provided at the time of the request. If the configuration can be provided, the system establishes the requested configuration. The system responds to the ØFL-CØNFIG request with a TTY message giving the action taken. Reference should be made to the output message manual for specific information.

3.06 If a configuration was denied, it is necessary to terminate the off-line procedures by typing in the ØFL-MØDE-03 message and the CS-, PS-, CC-, and SP-DGN messages as described in Part 7 before requesting a new configuration. Some reasons for denial are: MAC scratch pad in use, requesting non-existent units, and duplicate not available for active system use (as requesting CS bus 0 for off-line with bus 1 marked in trouble).

3.07 The ØFL-CØNFIG message causes the MAC scratch pad to be assigned to the off-line CC. The MAC scratch pad is required if an ØFL-PRØG, ØFL-EXEC-14, or ØFL-EXEC-15 message is going to be used. If any other ØFL-EXEC message is going to be used, the MAC scratch pad is not needed and it should be released by using ØFL-MØDE-05 message.

3.08 If the ØFL-CØNFIG and possibly the ØFL-MØDE messages are favorably acknowledged, the requested off-line configuration is established, at the MCC the OFF LINE and STOPPED lamps are lighted for the standby CC,

and the off-line system awaits an ØFL-MØDE, ØFL-EXEC, or ØFL-PRØG message.

3.09 Figure 1 shows the action required to start off-line operations.

4. ESTABLISHING AND CHANGING OFF-LINE MODE OF OPERATION

4.01 Seven ØFL-MØDE TTY messages are used to establish and change an off-line mode of operation. The format of the message is

ØFL-MØDE-aa.

01 — Starts the standby CC at a specified PS address. The standby CC must have previously been stopped by an ØFL-CØNFIG or ØFL-MØDE-02 message (aa = 02 below). The standby CC executes a program which must have been previously selected by means of the ØFL-EXEC-06 message described in 5.20 through 5.22. Briefly, the ØFL-EXEC-06 message is used to specify the start address of a program which is to be executed. This address is retained until the ØFL-MØDE-01 message is typed in. The ØFL-MØDE-01 message causes the program to be started.

02 — Stops the standby CC. The off-line program being executed is halted.

03 — Clears or zeros the CS memory areas associated with off-line operation and restores the routine matching without interrupt mode. This message is used in the procedures to end off-line testing. The full procedure is discussed in Part 7. In SP offices, if an SP was included in off-line operations, this message causes the SP to be diagnosed and then returned to service if it passes diagnosis. Since the message signals the end of off-line operations, the OFF LINE lamp at the MCC is extinguished.

Note: Beginning with Issue 5 of CTX-4 and CTX-5, the SP will not be diagnosed and returned to service by the ØFL-MØDE-03 message but by the SP-DGN message.
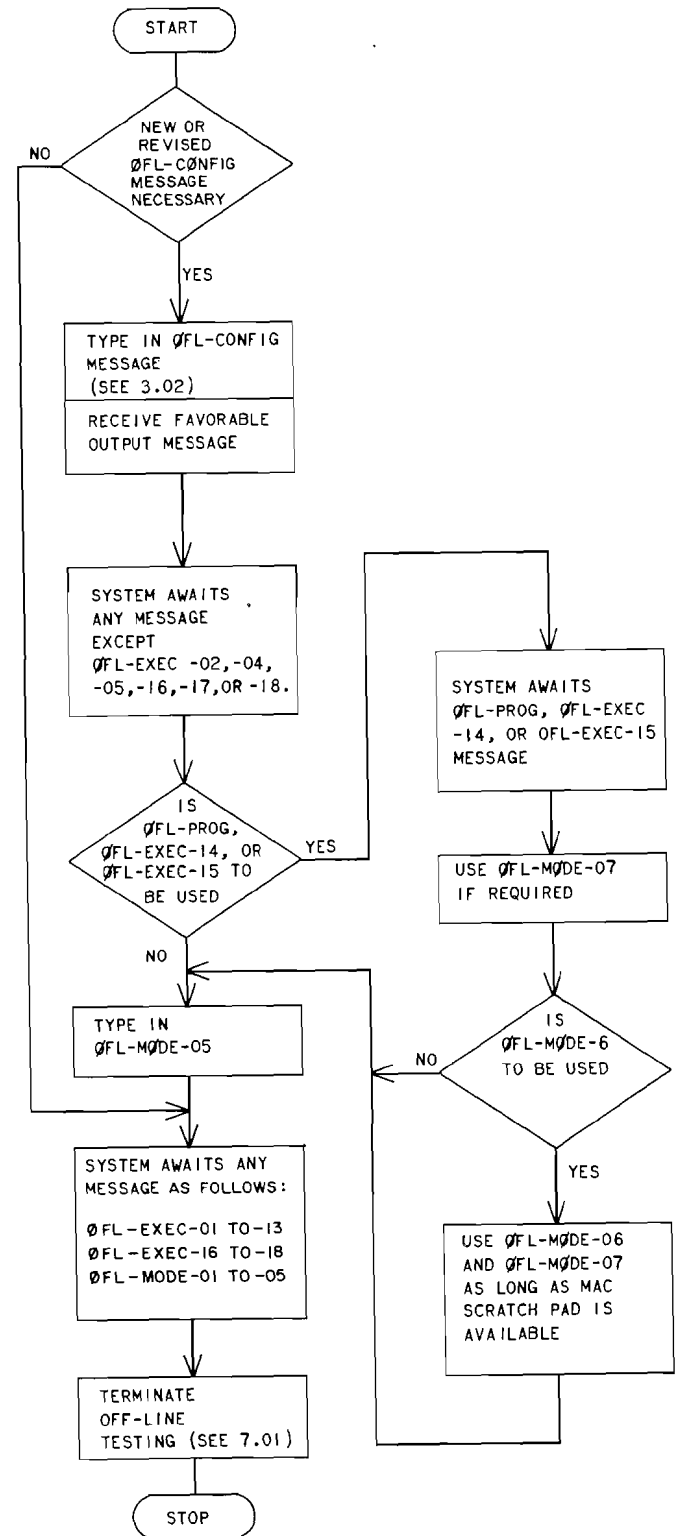
Fig. 1—How to Make an Off-Line Test

04 — Starts the standby CC at the address currently in the program address register. The standby CC takes up where it left off when it was stopped by the ØFL-CØNFIG or ØFL-MØDE-02 message. The message differs from aa = 01 option above in that aa = 01 starts the standby CC at a specified address; aa = 04 starts the standby CC at the address being processed when the standby CC was stopped.

05 — Removes the off-line program from the MAC scratch pad to allow system audits to run. The ØFL-CØNFIG message seizes the MAC scratch pad for use with the off-line program. This scratch pad is needed only if an ØFL-PRØG, ØFL-EXEC-14, or ØFL-EXEC-15 message is to be used. If an ØFL-EXEC-01 through ØFL-EXEC-13 or ØFL-EXEC-16 through ØFL-EXEC-18 message is to be used, the MAC scratch pad should be released from the off-line program.

06 — Stops the standby SP. The standby CC must be stopped or the request is invalid.

07 — Starts the standby SP at the beginning of the SP off-line program written into the SPCS from the TTY. The ØFL-EXEC-15 message is used to write this program.

5. PURPOSE OF OFF-LINE EXECUTION TELETYPEWRITER MESSAGES

5.01 There are 18 ØFL-EXEC TTY messages used to request specific actions by the off-line system. The format of the message is

ØFL-EXEC-aa bbbbbbbb cccccccc.

The variable aa is a decimal number (01 through 18) which identifies the particular off-line action to be taken. The two data subfields are eight octal digits each. When 5-, 6-, or 7-digit addresses are used, the left-most digit(s) must be 0 so that the total number of digits is always eight. Unused portions of the data subfields are always filled with zeros. The following paragraphs explain each message. A short procedure using each of the

ØFL-EXEC messages is given in Tables E through AK.

INITIATING A PROGRAM LOOP (ØFL-EXEC-01)

5.02 The following message causes the off-line CC or the off-line SP to repeatedly execute a program loop which must be in CC or SP instructions:

ØFL-EXEC-01 0bbbbbbb 0ccccccc.

bbbbbbb = 7-digit (octal) starting address of the program to be executed

ccccccc = 7-digit (octal) ending address of the program to be executed.

The loop is executed in an existing system program. It is normally a series of instructions that are believed to have failed execution previously. The loop may also be used to exercise equipment that is suspected of failure, such as CS addressing circuitry. The off-line program receives a configuration for the ØFL-EXEC-01 command which includes

(a) The standy CC which must be stopped

(b) A PS containing information block 0 (PS 0 or PS 1)

(c) A K-code 1 CS (CS 0 or the highest numbered CS in the office)

(d) An SP and SPCS, when required.

5.03 The beginning and ending addresses of a CC program may be obtained from the generic program map (PK-1A002-XX). XX identifies the particular generic program involved. The program map shows the beginning and ending PS addresses of all PIDENTS that make up the No. 1 ESS programs.

5.04 The program selected must be structured to reach the terminal address specified by ccccccc. If the program selected is not so structured, the looping action specified by the message is not affected. Of course, the program specified may be self-looping; that is, a return transfer to the initial address may be a part of the program. If the selected program is in a CC, the looping action may be stopped by typing in ØFL-MØDE-02.

5.05 The ØFL-EXEC-01 message sets up the mode control register (MØCR) of the standby CC so that a program address register (PAR) match in the breakpoint mode causes an interrupt when the address specified by variable cccccc is reached by the standby CC. The PAR match causes a G-level interrupt in the standby CC which, in turn, causes the standby program to be restarted at address bbbbbb; this method of operation permits repetition and, therefore, continuous execution of a selected program.

5.06 If the address range bbbbbb through cccccc is in an SP community, SP, SPCS, and SPCS bus must be included in the off-line configuration. The off-line SP continues to execute the instruction in the SP program loop until the SP is stopped by typing in ØFL-MØDE-02 and ØFL-MØDE-06.

OBTAINING A SYNC PULSE (ØFL-EXEC-02)

5.07 The following message causes the match circuitry of CC to emit a sync pulse whenever a specified PS or CS address is reached:

ØFL-EXEC-02 0bbbbbbb 00cccccc

bbbbbbb = Specified PS address

cccccc = Specified CS or SPCS address.

5.08 The message can be used with only one of the variables (bbbbbbb or cccccc) specified. Zeros must be typed in for the unused variable.

5.09 A sync pulse can be obtained on a PS address match, a CS address match, or an SPCS address match. The sync pulse is emitted by matcher 0 (MO; 326-04, pin 2) when the specified PS address bbbbbbb is reached (that is, when the PAR equals bbbbbbb). The sync pulse is emitted by matcher 1 (M1; 326-04, pin 24) when the specified CS or SPCS address cccccc is reached (that is, when the *index adder output register [IAOR]* equals cccccc).

5.10 The sync pulse may be requested for an active system or a standby system. If an off-line configuration exists and the standby CC is stopped, the off-line system emits the sync pulse; otherwise, the sync pulse is obtained from the active system. The sync pulse is used to provide oscilloscope sync when displaying traces of critical logic changes.

5.11 To use this message when the standby CC is stopped, an ØFL-EXEC-02 message is used as explained in 5.07; it is then necessary to control-write the starting address of the program to be run into the PAR using an ØFL-EXEC-06 message. In this case, the PS containing the program to be run must be off-line. In addition, if a CS or an SPCS address is to be matched, the CS or SPCS containing the address must be off-line. An ØFL-MØDE-01 message is then used to start the standby CC.

EXECUTING PROGRAM ØLCP15 REPEATEDLY (ØFL-EXEC-03)

5.12 The following message causes the off-line system to repeatedly execute the program ØLCP15, which may consist of up to 64 PS words:

ØFL-EXEC-03 00000000 00000000.

5.13 Program ØLCP15 is a complete PS permanent magnet twistor (PMT) card which can be altered in the field to suit particular requirements. The required off-line configuration is a CC, a PS containing information block 0 (PS 0 or PS 1), and a K-code 1 CS (either CS 0 or the highest CS in the office). The off-line program compares the first and last word of the card before executing any instructions from it. Octal 3 is the identifying code for program ØLCP15. The other 62 instructions on the card may be utilized to provide a wide selection of test routines written to solve peculiar problems. The routines written on this card must have continuity and must remain internal to the card. If CS operations are performed, they must be limited to the off-line CS. In a similar manner, PS reads must be executed from the off-line PS only. Off-line execution is stopped with an ØFL-MØDE-02 message. Reference should be made to 8.31 through 8.35 for the procedure to use in changing and using the PMT card.

DUMPING CENTRAL CONTROL REGISTERS ON MATCH (ØFL-EXEC-04)

5.14 Either of the following messages causes the contents of the active CC and the buffer bus registers to be printed (dumped) on the maintenance TTY after a match with a PS, CS, or SPCS address:

ØFL-EXEC-04 0bbbbbbb 00000000

ØFL-EXEC-04 00bbbbbb 00000000

    bbbbbbb = PS address to be matched

      bbbbbb = CS or SPCS address to be matched.

Note: An off-line configuration cannot exist while obtaining this dump. The CSs must be running in step. The CC-RESTØRE message should be used if the standby CC is not running.

5.15 The ØFL-EXEC-04 message is not valid for addresses in programs performed in A- through F-level interrupts. The dump occurs when the octal address specified in the message is reached by the active CC. This message provides the facility for examining the contents of the various CC registers at a critical point in a program without interfering with regular work. When the active CC reaches the specified address, the match circuitry causes an interrupt which, in turn, causes a transfer to the program that dumps the desired information.

For offices with generic programs prior to CTX-7 Issue 9 and 1E4, the dump is contained in output message TW02 which consists of 32 words of 8-octal digits each. In order, these 32 words are the contents of the following registers:

(1) Buffer (B) register

(2) Address storage register (ASR)

(3) F register

(4) J register

(5) K register

(6) X register

(7) Y register

(8) Z register

(9) L register

(10) K-addend register

(11) External match register—0 (AR0)

(12) Internal match register—0 (DR0)

(13) External match register—1 (AR1)

(14) Internal match register—1 (DR1)

(15) Match control register (MACR)

(16) Match mode control register (MØCR)

(17) Match cycle control flip-flops (MACF)

(18) Central pulse distributor controlled status flip-flops (CSTF)

(19) Peripheral bus control flip-flops (PBCF)

(20) Peripheral unit maintenance summary (PUMS)

(21) Store error summary—A (SESA)

(22) Store error counter flip-flops (SECF)

(23) Millisecond clock state flip-flops (MSCF)

(24) Emergency action control flip-flops (EACF)

(25) Pulse sources (V positions) (PSV)

(26) Miscellaneous maintenance flip-flops (MMIF)

(27) MCC data insert (MCCD)

(28) Maintenance interrupt source flip-flops (MAIS)

(29) Normal interrupt source flip-flops (NØIS)

(30) Pest control flip-flops (PEST)

(31) Interrupt level activity flip-flops (ILAF)

(32) MCC flip-flops (MCCF).

For offices with CTX-7 Issue 9, 1E4 and later generic programs, the dump is contained in output message CCINT which consists of 12 words of 8 octal digits each. In order, these 12 words are the contents of the following registers:

(1) External match register—0 (AR0)

(2) Internal match register—0 (DR0)

(3) External match register—1 (AR1)

(4) Internal match register—1 (DR1)

(5) Store error summary—A (SESA)

(6) Store error counter flip-flops (SECF)

(7) Match control register (MACR)

(8) Peripheral bus control flip-flops (PBCF)

(9) Peripheral unit maintenance summary (PUMS)

(10) Pulse sources (V positions) (PSV)

(11) Emergency action control flip-flops (EACF)

(12) MCC flip-flops (MCCF)

5.16 After the completion of the desired dump, use the ØFL-MØDE-03 message followed by CC-RESTØRE-.

> *Note:* Do not forget to deactivate this routine.

DUMPING CALL STORE OR SIGNAL PROCESSOR CALL STORE CONTENTS (ØFL-EXEC-05)

5.17 The following messages cause up to 31 consecutive CS or SPCS locations in the active system to be dumped on a match of a PS, CS, or SPCS address. A match occurs when the specified address (bbbbbbb) appears in the program address register (PAR). The first location to be dumped is (dddddd). Alternatively, the first location to be dumped can be an address contained in a CC register (or, for later generic program issues, an SP register) at the time of an address match. A code (ee) is used to specify the CC or SP register.

ØFL-EXEC-05 0bbbbbbb cc dddddd.

or

ØFL-EXEC-05 0bbbbbbb cc000ee.

bbbbbbb = PS, CS, or SPCS address to be matched

cc = Octal number (01 through 37) of consecutive CS locations to be dumped

dddddd = Address of first CS or SPCS location to be dumped

ee = A code to specify a CC or SP register, depending upon the office generic program. Address in specified register is first location to be dumped.

For offices with generic programs prior to CTX-7, Issue 9 and 1E4, variable ee has the following values:

ee = 00—B register

ee = 02—F register

ee = 03—J register

ee = 04—K register

ee = 05—X register

ee = 06—Y register

ee = 07—Z register

ee = 10—L register

For offices with CTX-7 Issue 9, 1E4 and later generic programs, ee has the following values:

For CC:

ee = 00—L register

= 01—B register

= 02—F register

= 03—J register

= 04—K register

= 05—X register

= 06—Y register

= 07—Z register

For SP:

ee = 10—L register

= 11—B register

= 12—F register

= 13—J register

= 14—K register

= 15—X register

= 16—Y register

= 17—P register

= 20—Q register

= 21—A register

= 22—ASR register

= 23—I register

Note: An off-line configuration cannot exist while obtaining this dump. The CCs must be running in step. The CC-RESTØRE message should be used if the standby CC is not running.

5.18 The ØFL-EXEC-05 message provides the facility for examining the contents of temporary memory (for example, a call register) at some critical point in a program without interfering with regular work. When the active CC reaches the specified address, the match circuitry causes an interrupt, which, in turn, causes an output message to be typed out containing the contents of the requested CS locations.

For offices with generic programs prior to CTX-7 Issue 9 and 1E4, the dump is contained in output message TWO2. A one line TWO2 message specifying the starting address of the dump is also given if the ee option is used. If the starting address is out of range, no dump will occur.

For offices with CTX-7 Issue 9, 1E4 and later generic programs, the dump and its starting address are contained in output message CCINT.

5.19 After completion of the desired dump, use the ØFL-MØDE-03 message followed by CC-RESTØRE.

INITIALIZING PROGRAM ADDRESS REGISTER OF STANDBY CENTRAL CONTROL (ØFL-EXEC-06)

5.20 The following message initializes the PAR to the address specified:

ØFL-EXEC-06 0bbbbbbb 00000000.

bbbbbbb = PS or CS address to which PAR is to be initialized. A CS address must be preceded with two or three zeros to make a total of eight digits.

Prior to using this message, an off-line configuration should be established which includes a CC, a PS, and a CS when desired.

5.21 This message provides the facilities for specifying the start address of a program to be executed by the off-line CC. A CS address can be used only if a previously stored CS program has been stopped and it is to be restarted at a specified address. Subsequently, when the ØFL-MØDE-01 message is typed in, the standby CC starts executing the instructions which make up the program. The program selected by this method must be self-looping; if it is not self-looping, predictable results cannot be obtained. Reference should be made to 5.02 through 5.06 for alternate means of starting a program and for a discussion of means for selecting programs.

5.22 The message requires that the standby CC be stopped. The active CC control-writes into the standby CC, and the standby CC must be stopped for this to be accomplished. If the standby CC is not stopped, it fails to receive the control-write and goes on doing the work it was performing prior to the attempted control-write. In this case, the message is ineffective even though an ØK acknowledgement is typed out. The ØFL-MØDE-01 message should be used to start the standby CC. Typically, the program executed as a result of this message is terminated using the ØFL-MØDE-02 message.

INITIALIZING CENTRAL CONTROL REGISTERS (ØFL-EXEC-07)

5.23 The following message causes the octal data specified to be control-written into one of the registers of the standby CC:

ØFL-EXEC-07 000000bb cccccccc.

bb = Code of the CC register to be control-written. (See below.)

ccccccc = Octal data to be control-written into the specified register.

The standby CC must be stopped to use this message. The ØFL-EXEC-06 and ØFL-MØDE-01 messages are normally used to start the standby CC. The registers which can be initialized and their corresponding codes are tabulated as follows:

CODE (bb)	STANDBY CC REGISTERS
00	Buffer (B) register
02	External match register—0 (AR0)
04	Internal match register—0 (DR0)
06	External match register—1 (AR1)
10	Internal match register—1 (DR1)
12	Match control register, right half (MACR)
13	Match control register, left half (MACL)
14	Match mode control register (MØCR)
16	Match cycle control flip-flops (MACF)
20	Maintenance interrupt source flip-flops (MAIS)
22	Normal interrupt source flip-flops (NØIS)
24	Program address register (PAR)
26	Index adder output register (IAØR)
30	Logic register (L)
32	Buffer order word register, right half (BØWR)
34	Buffer order word register, left half (BØWR) (BØWL)
36	Pest control flip-flop (PEST)

5.24 The function and significance of the bits in the registers in 5.23 (with the exception of the B and L registers) are shown in PF-1A016 (CC diagnostic programs). The contents of the B and L registers depend on the particular situation being tested.

INITIALIZING A CALL STORE, SIGNAL PROCESSOR CALL STORE, OR SIGNAL PROCESSOR LOCATION (ØFL-EXEC-08)

5.25 The following message causes the active CC to write octal data into an off-line CS, SPCS, or SP location at the specified address:

ØFL-EXEC-08 00aaaaaa bbbbbbbb.

aaaaaa = Address to be written into

bbbbbbbb = Octal data to be written.

The message requires that the CS, SPCS, or SP should be off-line and that the standby CC should be stopped. This message can be used to change one word of an existing program which is in the CS or SPCS. When writing into the off-line SP registers, bit 12 of the SP register address must identify the off-line SP. Bit 12 = 1 for SP 1 or 0 for SP 0.

WRITING A CALL STORE OR A SIGNAL PROCESSOR CALL STORE BLOCK WITH ALL ONES (ØFL-EXEC-09) (GENERICS PRIOR TO CTX-4)

5.26 The following message causes the off-line CC to repeatedly and continuously write a word containing all ones into an off-line CS or SPCS at consecutive addresses:

ØFL-EXEC-09 00bbbbbb 00cccccc.

bbbbbb = First address to be written

cccccc = One more than the last address to be written

When address cccccc is reached, the cycle is repeated.

5.27 In order for the message to be acted on by the system, three conditions must be met.

(a) The CS or SPCS designated in the address must be off-line.

(b) PS 0 or PS 1 must be off-line.

(c) The standby CC must be stopped.

5.28 The writing continues until the standby CC is stopped with the ØFL-MØDE-02 message.

WRITING A CALL STORE OR A SIGNAL PROCESSOR CALL STORE BLOCK WITH THE CONTENTS OF BB17 (ØFL-EXEC-09) (CTX-4 AND LATER GENERICS)

5.29 The following message causes the off-line word containing the contents of BB17 into an off-line CS or SPCS at consecutive addresses:

ØFL-EXEC-09 00bbbbbb 00cccccc.

bbbbbb = First address to be written

cccccc = One more than the last address to be written.

When address cccccc is reached, the cycle is repeated.

5.30 In order for the message to be acted upon by the system, three conditions must be met.

(a) The CS or SPCS designated in the address must be off-line.

(b) PS 0 or PS 1 must be off-line.

(c) The standby CC must be stopped.

5.31 If it is desired to modify the data pattern being written into the CS, the standby CC must first be stopped by typing in ØFL-MØDE-02. The new data must then be inserted into buffer bus 17 by operating or releasing the appropriate PROGRAM CONTROL keys. Writing will begin again when the ØFL-EXEC-09 message is retyped. The writing continues until the standby CC is stopped with the ØFL-MØDE-02 message.

READING AN OFF-LINE CALL STORE OR SIGNAL PROCESSOR CALL STORE (ØFL-EXEC-10)

5.32 The following message causes the active CC to read consecutive words from an off-line

CS or SPCS and to print up to 64 words in a TW02 message:

ØFL-EXEC-10 00bbbbbb 00000ccc.

bbbbbb = Address of first word to be read

ccc = Number (in octal) of words to be read. Note that ccc must be 100 or less.

5.33 In order for the system to act on the message, three conditions must be met.

(a) The CS or SPCS designated in the address must be off-line.

(b) PS 0 or PS 1 must be off-line.

(c) The standby CC must be stopped.

5.34 This feature is used to verify the results of another ØFL-EXEC message which has been stopped by the ØFL-MØDE-02 message.

READING A CALL STORE OR A SIGNAL PROCESSOR CALL STORE BLOCK (ØFL-EXEC-11)

5.35 The following message causes the off-line CC to repeatedly and continuously read words from an off-line CS or SPCS at consecutive address:

ØFL-EXEC-11 00bbbbbb 00cccccc.

bbbbbb = First address to be read

cccccc = One address greater than the last address to be read.

When address cccccc is reached, the cycle is repeated.

5.36 In order for the system to act on the message, three conditions must be met.

(a) The CS or SPCS designated in the address must be off-line.

(b) PS 0 or PS 1 must be off-line.

(c) The standby CC must be stopped.

5.37 The reading continues until the standby CC is stopped with the ØFL-MØDE-02 message.

WRITING DATA INTO A CALL STORE OR A SIGNAL PROCESSOR CALL STORE LOCATION (ØFL-EXEC-12)

5.38 The following message causes the off-line CC to repeatedly and continuously write octal data into a specified CS, SPCS, or internal SP location:

ØFL-EXEC-12 00bbbbbb cccccccc.

> bbbbbb = Address to be written into; if an SP register address, bit 12 must indicate the off-line SP (bit 12 = 1 for SP 1).
>
> cccccccc = Octal data to be written.

5.39 In order for the system to act on this message, three conditions must be met.

(a) If a CS address is indicated, a CCCS must be off-line; if an SP internal register or SPCS address is indicated, a CCCS and an SPCS must be off-line.

(b) PS 0 or PS 1 must off-line.

(c) The standby CC must be stopped.

5.40 The writing continues until the standby CC is stopped with the ØFL-MØDE-02 message.

READING DATA FROM A CALL STORE, A SIGNAL PROCESSOR CALL STORE, OR AN INTERNAL SP REGISTER LOCATION (ØFL-EXEC-13)

5.41 The following message causes the off-line CC to repeatedly and continuously read the data from an off-line CS, SPCS, or SP:

ØFL-EXEC-13 00bbbbbb 00000000.

> bbbbbb = Location to be read; if an SP register address, bit 12 must indicate an off-line SP (bit 12 = 1 for SP 1).

5.42 In order for the message to be acted on, three conditions must be met.

(a) If a CS register is indicated, a CCCS must be off-line; if an SP register is indicated, a CCCS and an SPCS must be off-line.

(b) PS 0 or PS 1 must be off-line

(c) The standby CC must be stopped.

5.43 The reading continues until the standby CC is stopped with the ØFL-MØDE-02 message.

INITIATING A LOOP OF A SPECIAL SIGNAL PROCESSOR PROGRAM ØLCP14 (ØFL-EXEC-14) (SP OFFICES ONLY)

5.44 The following message initiates a program loop in the off-line SP system using a special PS PMT (permanent magnet twistor) card written for this purpose:

ØFL-EXEC-14 00000000 00000000.

5.45 In order for this message to be acted on, several conditions must be met.

(a) The off-line configuration must include the standby CC with PS, PS bus, CS, CS bus, SP, SPCS, and SPCS bus.

(b) The OL3 flip-flop must be set, special control group 1 flip-flops must be initialized, and SP error summary flip-flops must be initialized (Table AG).

(c) The first word of the program must be octal 16, which is the valid identifying code.

(d) The last word of the program must be octal 01600101, which is a transfer order to the first word in the program.

(e) A card containing the test information must be in the PS.

5.46 The program repeatedly executed is ØLCP14. ØLCP14 is a complete PS PMT card which can be altered in the field to suit particular requirements. The instructions written on the card for this routine are SP instructions and require only the right-half of the PS word. The left-half PS words are not used. The instructions are read from the PS and are written into the SPCS for execution by the off-line SP. Reference should be made to 8.32 for procedures to use in changing and using the PMT card.

WRITING A SIGNAL PROCESSOR PROGRAM INTO A SIGNAL PROCESSOR CALL STORE FOR EXECUTION BY OFF-LINE SIGNAL PROCESSOR (ØFL-EXEC-15) (SP OFFICES ONLY)

5.47 The following message is used to write a program into the off-line SPCS:

ØFL-EXEC-15 aaaaaaaa bbbbbbbb/
15 cccccccc dddddddd/
.
.
.
15 xxxxxxxx 01600101.

All of the variable fields are program instructions which are loaded sequentially. This message is variable in length depending on the number of instructions. The maximum length is 49 lines. The 15 must be repeated with each line.

> *Note:* A description of SP program instructions is given in Section 231-100-102.

5.48 In order for this message to be acted on, several conditions must be met.

(a) The off-line configuration must include the standby CC with PS 0 or 1, PS bus, CS, CS bus, SP, SPCS, and SPCS bus.

(b) The OL3 flip-flop must be set, special control group 1 flip-flops must be initialized, and SP error summary flip-flops must be initialized (Table AH).

(c) The last word of the program must be octal 01600101 which is a transfer order to the first word in the program.

(d) The ØFL-MØDE-07 message must be typed in to start the program.

5.49 The off-line program, upon reception of the ØFL-MØDE-07 input message, tests the last instruction written into the off-line SPCS by the ØFL-EXEC-15 message. The last instruction loaded must be a transfer to location 101 in the off-line SPCS. If the last instruction is not the required transfer, the message is rejected.

DUMPING CALL STORE OR SIGNAL PROCESSOR CALL STORE CONTENTS VIA AN INDIRECTLY OBTAINED ADDRESS (ØFL-EXEC-16)

5.50 The following messages cause up to 31 consecutive CS or SPCS locations in the active system to be dumped on a match of a PS, CS, or SPCS address. The ØFL-EXEC-16 message is equivalent to the ØFL-EXEC-05 message except that one level of indirectness is used to obtain the CS address to begin the dump. This means that the contents of the address (dddddd) is obtained and used as the first location dumped. If a CC or SP register is specified (ee), two levels of indirectness are used. For example, if ee = 00, the B register is read to obtain an address. This new address is read to obtain a second address. This second new address is the first CS location to be dumped.

ØFL-EXEC-16 0bbbbbbb ccdddddd.

or

ØFL-EXEC-16 0bbbbbbb cc0000ee.

bbbbbbb = PS, CS or SPCS address to be matched

cc = Octal number (01 through 37) of consecutive CS locations to be dumped

dddddd = Address of the first location to be dumped

ee = Code to specify a CC or SP register, depending upon the office generic program.

For offices with generic programs prior to CTX-7 Issue 9 and 1E4, variable ee has the following values:

ee = 00—B register

= 01—F register

= 03—J register

= 04—K register

= 05—X register

= 06—Y register

= 07—Z register

= 10—L register

For offices with CTX-7 Issue 9, 1E4 and later generics, variable ee has the following values:

For CC:

ee = 00—L register

= 01—B register

= 02—F register

= 03—J register

= 04—K register

= 05—X register

= 06—Y register

= 07—Z register

For SP:

ee = 10—L register

= 11—B register

= 12—F register

= 13—J register

= 14—K register

= 15—X register

= 16—Y register

= 17—P register

= 20—Q register

= 21—A register

= 22—ASR register

= 23—I register

Note: An off-line configuration cannot exist while obtaining this dump. The CCs must be running in step. The CC-RESTØRE message should be used if the standby CC is not running.

5.51 When the active CC reaches the specified address (when bbbbbb equals the address in the PAR or IAØR), the match circuitry causes an interrupt, which, in turn, causes either a TWO2 or CCINT output message to be typed containing the contents of the requested CS locations (Fig. 2).

For offices with generic programs prior to CTX-7 Issue 9, and 1E4 the dump is contained in output message TWO2. For the dddddd option, a one word TW02 message specifies the starting address (contents of dddddd) of the dump. For the ee option, two one-line TW02 messages are given. The first gives the contents of the register specified by ee. The second contains the starting address (contents of the address in the register specified by ee) of the dump. No dump is given if the specified start address is out of range.

For offices with CTX-7 Issue 9, 1E4 and later generic programs, the dump is contained in output message CCINT. A single CCINT output message is printed for both the dddddd and ee options; however, for the dddddd option (one level of indirectness), the first address printed is the first location dumped. For the ee option (two levels of indirectness), the first address printed is read from the specified CC or SP register to obtain a second address. This address is the second address printed and is the starting location of the dump.

5.52 After completion of the desired dump, use the ØFL-MØDE-03 message followed by CC-RESTØRE-.

DUMPING CENTRAL CONTROL REGISTERS WHEN A PROGRAM STORE SINGLE ERROR OCCURS (ØFL-EXEC-17)

5.53 The following message causes the contents of the active CC and the buffer register to be printed (dumped) on the maintenance TTY after a PS single error occurs:

ØFL-EXEC-17 00000000 00000000.

OFL-EXEC-16 Obbbbbbb ccdddddd: dddddd ────────► ADDR I ─►

(CS/SPCS LOCATION)

DATA TO BE DUMPED

I
I
I
I
I
I
cc

OFL-EXEC-16 Obbbbbbb ccOOOOee: ee ────► ADDR I ─► ADDR 2 ─►

(CC REG)   (CS/SPCS LOCATION)

DATA TO BE DUMPED

I
I
I
I
I
I
cc
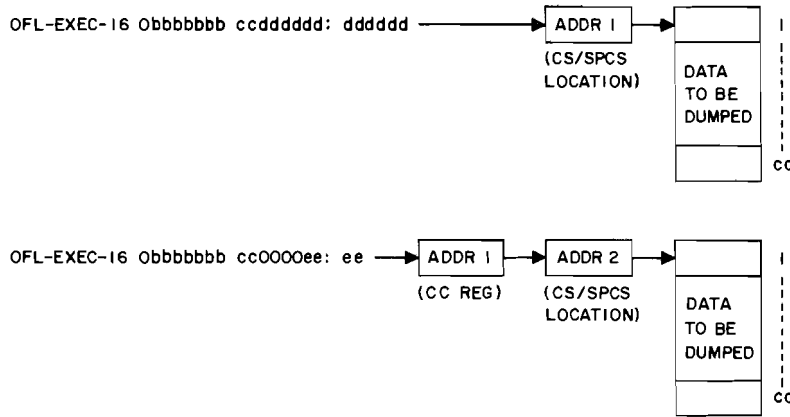
Fig. 2—OFL-EXEC-16 Levels of Indirectness

5.54 The dump is contained in either a TW02 or CCINT output message as follows:

For offices with generic programs prior to CTX-7 Issue 9 and 1E4, the dump is contained in output message TWO2 consisting of 32 words of 8-octal digits each. Reference should be made to 5.15 for a list of these words.

> ***Note:*** If a valid PS single error occurred, words 11 and 12 of the TW02 message will show the address of the PS error, and words 13 and 14 will show the error correction bits.

For offices with CTX-7 Issue 9, 1E4 and later generic programs, the dump is contained in output message CCINT which consists of 10 words of 8 octal digits each. In order, these words consist of the following:

(1) ACT-AR0=Snap of standby ASR (PS address)

(2) ACT-DR0=Snap of active ASR (PS address)

(3) ACT-AR1=Snap of standby COR bits (error correction bits)

(4) ACT-DR1=Snap of active COR bits (error correction bits)

(5) SBY-AR0=Snap of active ASR (PS address)

(6) SBY-DR0=Snap of standby ASR (PS address)

(7) SBY-AR1=Snap of active COR bits (error correction bits)

(8) SBY-DR1=Snap of standby COR bits (error correction bits)

(9) MACR=Contains 0555 in low order bits

(10) SBY-BREG=Contents of standby BR at time of interrupt

5.55 After the completion of the dump, use ØFL-MØDE-03 message followed by CC-RESTØRE-.

DUMPING CENTRAL CONTROL REGISTERS WHEN A CALL STORE SINGLE ERROR OCCURS (ØFL-EXEC-18)

5.56 The following message causes the contents of the active CC and the buffer registers to be printed (dumped) on the maintenance TTY when a CS single error occurs:

ØFL-EXEC-18 00000000 00000000.

5.57 The dump is contained in either a TW02 or CCINT output message as follows:

For offices with generic programs prior to CTX-7 Issue 9 and 1E4, the dump is contained in output message TW02 consisting of 32 words of 8-octal digits each. Reference should be made to 5.15 for a list of these words.

> *Note:* ØFL-EXEC-18 will cause a dump if a bad PS word is read but not if control is transferred to a bad PS word. If a valid CS single error occurred, words 11 and 12 of the TW02 message will show the address of the CS error, and words 13 and 14 will show the contents of the word.

For offices with CTX-7 Issue 9, 1E4 and later generic programs, the dump is contained in output message CCINT which consists of 9 words of 8 octal digits each. In order, these words consist of the following data:

(1) ACT-AR0=Snap of standby BR (CS data read or written)

(2) ACT-DR0=Snap of active BR (CS data read or written)

(3) ACT-AR1=Snap of standby IAOR (CS address)

(4) ACT-DR1=Snap of active IAOR (CS address)

(5) SBY-AR0=Snap of active BR (CS data read or written)

(6) SBY-DR0=Snap of standby BR (CS data read or written)

(7) SBY-AR1=Snap of active IAOR (CS address)

(8) SBY-DR1=Snap of standby IAOR (CS address)

(9) SBY-BREG=CS data read or written by SBY CC

5.58 After the completion of the dump, use the ØFL-MØDE-03 message followed by CC-RESTØRE-.

> *Note:* ØFL-EXEC-17 and -18 are more extensive error trapping messages than those discussed in 8.23 through 8.27 and do not stop when the first error is trapped. Do not forget to deactivate these routines.

6. STORING AN OFF-LINE PROGRAM IN CALL STORE AND EXECUTING BY STANDBY CENTRAL CONTROL (ØFL-PRØG)

6.01 The ØFL-PRØG message is used to load a special purpose program into the CS for off-line execution by the standby CC. This message automatically starts the program. The intent of this maintenance tool is to give flexibility in diagnosing troubles. The first loaded address is at mnemonic address M4GS+4 which is 0015707. Each instruction is loaded into two CS words. Instructions such as ENTJ are not allowed.

6.02 This message is variable in length, depending on the number of instructions in the program. The maximum length is 48 lines. The format of the message is

ØFL-PRØG-aaaaaaaaaaaaaa/

bbbbbbbbbbbbbbbb/

.

.

.

ccccccccccccc.

aaaaaaaaaaaaa = Thirteen octal digits used to set up the match control register (MACR) and the mode control register (MØCR) in the standby CC. *For generic programs prior to CTX-7 Issue 9 and 1E4,* the first six octal digits from the left are used to set up the MACR and the next seven octal digits are used to set up the MOCR. *For CTX-7 Issue 9, 1E4 and later generics,* the first five octal digits from the left are used to set up the MOCR and the next eight octal digits are used to set up the MACR.

If no change in MACR or MØCR is desired, zeros are typed into either the appropriate octal digits. The MACR and MØCR registers are part of the buffer bus system and control matching modes according to their contents. The bits of each register are listed, according to their functions, in CC diagnostic program PF-1A016. After the desired options have been selected, the binary number so obtained is converted to its octal equivalent for typing into the system.

For generic programs prior to CTX-7 Issue 9 and 1E4,

bbbbbbbbbbbbb = No. 1 ESS program orders in octal form.

For CTX-7 Issue 9, 1E4 and later generics,

bbbbbbbbbbbbb = No. 1 ESS program orders in octal form, as it would be from a program listing.

Each line is a separate instruction including operation, option, and data/address fields. The continue character (/) should be used to separate each of the 13-digit octal entries. The last line

of this message is fixed, as follows to indicate that the message is complete:

For generic programs prior to CTX-7 Issue 9 and 1E4,

ccccccccccccc = 1777777777777

For CTX-7 Issue 9, 1E4 and later generics,

ccccccccccccc = 3777737777777

6.03 The off-line configuration requires:

(a) Standby CC to be stopped

(b) A K-code 1 CS (either CS 0 or the highest numbered CS in the office).

6.04 The system types a response after each line of the message, including the last, to indicate its receipt. If an unfavorable response is received at the end of a line, the line should be repeated. The size of the CS area used to store instructions is limited. No more than 48 instructions (lines) can be typed in. If this upper limit is not observed, the input is disregarded.

6.05 The ØFL-PRØG message requires the active CC to control-write into the standby CC, and the standby CC must be stopped for this to be accomplished. If the standby CC is not stopped, it fails to receive the control-write and goes on doing the work it was performing prior to the attempted control-write. The message is ineffective even though an ØK response is typed out.

6.06 Once the ØFL-PRØG message is typed in, it is necessary to terminate off-line operation, as discussed in Part 7, before typing in the ØFL-PRØG message again.

7. TERMINATING OFF-LINE OPERATION

7.01 After the desired off-line tests are performed, proceed in accordance with the following steps in order to terminate the off-line configuration.

Note: ØFL-EXEC-02 message does not require termination. Messages ØFL-EXEC-04, -05, -16, -17, and -18 require only (3) and (6) below. For all other messages, use the entire procedure below as applicable.

(1) Type in the following message to halt off-line execution by stopping the off-line CC:

ØFL-MØDE-02.

(2) If an SP was included in the off-line operation, use the following message to stop it:

ØFL-MØDE-06.

Note: Do not use the ØFL-MØDE-06. message without the standby CC being stopped or the system will not accept it as a valid request.

(3) Type in the following message to clear the off-line memory areas and extinguish the OFF LINE lamp at the MCC:

ØFL-MØDE-03.

(4) Use one of the following input messages for each CS or SPCS to be returned to service:

cS
~~CC~~-RESTØRE-a b cc.

a = A for an SPCS community

= C for a CCCS community

b = S for a CS

= B for a bus

cc = Member number of the unit to be restored.

(5) If a PS was used in the off-line configuration, restore it to service by typing in the following message:

PS-RESTØRE-Saa.

aa = Unit number (00 through 11) of PS

(6) Restore the standby CC to normal service by typing in the following message:

CC-DGN-CCR.

Note 1: An alternate way of putting the CC back on line is:

CC-RESTØRE-.

Note 2: CC-RESTØRE does not usually diagnose the CC but blindly restores it to service. The CC will be diagnosed only if the system is unable to get it joined and running.

Caution: The above RESTØRE message should only be used during off-line memory dumps or if the testing done during off-line run time has in no way involved the CC directly; that is, no manual action has been performed on this unit (including the use of an oscilloscope). There is always the danger that any activity can be the cause of a system-degrading condition. The potential harm of such a condition, if it exists, is minimized by subjecting the CC involved to complete diagnosis before its restoral to the system.

(7) Restore the standby SP to normal service if it was involved in the off-line configuration by typing the following message:

SP-DGN-ANR.

Note 1: An alternate way of putting the SP back on line is:

SP-RESTØRE-A.

Note 2: SP-RESTØRE returns the standby SP unconditionally to service.

Caution: Do not type in the SP-RESTØRE message if the SP is causing system trouble and may possibly harm the system if returned to service.

Note: The caution statement under (6) above is also applicable to the SP.

(8) The following input message establishes a normal call processing configuration with all available PS units:

PS-NØRMAL-.

7.02 The termination procedure outlined in 7.01 (1) through (7) automatically subjects the units to a diagnosis and restores them to service if the unit passes the tests. If the unit does not

pass the tests, appropriate system actions are taken and TTY messages are printed out.

8. EXAMPLES OF OFF-LINE TESTS

Note: The following examples are by no means the only off-line tests possible. One objective here is to show the proper sequence of TTY messages to set up, test, and terminate off-line operations.

CENTRAL CONTROL FAULT RECOGNITION TEST ROUTINES

8.01 Table A lists 12 CC-FØR (fault recognition) programs which can be used off-line. These tests can be initiated by an on-line system; however, in the case of a marginal trouble, the fault may not occur when the FØR program is run on-line. While the system is on-line, the test routine is executed only once. Off-line testing can be utilized to repeatedly execute the desired test routine using the following message:

ØFL-EXEC-01 0bbbbbbb 0ccccccc.

8.02 The test routines in Table A may be called in as follows. The address of program CC TEST is typed in this message as bbbbbbb. CC TEST, in turn, starts one of the other programs in the list which is specified by keying in the start address on the PROGRAM CONTROL keys at the MCC. The BLCK key is released. (The DATA lamp is lighted.) The 23 PROGRAM CONTROL keys then specify the start address of one of the above programs when the message is typed in. Each program is self-looping; that is, it returns to CC TEST when satisfactorily completed. CC TEST again starts the subject program and so on. If any of the tests fail, the loop described above is not maintained and control is transferred to program CC SWAP. Normally, this program would take actions appropriate to a failure; however, if the address of CC SWAP is specified as the breakpoint address in variable ccccccc, the match would cause a return to CC TEST and from there to the subject program and so on. Thus, a continuous loop along this path is maintained.

8.03 The off-line procedure utilizes a short looping program to repeatedly execute the selected

TABLE A

CC-FOR TEST ROUTINES

SYMBOLIC START ADDRESS	BRIEF DESCRIPTION OF TEST ROUTINE
CC TEST	Monitors remaining programs in list
CCAS21	Error detection and correction 1
CCBS21	Error detection and correction 2
CCCB21	Error detection and correction 3
CCAS22	Index adder
CCAS23	Register
CCAS24	Parity generator
CCAS25	Mask and complement
CCAS26	Insertion mask
CCAS27	PS address incrementing
CCAS28	Homogeniety logic
CCAS32	K register and logic 1
CCBS32	K register and logic 2

test routine and to set up a breakpoint match mode on the address of CC SWAP + 1 to restart the loop if any tests fail. The CC-FØR symbol reference table in the program listing (PIDENT CCFRS OR CCFRP) must be consulted to obtain three *absolute* PS addresses (PR-1A015):

    (a) Octal address of CC SWAP

    (b) Octal address of CC TEST

    (c) Octal address of selected test routine in Table A.

All memory units and buses must be available so that the standby CC may be used off-line.

8.04 Use the following procedure.

    (1) Set up an off-line configuration. Refer to 5.02 for the required selections and to 3.02 for variable data.

    (2) Set MCC PROGRAM CONTROL locking keys [buffer bus (BB) location 17] to the binary equivalent of the octal address of the selected test routine from Table A.

    (3) Set up the breakpoint match mode for possible test failures by typing in the following message:

ØFL-EXEX-01 0bbbbbbb 0ccccccc.

    bbbbbbb = Octal address of CC TEST

    ccccccc = Octal address of CC SWAP+1

    (4) Use an oscilloscope to observe the results of this test.

8.05 The off-line mode will be maintained until it is manually terminated or a maintenance interrupt action occurs in the active CC or an off-line unit is restored to system use. In this case, the preferable procedure is to restore all units (as given below) and to set up the mode from the beginning again. To end the off-line mode, use the following procedure.

    (1) Stop the standby CC by typing in

ØFL-MØDE-02.

    (2) Discontinue the off-line mode by typing in

ØFL-MØDE-03.

    (3) Restore MCC PROGRAM CONTROL locking keys (BB17) to their normal state.

    (4) Restore the PS to normal by typing in the following message:

PS-RESTØRE-Saa.

    = Member number (00 through 11) of PS to be returned to service.

    (5) Restore the CS to normal by typing in the following message:

CS-RESTØRE-CS cc.

CS-RESTØRE-CB cc.

Refer to 7.01(4) for variable data.

    (6) Return the CC to normal (unless it is desired to leave the CC out of service) by typing in

CC-DGN-CCR.

    (7) Restore the system to a normal configuration by typing in the following message:

PS-NØRMAL-.

Note: Portions of other CC test programs may be executed in the off-line mode. Each test program must be carefully checked to ensure that a loop can be set up and maintained. Failure transfers may cause the loop to be broken, so that the break point address match must be set at the end of the required test but before a transfer decision is made. Only tests which are independent of duplicate CCs can be executed; thus, matcher and interrupt tests are not meaningful in the off-line mode.

IDENTIFYING A PROGRAM STORE CAUSING SINGLE ERRORS

8.06 The test examples following 8.18 are designed to test PS readout circuitry. The tests assume that the faulty PS has been identified. If the faulty PS has been identified, proceed to 8.18.

8.07 When the system detects an excessive amount of single errors, the automatic actions of the error programs result in either:

(a) Removing the faulty unit from service and having it diagnosed.

(b) Generating an output message that contains the error record tables. This occurrence indicates that an error problem occurred and disappeared before the faulty unit could be identified.

A. Case No. 1—Unit Removed From Service by Error Programs

8.08 When a PS is removed from service due to a single-error problem, the store is automatically diagnosed in an effort to find the faulty circuit pack. If the store fails diagnosis, either the DR01 main diagnostic program output message or the PS01 supplementary output message which follows the main diagnostic output message should provide the necessary information needed to identify the faulty circuit pack. However, if the PS should pass diagnosis, the PS01 output message, which in this case accompanies the diagnostic ALL TESTS PASS message, supplies the identity of the PS that was removed from service and indicates whether the trouble was repeatable or was not repeatable at the time the PS was removed from service.

8.09 If the trouble was nonrepeatable, PS01 output message indicates that the trouble was found by the error programs. If the trouble was originally repeatable, PS01 output message indicates that the trouble was handled by the deferred fault recognition (DFØR) programs. The fact that the diagnostic program cannot find the trouble indicates that the fault is intermittent or address dependent.

8.10 When the diagnostic program cannot locate the cause of the error problem, Tests A through G should be used. However, before proceeding, the following series of messages should be typed into the system in the order shown to establish that the trouble is indeed a single-error problem.

(1) PCS-INITERR-. (Initialize error programs.)

(2) T-READ-0015130 02. (Read accumulated single-error counts). Address 0015130 is symbolic name P6MIR4; see PF-1A031 for details.

(3) PS-RESTØRE-Sa. or PS-RESTØRE-Saa. (Restore PS to service.)

(4) T-READ-0015130 02. (Read accumulated single-error counts.)

8.11 Repeat 8.10(4) several times or until the PS is removed from service by the system. If the readings obtained in (4) are larger than those of (2), then the problem is of a single-error nature. Remove the PS from service (PS-REMØVE-Sa or PS-REMØVE-Saa) and proceed as indicated in 8.18. If the counts do not increase and the system removes the PS from service, the trouble is not of a single-error nature. Repeating the PS diagnosis may pinpoint such a trouble; otherwise, an off-line loop must be established which repeatedly reads the PS at some address while exact waveforms within the PS are examined with an oscilloscope.

B. Case No. 2—Unit Not Removed From Service by Error Programs

8.12 When the error trapping program does not collect a sufficient amount of error data to identify the unit which should be removed from service, the system eventually dumps the error record tables (via PS08 and PS09 output messages). The contents of PS09 output message indicate whether the system experienced a PS single-error problem. The contents of PS08 output message may or may not indicate the suspected store. If errors were encountered during error trapping, PS08 generally indicates that a group of equipment, including a PS, a bus, and a CC, is suspected. The bad unit is usually the indicated PS even though this assumption should be confirmed before attempting to pinpoint the trouble.

8.13 The PS08 message fails to identify the suspected store if the error problem completely vanishes as soon as the error trapping is started. Such a situation may arise for one of the following reasons.

(a) The trouble is strictly a marginal hardware component that did not fail while the system was error trapping.

(b) The trouble, being either a hardware or marginal fault, is associated with the operation of some particular program, and the offending program either did not or cannot run while the error trapping program is active.

8.14 With only one single-error record table dump, there is no possible way to be sure which of the two conditions is causing the error problem. Therefore, the error parameters should be adjusted to new values which cause the system to start the error trapping problem as soon as the first single error is detected by the error scan programs. This is done by typing in the following message:

PS-ALTERR-1 00040002 00000000.

(Alter error parameters.)

8.15 If the subsequent dumps of the error record tables do not identify the PS which is causing the single-error problem, the only recourse is to remove one store at a time from service and to note if the error problem goes away when a given PS is removed from service. This is done by typing in the following message:
PS-REMØVE-Saa.

aa = PS to be removed from service.

8.16 If removing a given PS from service does not clear up the error problem, it may be returned to normal by typing in the following message:
PS-RESTØRE-Saa.

aa = PS to be returned to service.

The next PS may then be removed from service, etc.

8.17 When the faulty PS has been located, the error parameters should be returned to normal by typing in the following message:

PS-ALTERR-0 00000000 00000000.

LOCATING PROGRAM STORE SINGLE ERRORS

8.18 The following tests should now be followed in order to locate the trouble within the PS. Table B lists symptoms and the recommended sequence of tests.

A. Test A—Deferred Fault Recognition Tests

8.19 Use the following procedure.

(1) Request the system to perform deferred FØR tests on all PSs by typing in

PS-DFØR-0000000.

A PS06 message reports on the results of this test. No failing address test is made. If PSs fail deferred FØR tests, the trouble is not address sensitive and should be found by the diagnostic program. Therefore, (2), (3), and (4) are not applicable.

(2) Request the system to perform a failing address test at the location specified by typing in

PS-DFØR-aaaaaaa.

aaaaaaa = Octal address to be checked.

A PS06 message reports on the results of this test.

Note: If the tests fail, the probable causes are

(a) Bad magnet on twistor card

(b) Bad twistor card

(c) Bad module of twistor cards

(d) Broken twistor wire and/or

(e) Module or twistor wire out of alignment.

(3) If inconsistent results are obtained, repeat (1) and (2).

(4) If a failing address is found, adjacent locations on the same twistor card should be tested by repeating (2) except supplying the adjacent address.

(5) If adjacent addresses are ØK, repeat (2) for the corresponding address on adjacent twistor cards.

B. Test B—Verification

8.20 Use the following procedure to request the system to set up conditions to match duplicate modules.

TABLE B

KEY SHEET FOR TROUBLESHOOTING TESTS

SYMPTOM	GENERAL TYPE OF TROUBLE	LIKELY CAUSE	OTHER POSSIBLE CAUSES	RECOMMENDED ORDER OF APPLICABLE TESTS
PS was removed from service by the error programs and passes diagnosis. PS01 output message gives ERR. Error problem causes repeated dumps of the error record tables (PS08 and PS09 output messages).	Marginal readout channel	Marginal low level selector	Marginal readout amplifier, sampler, pulse originator, cable driver, or magnet on twistor card	(1) Test D, Trap Errors (2) Test C, Partial Diagnosis (3) Test E, Off-line program using test address. If no test address is available, skip Test E and proceed to next test. (4) Test F, Off-line program using PS maintenance test words
PS removed from service by the deferred FOR programs but passes diagnosis. PS01 output message gives DFOR.	Repeatable address sensitive fault	Bad twistor card	Broken twistor wire Module out of alignment	(1) Test A, Deferred FOR Programs (2) Test B, Verification (3) Test G, loop on test address and provide sync pulse

Note: It is assumed that the faulty PS has been identified. (See 8.07 for procedures to identify the faulty unit if identity is not known.)

(1) Type in the following message:

MCW-VERIFY-CPY bb cc.

bb = Number (00 through 11) of PS containing module to be verified.

cc = Octal number (00 through 17) of module to be verified.

(2) Depress FRAME CONTROL—REQ INH pushbutton on the PS control panel. If a favorable MA07 output message is obtained, proceed to (3); if an output message is not obtained, repeat (1) and (2). If output message still fails, scan point or pushbutton may be fault.

(3) Depress FRAME CONTROL—VER pushbutton on the PS control panel. CW04 and CW13 messages report the results.

8.21 Results obtained from verifying modules of the same MOD group and modules of other MOD groups (Fig. 3) should indicate a faulty store, module, twistor tape, twistor card, word, or a single bit.

C. Test C—Partial Diagnosis

8.22 To request the system to diagnose only the readout channels, type in the following message:

PS-PARDGN-07 07 Saa.

aa = Number (00 through 11) of PS containing channels.

Test results are printed out in the DR01 or PS01 message. Repeat the test several times to make sure no marginal problem exists.
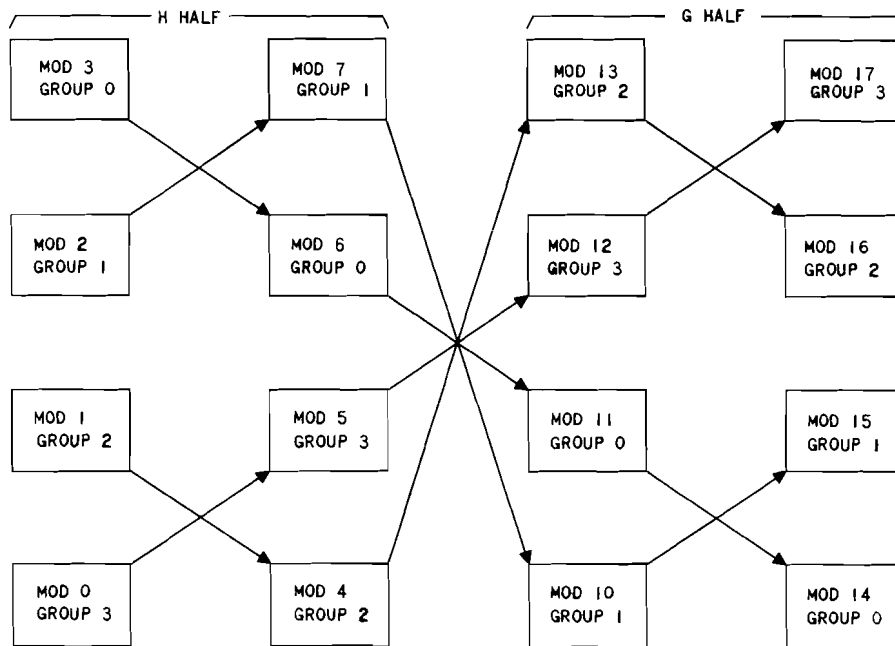
Fig. 3—PS Module Array

D. Test D—Trap Errors

8.23 Use the following procedure to trap errors.

(1) If the PS is removed from service, type in the following message:
PS-REST∅RE-Saa.

aa = Number of PS being restored.

If the system does not leave the PS in service long enough to trap errors, type in PCS-SKIPERR-4 and then repeat (1).

(2) Start trapping errors for a maximum of one minute by typing in

PCS-TRAPPER-6.

A PS05 output message gives the central control corrections bits. A simple conversion of the correction bits gives the bit position of the single error. Reference should be made to output message manual. If correction bits are obtained, the entire test should be repeated to ensure consistent results.

Note: If a time-out occurs and no correction bits are obtained, type in

PCS-TRAPPER-5.

This message remains active until the next hourly routines are performed. When this message is received, the program initiates the correction bit trap mode when and if the error parameter is exceeded.

(3) If error locations are found, the PS can be removed from service by typing in the following message:
PS-REM∅VE-Saa.

aa = Number of PS to be removed from service.

(4) If no error locations are found, the system may be requested to scan for excessive errors by typing in

PCS-INITERR-.

E. Test E—Looping on Test Address

8.24 This test results in taking a PS, a CS, and a CC off-line and in running a program which has been precoded from the CS. The program is designed to read at a test address (supplied as part of the input message) and then to read at the address of a known test word. The program loops on a particular combination of given address and test word address for 100 readings and then goes on to another test word address. There are 24 test word addresses that are used by the program for looping. After all 24 combinations are exercised, the entire loop is repeated. This manner of exercising the readout circuitry should cause a marginal pack to fail and to be detected by the error trapping program which is started by the trap error message. The resulting PS05 message should be carefully analyzed since errors could have been detected in the active system.

8.25 Use the following procedure to establish the required off-line configuration.

(1) Type in one of the following messages:

ØFL-CØNFIG-aa 0 00 0.
(Non-SP offices)
ØFL-CØNFIG-aa 0 00 0 99 0.
(SP offices)

aa = Number (00 through 11) of PS being tested.

(2) Start the off-line test by typing in one of the following:

(a) *In offices with generic programs prior to CTX-7 Issue 9 and 1E4,* type in

ØFL-PRØG-0005550000203/
003400 (TEST ADDR)/
0030037777777/
000410000 4050
003440aa37702/ (See Note.)
0400400015731/
0400400015731/
003440aa40102/ (See Note.)
0400400015731/
0035100015715/
0005000016000
0031137777772/
0035437777633/

0275100000000/
0165200000000/
0152700000000/
0153500000000/
0310400000000/
0152700000000/
0153500000000/
1343060015743/
1103060015735/
0274400100000/
0015100016000/
0140400000000/
1777777777777.

*Use 015270 if information block is in H half of PS or 015350 if information block is in G half of PS.

(b) *For offices with CTX-7 Issue 9, 1E4 and later generic programs,* type in:

ØFL-PRØG-0020300055500/
007000 (TEST ADDR)/
0060037777777/
0010200004050/
007100aa37702/ (See Note.)
1001000015731/
1001000015731/
007100aa40102/ (See Note.)
1001000015731/
0072200015715/
0012000016000/
0062237777772/
0073037777633/
0572200000000/
0352400000000/
0325600000000/
0327200000000/
0621000000000/
0325600000000/
0327200000000/
2706120015743/
2206120015735/
0571000100000/
0032200016000/
0301000000000/
3777737777777.

*Use 032560 if information block is in H half of PS or 032720 if information block is in G half of PS.

Note 1: See Table C for the symbolic coding of this program.

TABLE C

SYMBOLIC CODE OF OFF-LINE PROGRAM FOR LOOPING ON TEST ADDRESS

LOCATION	INSTRUCTION		COMMENTS
(15707) BGN	WY	TEST ADDR	Set Y to test addr
(15711)	WB	Ø.37777777	Initialize interrupt
(15713)	BM	B8ILAF	Level act F/F
(15715) ØNE	WX	Ø.H/GKCODE+37702	Set X to addr of test word
(15717)	T	LØØP,,J	To loop
(15721)	T	LØØP,,J	To loop
(15723)	WX	Ø.H/GKCODE+40102	Set X to addr of test word
(15725)	T	LØØP,,J	To loop
(15727)	WJ	ØNE	Set J for repeat test
(15731) LØØP	JM	TEMP	Save return addr
(15733)	WF	—5	Set F for block addr
(15735) +2	WZ	—100	Set Z for 100 readings
(15737)	WJ	O, X	Move X to J
(15741)	AFR	O, J	Add F to J
(15743) +5	XHKC GKC	O, J	Read test word
(15745)	MC	O, Y	Read test addr
(15747)	XHKC GKC	O, J	Read test word again
(15751)	TRAU	LØØP+5, ZA	Is it 100 readings?
(15753)	TRAU	LØØP+2, FA	Is it last of block?
(15755)	WX	E. 15, X	Next of same block
(15757)	MJ	TEMP	Restore J reg
(15761)	T	O, J	Resume for next block of Test Word addr

Note 1: 15707-15762 are the call store locations where the program is loaded in order to be executed.

Note 2: Address 16000 (TEMP) is used as a scratch word for the RA.

Note 2: Supply aa as follows for bits 15 through 20:

TEST ADDRESS	INFORMATION BLOCK	OCTAL DIGITS TO INSERT (aa)
10XXXXX-11XXXXX	0	10
12XXXXX-13XXXXX	1	12
14XXXXX-15XXXXX	2	14
16XXXXX-17XXXXX	3	16
20XXXXX-21XXXXX	4	20
22XXXXX-23XXXXX	5	22

(3) Start error trapping by typing in

PCS-TRAPPERR-7.

(4) Discontinue the off-line mode by typing in the following messages:

ØFL-MØDE-02.

ØFL-MØDE-03.

CS-RESTØRE-CS 00.

CS-RESTØRE-CB 00.

PS-RESTØRE-Saa. (See 7.01.)

CC-DGN-CCR.

PS-NØRMAL-.

F.   Test F—Looping on Test Words

8.26   This off-line program loops in the same manner as Test E except that no test address is supplied with the input messages so that the program loops on the addresses of the known test words.   The same configuration is required as in Test E.

8.27   Use the following procedure:

(1) Establish the off-line configuration by typing in

ØFL-CØNFIG-aa 0000.
(Non-SP offices)

ØFL-CØNFIG-aa 0000990.
(SP offices)

See 3.02 for variable data.

(2) Start the off-line program by typing in one of the following:

(a) *For offices with generic programs prior to CTX-7 Issue 9 and 1E4,* type in:

ØFL-PRØG-0005550000203/
003110aa00000/ (See note.)
0030037777777/
0004100004050/
0136400037675/
0034037777750/
0034437777772/
1304500016077/
0235400100000/
1305500016077/
0303000015743/
0236400000001/
1243060015723/
0136400040075/
0000400015721/
0002100016100/
0034400000000/
1251100016050/
0274000000000/
1315400016050/
0343220015745/
0035137777633/
0112700000007/
0113500000000/ *
0352700000007/
0353500000000/ †
0112700000007/
0113500000000/ *
1143060015761/
1315400016050/
0343060015757/
0000400015747/
1777777777777.

*Use 011270 if information block is in H half of PS or 011350 if information block is in G half of PS.

†Use 035270 if information block is in H half of PS or 035350 if information block is in G half of PS.

(b) *For offices with CTX-7 Issue 9, 1E4 and later generic programs,* type in:

ØFL-PRØG-0020300055500/
006220aa00000/ (See Note.)
0060037777777/
0010200004050/
0175000037675/
0070037777750/
0071037777772/
2611200016077/
0473000100000/
2613200016077/
0606000015743/
0675000000001/
2506120015723/
0275000040075/
0001000015721/
0004200016100/
0071000000000/
2522200016050/
0570000000000/

2633000016050/
0706420015745/
0072237777633/
0225600000000/ *
0227200000000/
0725600000000/ †
0727200000000/
0225600000000/ *
0227200000000/
2306120015761/
2633000016050/
0706120015757/
0001000015747/
3777737777777.

* Use 022560 if information block is in H half of PS or 022720 if information is in G half of PS.

† Use 072560 if information block is in H half of PS or 072720 if information is in G half of PS.

Note 1: See Table D for the symbolic coding of this program.

TABLE D

SYMBOLIC CODE OF OFF-LINE PROGRAM FOR LOOPING ON TEST WORDS

LOCATION	INSTRUCTION		COMMENTS
(15707) BGN	WF	KCODE	Set F to H or G K code
(15711)	WB	∅.37777777	Initialize interrupt
(15713)	BM	B8ILAF	Level activity F/F
(15715)	WK	∅.37675, F	Set K to first Test Word addr
(15717)	WY	—23	Set Y for table index
(15721)	WX	—5	Test words in groups of 6
(15723) TGEN	KM	TABLE+23, YA	Load Test Word addr in table
(15725)	WZ	E.15, K	Add E.15 to Test Word addr
(15727)	ZM	TABLE+23, YA	Load Test Word addr in table
(15731)	TRP	G∅∅N, Y	Is the table loaded?
(15733)	WK	1, K	Next Test Word addr
(15735)	TRAU	TGEN, XA	Group done?
(15737)	WK	∅.40075, F	Next group
(15741)	T	TGEN-1	Continue in loop
(15743) G∅∅N	EZEM	TABLE+24	Table end code
(15745)	WX	0	Set table PTR 1
(15747)	MF	TABLE, XA	Bring in Test Word addr
(15751)	WY	0, X	Set table PTR 2
(15753)	MZ	TABLE, YA	Bring in Test Word addr
(15755)	TRAZ	G∅∅N+1, Z	Table done?
(15757) L∅∅P	WJ	—100	Set J for 100 times
(15761)	XHKC GKC	0, F	Read first Test Word addr
(15763)	XHKC GKC	0, Z	Read next Test Word addr
(15765)	XHKC GKC	0, F	Read first Test Word addr
(15767)	TRAU	L∅∅P+1, JA	Is it 100 times?
(15771)	MZ	TABLE, YA	Bring in next Test Word addr
(15773)	TRAU	L∅∅P, Z	Table done?
(15775)	T	BEAT	Continue

Note 1: 15707-15776 are the call store locations where the program is loaded in order to be executed.

Note 2: 16050-16100 are used as scratch words for the test word address table.

Note 2: Supply aa as follows for bits 15 through 20:

X20	X19	X18	X17	X16	X15	INFOR-MATION BLOCK	OCTAL DIGITS TO IN-SERT (aa)
0	0	1	0	0	0	0	10
0	0	1	0	1	0	1	12
0	0	1	1	0	0	2	14
0	0	1	1	1	0	3	16
0	1	0	0	0	0	4	20
0	1	0	0	1	0	5	22

(3) Start the error trapping by typing in

PCS-TRAPERR-7.

(4) Discontinue the off-line mode by typing in the following messages:

ØFL-MØDE-02.

ØFL-MØDE-03.

CS-RESTØRE-CS 00.

CS-RESTØRE-CB 00.

PS-RESTØRE-Saa. (See 7.01.)

CC-DGN-CCR.

PS-NØRMAL-.

G. Test G—Sync Pulse

8.28 This off-line program loops on a test address. The operation of the store can be observed with an oscilloscope. The sync pulse is generated by standby CC matcher 0 (M0) each time the PAR equals the selected PS test address.

8.29 Use the following procedure:

(1) Type in

ØFL-CØNFIG-aa 0 00 0.
(Non-SP offices)

ØFL-CØNFIG-aa 0 00 0 99 0.
(SP offices)

aa = Number (00 through 11) of PS causing errors.

(2) Initialize CC registers by typing in

ØFL-EXEC-07 00000002 0*******

(3) Start looping by typing in one of the following:

(a) *For offices with generic programs prior to CTX-7 Issue 9 and 1E4,* type in

ØFL-PRØG-0000000000042/
001040*******/
0000400015707/
1777777777777.

*Supply program store test address.

(b) *For offices with CTX-7 Issue 9, 1E4 and later generic programs,* type in:

ØFL-PRØG-0004200000000/
002100*******/
0001000015707/
3777737777777.

* Supply program store test address.

(4) Discontinue the off-line mode by typing in the following messages:

ØFL-MØDE-02.

ØFL-MØDE-03.

CS-RESTØRE-CS 00.

CS-RESTØRE-CB 00.

PS-RESTØRE-Saa. (See 7.01.)

CC-DGN-CCR.

PS-NØRMAL-.

PROCEDURE FOR USING ∅FL-EXEC MESSAGES

8.30 The procedure for using the OFL-EXEC messages is tabulated for easy reference in Tables E through AG. These examples show the minimum sequence of messages which should precede and succeed the OFL-EXEC messages. In tables where it occurs, messages above the cross-hatched area are for initiating the off-line operation, and messages below it are for terminating the off-line operation and restoring the system to normal. Numbers in parentheses refer to paragraphs which contain specific information.

PROGRAM ∅LCP15 TEST ROUTINES

8.31 The following procedure assumes that information to be included on the PS memory card is available. Two cards with identical information are required. The ∅FL-EXEC-03 input message and PS memory card are explained in 5.12 and 5.13. The required off-line configuration is a CC, a PS containing information block 0 (PS 0 or PS 1), and a K-code 1 CS (either CS 0 or highest numbered CS in office). The first address of the card is 1027300 and the last address is 1027377.

8.32 Use the following procedure to insert desired information into recent change area of the CS and then into the PS.

(1) Type in the following recent change message for right-half PS words:

For CTX-5 and earlier generics, use:

    RC-CHPSWD-.
    ADD: 1027300, (First octal address)
    DAT: aaaaaaaa↑

For CTX-6 and later generics, use:

    RC: PSWD:/
    ADD 1027300/ (first octal address)
    DAT aaaaaaaa!

    aaaaaaaa = First octal data word to be used; rightmost eight digits for right-half of PS word.

(2) Type in the following recent change message for left-half PS words:

For CTX-5 and earlier generics, use:

    RC-CHPSWD-.
    ADD: 5027300, (first octal address)
    DAT: 000bbbbb↑

TABLE E

USING ∅FL-EXEC-01 IN NON-SP OFFICES

STEP	TTY MESSAGE	SYSTEM ACTION
1	∅FL-C∅NFIG-aa b cc d. (3.02)	Establish off-line configuration
2	∅FL-M∅DE-05. (4.01)	Release MAC scratch pad.
3	∅FL-EXEC-01 0bbbbbbb 0ccccccc. (5.02)	Looping of selected program begins.
4	∅FL-M∅DE-02.	Stop off-line CC.
5	∅FL-M∅DE-03.	Clear off-line memory areas.
6	CS-REST∅RE-CS cc. (7.01)	Diagnose units and return them to service if tests pass. Return system to normal configuration.
7	CS-REST∅RE-CB cc. (7.01)	
8	PS-REST∅RE-S aa. (7.01)	
9	CC-DGN-CCR.	
10	PS-N∅RMAL-.	

TABLE F

USING ØFL-EXEC-01 IN SP OFFICES

STEP	TTY MESSAGE	SYSTEM ACTION
1	ØFL-CØNFIG-aa b cc d ee f. (3.02)	Establish minimum off-line configuration.
2	ØFL-MØDE-05. (4.01)	Release MAC scratch pad.
3	ØFL-EXEC-01 0bbbbbbb 0ccccccc. (5.02)	Looping of selected program begins.
4	ØFL-MØDE-02.	Stop off-line CC.
5	ØFL-MØDE-06. (Omit if an SP was not included in off-line operation.)	Stop off-line SP.
6	ØFL-MØDE-03.	Clear off-line memory areas.
7	CS-RESTØRE-AS cc. (7.01) (Omit if SPCS was not included.)	Diagnose units and return them to service if tests pass. Return system to normal configuration.
8	CS-RESTØRE-AB cc. (7.01) (Omit if SPCS bus was not included.)	
9	CS-RESTØRE-CS cc. (7.01)	
10	CS-RESTØRE-CB cc. (7.01)	
11	PS-RESTØRE-S aa. (7.01)	
12	CC-DGN-CCR.	
13	SP-DGN-ANR. (Omit if SP was not included.)	
14	PS-NØRMAL-.	

For CTX-6 and later generics, use:

RC: PSWD:/
ADD 5027300/ (first octal address)
DAT bbbbb!

bbbbb = First octal word to be used; left-most five digits for left-half of PS word.

(3) Repeat (1) and (2) for each additional data word to be used.

(4) Update the PS module in which the data is to be used (module 1 in the H-half of PS 0 and module 1 in the G-half of PS 1). Refer to Section 231-004-301 or 231-109-301 for procedure.

8.33 The following steps are used to verify that the new information on the PS memory card (test card) is correct.

(1) Obtain a copy of the right-half word in the PS by typing in

T-READ-1027300 xx.

(2) Obtain a copy of the left-half word in the PS by typing in

T-READ-5027300 xx.

xx = Length of test program.

USING ØFL-EXEC-02
(ACTIVE CC EMITS SYNC PULSE)

STEP	TTY MESSAGE	SYSTEM ACTION
1	ØFL-EXEC-02 0bbbbbbb 00000000. or ØFL-EXEC-02 00000000 00cccccc.	A sync pulse is emitted when the specified PS, CS, or SPCS address is matched. *Note 1:* An off-line configuration cannot exist when the sync pulse comes from the active CC. *Note 2:* Do not use ØFL-MØDE-02. after the above message if an off-line configuration is not used. *Note 3:* This off-line does not require termination messages.

System response to each message is TW02 with xx 8-digit octal numbers. If xx is greater than decimal 16, successive T-READ messages must be made to obtain all the information in the test program. Octal 20 must be added to the preceding address to obtain the next successive T-READ message. Eight successive T-READ messages will be required if the entire test card is utilized. If errors are found, correct them by repeating the necessary recent change messages and updating the PS memory cards.

8.34 If the desired PS memory card is available but is not loaded into PS, use the following procedure to place the cards into both information block 0 PSs.

(1) Remove PS 0 from service by operating FRAME CONTROL—REQ INH pushbutton on control panel of PS 0.

(2) When FRAME CONTROL—OS lamp on PS 0 control panel lights, place the test card in location PS 0 module 1, PASS 0, card 73.

(3) Type in the appropriate MCW-VERIFY message to check for errors and/or mismatches. (See TTY input message manuals.)

Note: There should be no errors associated with the test card and the number of mismatches

should be equal to the number of overwritten instructions on the test card.

(4) Operate FRAME CONTROL—VER pushbutton on the control panel of PS 0. Expect 64 or less mismatches on module 1, PASS 0, card 73 only.

(5) Restore PS 0 to service by operating FRAME CONTROL—NOR pushbutton on control panel for PS 0.

(6) When PS 0 has been restored to service by the system, remove PS 1 from service by operating FRAME CONTROL—REQ INH pushbutton on control panel of PS 1.

(7) When FRAME CONTROL—OS lamp on PS 1 control panel lights, place the test card in location PS 1 module 11, PASS 0, card 73.

(8) Type in the appropriate MCW-VERIFY message to check for errors and/or mismatches. (See TTY input message manuals.)

Note: There should be no errors or mismatches associated with the test card.

(9) Operate FRAME CONTROL—VER pushbutton on the control panel of PS 1. Expect no errors.

TABLE H

USING ØFL-EXEC-02 IN NON-SP OFFICES
(STANDBY CC EMITS SYNC PULSE)

STEP	TTY MESSAGE	SYSTEM ACTION
1	ØFL-CØNFIG-aa b cc d. (3.02)	Establish minimum off-line configuration.
2	ØFL-MØDE-05. (4.01)	Release MAC scratch pad.
3	ØFL-EXEC-02 0bbbbbbb 00000000. or ØFL-EXEC-02 00000000 00cccccc. (5.07)	A sync pulse is emitted by the standby CC when the specified PS, CS, or SPCS address is matched.
4	ØFL-EXEC-06 0bbbbbbb 00000000. (5.20)	PAR of off-line CC is initialized to starting address.
5	ØFL-MØDE-01.	The off-line CC is started at address bbbbbb of Step 4.
6	ØFL-MØDE-02.	Stop off-line CC.
7	ØFL-MØDE-03.	Clear off-line memory areas.
8	CS-RESTØRE-CS cc. (7.01) (Omit if CCCS was not off-line.)	Diagnose units and return them to service if tests pass. Return system to normal configuration.
9	CS-RESTØRE-CB cc. (7.01) (Omit if CCCS bus was not off-line.)	
10	PS-RESTØRE-S aa. (7.01) (Omit if PS was not off-line.)	
11	CC-DGN-CCR.	
12	PS-NØRMAL-.	

(10) When the verify indicates no errors or mismatches, restore PS 1 to service.

8.35 To repeatedly execute program ØLCP15 after the PMT test cards are in the PS, use the following procedure.

(1) Type in one of the following messages:

ØFL-CØNFIG-aa b cc d. (non-SP offices)

ØFL-CØNFIG-aa b cc d ee f. (SP offices)

Refer to 3.02 for variable data.

(2) Type in

ØFL-MØDE-05.

(3) Type in

ØFL-EXEC-03 00000000 00000000.

(4) Use an oscilloscope to observe the results of this test. The 779A bit matcher is used to obtain a sync pulse (Section 231-001-301).

8.36 The off-line mode will be maintained until it is manually terminated or until a maintenance interrupt action occurs in the active CC or an off-line unit is restored to system use. In this case, the preferable procedure is to restore all units (as given below) and to set up the mode from the beginning again. To end the off-line mode

TABLE I

USING ∅FL-EXEC-02 IN SP OFFICES
(STANDBY CC EMITS SYNC PULSE)

STEP	TTY MESSAGE	SYSTEM ACTION
1	∅FL-C∅NFIG-aa b cc d ee f. (3.02)	Establish minimum off-line configuration.
2	∅FL-M∅DE-05. (4.01)	Release MAC scratch pad.
3	∅FL-EXEC-02 0bbbbbbb 00000000. or ∅FL-EXEC-02 00000000 00ccccccc; (5.07)	A sync pulse is emitted by the standby CC when the specified PS, CS, or SPCS address is matched.
4	∅FL-EXEC-06 0bbbbbbb 00000000. (5.20)	PAR of off-line CC is initialized to starting address.
5	∅FL-MODE-01.	The off-line CC is started at address bbbbbb of Step 4.
6	∅FL-M∅DE-02.	Stop off-line CC.
7	∅FL-M∅DE-06. (Omit if an SP was not included in off-line operation.)	Stop off-line SP.
8	∅FL-M∅DE-03.	Clear off-line memory areas.
9	CS-REST∅RE-AS cc. (7.01) (Omit if SPCS was not included.)	Diagnose units and return them to service if tests pass. Return system to normal configuration.
10	CS-REST∅RE-AB cc. (7.01) (Omit if SPCS bus was not included.)	
11	CS-REST∅RE-CS cc. (7.01) (Omit if CCCS was not included.)	
12	CS-REST∅RE-CB cc. (7.01) (Omit if CCCS bus was not included.)	
13	PS-REST∅RE-S aa. (7.01) (Omit if PS was not included.)	
14	CC-DGN-CCR.	
15	SP-DGN-ANR. (Omit if SP was not included.)	
16	PS-N∅RMAL-.	

and to restore the system, use the following procedure.

(1) Discontinue the off-line program by typing in

ØFL-MØDE-02.

(2) Clear off-line memory areas by typing in

ØFL-MØDE-03.

TABLE J

USING ∅FL-EXEC-03 IN NON-SP OFFICES

STEP	TTY MESSAGE	SYSTEM ACTION
1	∅FL-C∅NFIG-aa b cc d. (3.02)	Establish minimum off-line configuration.
2	∅FL-M∅DE-05. (4.01)	Release MAC scratch pad.
3	∅FL-EXEC-03 00000000 00000000. (5.12)	Program ∅LCP15 (a complete PS memory card) is repeatedly executed.
4	∅FL-M∅DE-02.	Stop off-line CC.
5	∅FL-M∅DE-03.	Clear off-line memory areas.
6	CS-REST∅RE-CS cc. (7.01)	
7	CS-REST∅RE-CB cc. (7.01)	
8	PS-REST∅RE-S aa. (7.01)	Diagnose units and return them to service if tests pass. Return system to normal configuration.
9	CC-DGN-CCR.	
10	PS-N∅RMAL-.	

(3) Restore the PS to normal service by typing in the following message:

PS-REST∅RE-Saa.   (See 7.01)

aa = Member number of PS to be returned to service.

(4) Restore the CS(s) to normal service by typing in the store and bus restoral messages as appropriate:

CS-REST∅RE-CS cc.

CS-REST∅RE-CB cc.

CS-REST∅RE-AS cc.

CS-REST∅RE-AB cc.

cc = Member number of CS to be restored to service.

(5) Unless it is desired to have the CC out of service, return it to normal by typing in:

CC-DGN-CCR.

(6) Restore the SP to normal if it was involved in the off-line configuration by typing in the following message:

SP-DGN-ANR.

(7) Return all available PSs to a normal configuration by typing in:

PS-N∅RMAL-.

A. **Example 1—Test a CS Word Under Extreme Noise Conditions**

8.37 The following are procedures for an example using program ∅LCP15 to test a CS word under extreme noise conditions. This test program is used after a D-level interrupt printout (MA14 or CCINT) indicated a failing CS address. The block diagram in Fig. 4 gives a general description of the operations performed by the example test program. The diagram does not indicate the actual operations performed by the program instructions.

(1) Use the program instructions in Table AH for this test. (The program instructions are given as octal data with the PS addresses where

TABLE K

USING ∅FL-EXEC-03 IN SP OFFICES

STEP	TTY MESSAGE	SYSTEM ACTION
1	∅FL-C∅NFIG-aa b cc d ee f. (3.02)	Establish minimum off-line configuration.
2	∅FL-M∅DE-05. (4.01)	Release MAC scratch pad.
3	∅FL-EXEC-03 00000000 00000000. (5.12)	Program ∅CLP15 (a complete PS memory card) is repeatedly executed.
4	∅FL-M∅DE-02.	Stop off-line CC.
5	∅FL-M∅DE-06. (Omit if an SP was not included in off-line operation.)	Stop off-line SP.
6	∅FL-M∅DE-03.	Clear off-line memory areas.
7	CS-REST∅RE-AS cc. (7.01) (Omit if SPCS was not included.)	Diagnose units and return them to service if tests pass. Return system to normal configuration.
8	CS-REST∅RE-AB cc. (7.01 (Omit if SPCS bus was not included.)	
9	CS-REST∅RE-CS cc. (7.01)	
10	CS-REST∅RE-CB cc. (7.01)	
11	PS-REST∅RE-S aa. (7.01)	
12	CC-DGN-CCR.	
13	SP-DGN-ANR. (Omit if SP was not included.)	
14	PS-N∅RMAL-.	

the data is to be stored.) Use the procedures in 8.32 through 8.34 to insert the data into the recent change area.

(2) Refer to Section 231-001-301 which describes in detail the procedure for using the 779A bit matcher. Follow the procedure in Section 231-001-301 and plug the bit matcher into the standby CC test connector test location 124-27 (PAR). Set the bit matcher to program address 1027312. This address is the predicted state which the program will reach if the CS word fails. When the failure occurs, the match is made and the RST lamp on the bit matcher lights.

Caution: Do not insert or remove the bit matcher when the CC frame power is on.

(3) Follow the procedures in 8.35 to establish an off-line configuration including the CS under test and information block 0 (PS 0 or PS 1).

(4) Write the CS address into the logic register (L) by using the following message:

∅FL-EXEC-07 00000030 00cccccc.

30 = Code of logic register (L)

TABLE L

USING ØFL-EXEC-04

STEP	TTY MESSAGE	SYSTEM ACTION
1	ØFL-EXEC-04 0bbbbbbb 00000000. or ØFL-EXEC-04 00bbbbbb 00000000. (5.14)	TTY prints the contents of the CC and buffer bus registers. *Note 1:* An off-line configuration cannot exist while obtaining this dump. Either of these messages may be repeated as many times as necessary. ØFL-MØDE-03. and CC-RESTØRE-. must be typed between each request. *Note 2:* Do not use ØFL-MØDE-02. after ØFL-EXEC-04 message(s).
2	ØFL-MØDE-03.	Clear off-line memory areas.
3	CC-RESTØRE-.	Return standby CC to system.

TABLE M

USING ØFL-EXEC-05

STEP	TTY MESSAGE	SYSTEM ACTION
1	ØFL-EXEC-05 0bbbbbbb ccdddddd. or ØFL-EXEC-05 0bbbbbbb cc0000ee. (5.17)	The contents of up to 31 (decimal) consecutive CS or SPCS locations are dumped on a match of either a PS, CS, or SPCS. *Note 1:* An off-line configuration cannot exist while obtaining this dump. This message may be repeated as many times as necessary. ØFL-MØDE-03. and CC-RESTØRE-. must be typed between each request. *Note 2:* Do not use ØFL-MØDE-02. after the ØFL-EXEC-05 message(s).
2	ØFL-MØDE-03.	Clear off-line memory areas.
3	CC-RESTØRE-.	Return standby CC to system.

TABLE N

USING ØFL-EXEC-06 IN NON-SP OFFICES

STEP	TTY MESSAGE	SYSTEM ACTION
1	ØFL-CØNFIG-aa b cc d. (3.02)	Establish minimum off-line configuration.
2	ØFL-MØDE-05. (4.01)	Release MAC scratch pad.
3	ØFL-EXEC-06 0bbbbbbb 00000000. (5.20)	PAR is initialized to a specific address which is part of an off-line program.
4	ØFL-MØDE-01.	The looping program which contains bbbbbbb in Step 3 is started at this address.
5	ØFL-MØDE-02.	Stop off-line CC.
6	ØFL-MØDE-03.	Clear off-line memory areas.
7	CS-RESTØRE-CS cc. (7.01)	Diagnose units and return them to service if tests pass. Return system to normal configuration.
8	CS-RESTØRE-CB cc. (7.01)	
9	PS-RESTØRE-S aa. (7.01)	
10	CC-DGN-CCR.	
11	PS-NØRMAL-.	

ccccc = CS address to be control-written into L register.

Change the CS address by stopping the CC with the ØFL-MØDE-02 message. Change the address using ØFL-EXEC-07 message again and restart the program with the ØFL-EXEC-03 message.

(5) Start the program by typing in

ØFL-EXEC-03 00000000 00000000.

(6) The test pattern which the program writes into the test address can be changed by varying the data on BB17. BB17 bit positions are changed by PROGRAM CONTROL keys on the alarm, display, and control panel. Figure 5 is a block diagram of the procedure to follow to set test patterns on BB17 for locating a failing CS bit.

(7) Refer to Section 231-001-301 for procedure to use the 779A bit matcher with the dual trace oscilloscope.

(8) Follow the procedure in 8.36 to terminate off-line operation and to restore the unit to service.

B. Example 2—Testing to Determine Why a Program Order Is Not Functioning

8.38 The following are procedures for an example using program ØLCP15 to determine why MK or PMK order is not functioning. (Reference should be made to Section 231-001-102 for explanations of MK and PMK orders.) This test program is used after a C-level interrupt printout (MA14 or CCINT) indicated a CC mismatch when the PMK order was executed. A false bit was left in the accumulator (K) register after the PMK order which indicates the trouble is in the logic circuitry of the K register.

TABLE O

USING ∅FL-EXEC-06 IN SP OFFICES

STEP	TTY MESSAGE	SYSTEM ACTION
1	∅FL-C∅NFIG-aa b cc d 99.0 (3.02)	Establish minimum off-line configuration.
2	∅FL-M∅DE-05. (4.01)	Release MAC scratch pad.
3	∅FL-EXEC-06 0bbbbbbb 00000000. (5.20)	PAR is initialized to a specific address which is part of an off-line program.
4	∅FL-M∅DE-01.	The looping program which contains bbbbbbb in Step 3 is started at this address.
5	∅FL-M∅DE-02.	Stop off-line CC.
6	∅FL-M∅DE-03.	Clear off-line memory areas.
7	CS-REST∅RE-CS cc (7.01)	Disgnose units and return them to service if tests pass. Return system to normal configuration.
8	CS-REST∅RE-CB cc. (7.01)	
9	PS-REST∅RE-S aa. (7.01)	
10	CC-DGN-CCR.	
11	PS-N∅RMAL-.	

(1) Use the program instructions in Table AI for this test and the procedures in 8.32 through 8.34 to insert the data into the recent change area.

(2) Refer to Section 231-001-301 which describes in detail the procedure for using the 779A bit matcher. Follow the procedure in Section 231-001-301 and plug the bit matcher into the standby CC test connector test location 124-27 (PAR). The bit matcher is set to obtain a sync pulse for checking the contents of the K register after the suspected program order is performed.

● MK order suspected—Bit matcher set to address 1027304.

● PMK order suspected—Bit matcher set to address 1027307.

Caution: Do not insert or remove the bit matcher when the CC frame power is on.

(3) Follow the procedures in 8.35 to establish an off-line configuration including a PS (PS 0 or PS 1) and a K-code 1 CS (either CS 0 or the highest number CS in the office).

(4) Start the program by typing in

∅FL-EXEC-03 00000000 00000000.

(5) The contents of the accumulator (K) register, after the MK or PMK order is executed, can be predetermined by controlling the data and the test pattern used by the test program. The first three bit positions on BB17 are used to control the data which will be written into the K register by the MK order. The other bit positions on BB17 are set to 1s and/or 0s test pattern. The PMK order stores the results of the logical product (AND) of test pattern with contents of K register (after the MK order) in the K register. BB17 bit positions are changed by PROGRAM CONTROL keys on the alarm, display, and control panel.

TABLE P

USING ∅FL-EXEC-07 IN NON-SP OFFICES

STEP	TTY MESSAGE	SYSTEM ACTION
1	∅FL-C∅NFIG-aa b cc d. (3.02)	Establish minimum off-line configuration.
2	∅FL-M∅DE-05 (4.01)	Release MAC scratch pad.
3	∅FL-EXEC-07 000000bb cccccccc. (5.23)	Octal data is control written into the specified CC registers.
4	∅FL-EXEC-06 0bbbbbbb 00000000. (5.20)	PAR is initialized.
5	∅FL-MODE-01.	The program containing bbbbbbb in Step 4 is started looping.
6	∅FL-M∅DE-02.	Stop off-line CC.
7	∅FL-M∅DE-03.	Clear off-line memory areas.
8	CS-REST∅RE-CS cc (7.01)	
9	CS-REST∅RE-CB cc (7.01)	Diagnose units and return them to service if tests pass. Return system to normal configuration.
10	PS-REST∅RE-S aa. (7.01)	
11	CC-DGN-CCR.	
12	PS-N∅RMAL-.	

(6) Refer to Section 231-001-301 for procedure to use the 779A bit matcher with the dual trace oscilloscope.

(7) Follow the procedure in 8.36 to terminate off-line operation and restore the unit to service.

PROGRAM ∅LCP14 EXAMPLE TEST ROUTINE (SIGNAL PROCESSOR OFFICES ONLY)

8.39 The following are procedures for an example using program ∅LCP14 to test the SPs ability to write the value of flip-flop 1 into the even bits and then the odd bits of the K register using the MVFK order. When the MVFK order is executed, the bit copy circuit sets or resets the bit position of the K register, indicated in the order, to the value of flip-flip 1. This test program was used after an F-level interrupt printout (MA16 or SPINT) indicated an SP mismatch when the MVFK order was executed.

(1) Use the program instructions in Table AJ for this test. (The program instructions are given as octal data with the PS address where the data is to be stored.) Use the procedure in 8.32 through 8.34 to insert the data into the recent change area.

Note: Only the right-half PS word is required for SP program instructions.

(2) Refer to Table AC for the sequence of messages which should precede the ∅FL-EXEC-14 message which starts the program. The off-line mode will be maintained until it is manually terminated or until a maintenance interrupt action occurs in the active CC or an off-line unit is restored to system use. In this case the preferable procedure is to restore all units to service and to set up the mode from the beginning again.

(3) Three sync pulses are provided to test the contents of the K register and the associated circuitry with the dual trace oscilloscope.

TABLE Q

USING ØFL-EXEC-07 IN SP OFFICES

STEP	TTY MESSAGE	SYSTEM ACTION
1	ØFL-CØNFIG-aa b cc d 99 0. (3.02)	Establish minimum off-line configuration.
2	ØFL-MØDE-05. (4.01)	Release MAC scratch pad.
3	ØFL-EXEC-07 000000bb cccccccc. (5.23)	Octal data is control written into the specified CC register.
4	ØFL-EXEC-06 0bbbbbbb 00000000. (5.20)	PAR is initialized.
5	ØFL-MØDE-01.	The program containing bbbbbbb in Step 4 is started looping.
6	ØFL-MØDE-02.	Stop off-line CC.
7	ØFL-MØDE-03.	Clear off-line memory areas.
8	CS-RESTØRE-CS cc (7.01)	
9	CS-RESTØRE-CB cc. (7.01)	
10	PS-RESTØRE-S aa. (7.01)	Diagnose units and return them to service if tests pass. Return system to normal configuration.
11	CC-DGN-CCR.	
12	PS-NØRMAL-.	

- Flip-flop 2 can be used when a 1 is written into K(i).

- Flip-flop 3 can be used when a 0 is written into K(i).

- Flip-flop 4 can be used when a 1 or 0 is written into K(i).

i = Any one of the 23 bits of the K register.

(4) Refer to Table AC for the sequence of messages which are necessary to terminate the off-line operation.

SIGNAL PROCESSOR EXAMPLE TEST PROGRAM (ØFL-EXEC-15)

8.40 The following are procedures for an SP example test program (ØFL-EXEC-15) to determine why the ROTRT order is not functioning. (Reference should be made to Section 231-100-102 for explanation of SP program orders.) This test program was used after an F-level interrupt printout (MA16 or SPINT) indicated an SP mismatch when the ROTRT order was performed. The trouble probably occurred after the program order was decoded in the enable circuitry or in the rotate circuitry. This example is used to test the ROTRT order when the bits of the Q register are rotated five places to the right. The ROTRT order can be used to rotate the bits of the Q register from zero to eight places.

(1) Follow the steps in Table AD for the sequence of messages which should precede the ØFL-EXEC-15 message.

TABLE R

USING ∅FL-EXEC-08 IN NON-SP OFFICES

STEP	TTY MESSAGE	SYSTEM ACTION
1	∅FL-C∅NFIG-aa b cc d. (3.02)	Establish minimum off-line configuration.
2	∅FL-M∅DE-05. (4.01)	Release MAC scratch pad.
3	∅FL-EXEC-08 00bbbbbb cccccccc. (5.25)	Octal data (c—c) is written into the off-line CS location (b—b).
4	∅FL-M∅DE-02.	Stop off-line CC.
5	∅FL-M∅DE-03.	Clear off-line memory areas.
6	CS-REST∅RE-CS cc. (7.01)	Diagnose units and return them to service if tests pass. Return system to normal configuration.
7	CS-REST∅RE-CB cc. (7.01)	
8	PS-REST∅RE-S aa. (7.01)	
9	CC-DGN-CCR.	
10	PS-N∅RMAL-.	

TABLE S

USING ∅FL-EXEC-08 IN SP OFFICES

STEP	TTY MESSAGE	SYSTEM ACTION
1	∅FL-C∅NFIG-aa b cc d ee f. (3.02)	Establish minimum off-line configuration.
2	∅FL-M∅DE-05. (4.01)	Release MAC scratch pad.
3	∅FL-EXEC-08 00bbbbbb cccccccc. (5.25)	Octal data (c—c) is written into the off-line CS, SPCS, or SP at location (b—b).
4	∅FL-M∅DE-02.	Stop off-line CC.
5	∅FL-M∅DE-06. (Omit if an SP was not included in off-line operation.)	Stop off-line SP.
6	∅FL-M∅DE-03.	Clear off-line memory areas.
7	CS-REST∅RE-AS cc. (7.01) (Omit if SPCS was not included.)	Diagnose units and return them to service if tests pass. Return system to normal configuration.
8	CS-REST∅RE-AB cc. (7.01) (Omit if SPCS bus was not included.)	
9	CS-REST∅RE-CS cc. (7.01)	
10	CS-REST∅RE CB cc. (7.01)	
11	PS-REST∅RE-S aa. (7.01)	
12	CC-DGN-CCR.	
13	SP-DGN-ANR (Omit if SP was not included.)	
14	PS-N∅RMAL-.	

TABLE T

USING ∅FL-EXEC-09 IN NON-SP OFFICES

STEP	TTY MESSAGE	SYSTEM ACTION
1	∅FL-C∅NFIG-aa b cc d. (3.02)	Establish minimum off-line configuration.
2	∅FL-M∅DE-05. (4.01)	Release MAC scratch pad.
3	∅FL-EXEC-09 00bbbbbb 00cccccc. (5.29)	System continuously writes the contents of BB17 into the specified CS addresses.
4	∅FL-M∅DE-02.	Stop off-line CC.
5	∅FL-M∅DE-03.	Clear off-line memory areas.
6	CS-REST∅RE-CS cc. (7.01)	Diagnose units and return them to service if tests pass. Return system to normal configuration.
7	CS-REST∅RE-CB cc. (7.01)	
8	PS-REST∅RE-S aa. (7.01)	
9	CC-DGN-CCR.	
10	PS-N∅RMAL-.	

TABLE U

USING ∅FL-EXEC-09 IN SP OFFICES

STEP	TTY MESSAGE	SYSTEM ACTION
1	∅FL-C∅NFIG-aa b cc d ee f. (3.02)	Establish minimum off-line configuration.
2	∅FL-M∅DE-05. (4.01)	Release MAC scratch pad.
3	∅FL-EXEC-09 00bbbbbb 00cccccc. (5.26)	System continuously writes all ones into the specified CS or SPCS addresses.
4	∅FL-M∅DE-02.	Stop off-line CC.
5	∅FL-M∅DE-06. (Omit if an SP was not included in off-line operation.)	Stop off-line SP.
6	∅FL-M∅DE-03.	Clear off-line memory areas.
7	CS-REST∅RE-AS cc. (7.01) (Omit if SPCS was not included.)	Diagnose units and return them to service if tests pass. Return system to normal configuration.
8	CS-REST∅RE-AB cc. (7.01) (Omit if SPCS bus was not included.)	
9	CS-REST∅RE-CS cc. (7.01)	
10	CS-REST∅RE-CB cc. (7.01)	
11	PS-REST∅RE-S aa. (7.01)	
12	CC-DGN-CCR.	
13	SP-DGN-ANR (Omit if SP was not included.)	
14	PS-N∅RMAL-.	

TABLE V

USING ∅FL-EXEC-10

STEP	TTY MESSAGE	SYSTEM ACTION
1	∅FL-M∅DE-02. (4.01)	Stop standby CC.
2	∅FL-EXEC-10 00bbbbbb 00000ccc. (5.32)	TTY prints up to 100 (octal) consecutive CS or SPCS words. *Note 1:* An off-line configuration must exist when this message is used. *Note 2:* This message must be used in conjunction with another ∅FL-EXEC message (such as ∅FL-EXEC-08, -09, -12, or -15) to verify previous activity.
3	∅FL-M∅DE-04.	Restart standby CC.

TABLE W

USING ∅FL-EXEC-11 IN NON-SP OFFICES

STEP	TTY MESSAGE	SYSTEM ACTION
1	∅FL-C∅NFIG-aa b cc d. (3.02)	Establish minimum off-line configuration.
2	∅FL-M∅DE-05. (4.01)	Release MAC scratch pad.
3	∅FL-EXEC-11 00bbbbbb 00cccccc. (5.35)	System continuously reads consecutive CS locations.
4	∅FL-M∅DE-02.	Stop off-line CC.
5	∅FL-M∅DE-03.	Clear off-line memory areas.
6	CS-REST∅RE-CS cc. (7.01)	Diagnose units and return them to service if tests pass. Return system to normal configuration.
7	CS-REST∅RE-CB cc. (7.01)	
8	PS-REST∅RE-S aa. (7.01)	
9	CC-DGN-CCR.	
10	PS-N∅RMAL-.	

TABLE X

USING ∅FL-EXEC-11 IN SP OFFICES

STEP	TTY MESSAGES	SYSTEM ACTION
1	∅FL-C∅NFIG-aa b cc d ee f. (3.02)	Establish minimum off-line configuration.
2	∅FL-M∅DE-05. (4.01)	Release MAC scratch pad.
3	∅FL-EXEC-11 00bbbbbb 00cccccc. (5.35)	System continuously reads consecutive CS or SPCS locations.
4	∅FL-M∅DE-02.	Stop off-line CC
5	∅FL-M∅DE-06. (Omit if an SP was not included in off-line operation.)	Stop off-line SP.
6	∅FL-M∅DE-03.	Clear off-line memory areas.
7	CS-REST∅RE-AS cc. (7.01) (Omit if SPCS was not included.)	Diagnose units and return them to service if tests pass. Return system to normal configuration.
8	CS-REST∅RE-AB cc. (7.01) (Omit if SPCS bus was not included.)	
9	CS-REST∅RE-CS cc. (7.01)	
10	CS-REST∅RE-CB cc. (7.01)	
11	PS-REST∅RE-S aa. (7.01)	
12	CC-DGN-CCR.	
13	SP-DGN-ANR. (Omit is SP was not included.)	
14	PS-N∅RMAL-.	

TABLE Y

USING ∅FL-EXEC-12 IN NON-SP OFFICES

STEP	TTY MESSAGE	SYSTEM ACTION
1	∅FL-C∅NFIG-aa b cc d. (3.02)	Establish minimum off-line configuration.
2	∅FL-M∅DE-05. (4.01)	Release MAC scratch pad.
3	∅FL-EXEC-12 00bbbbbb cccccccc. (5.38)	Specified CS location is written into continuously.
4	∅FL-M∅DE-02.	Stop off-line CC.
5	∅FL-M∅DE-03.	Clear off-line memory areas.
6	CS-REST∅RE-CS cc. (7.01)	Diagnose units and return them to service if tests pass. Return system to normal configuration.
7	CS-REST∅RE-CB cc. (7.01)	
8	PS-REST∅RE-S aa. (7.01)	
9	CC-DGN-CCR.	
10	PS-N∅RMAL-.	

TABLE Z

USING ∅FL-EXEC-12 IN SP OFFICES

STEP	TTY MESSAGE	SYSTEM ACTION
1	∅FL-C∅NFIG-aa b cc d ee f. (3.02)	Establish minimum off-line con-figuration.
2	∅FL-M∅DE-05. (4.01)	Release MAC scratch pad.
3	∅FL-EXEC-12 00bbbbbb cccccccc. (5.38)	Specified CS, SPCS, or SP location is written into continuously
4	∅FL-M∅DE-02.	Stop off-line CC.
5	∅FL-M∅DE-06. (Omit if an SP was not included in off-line operation.)	Stop off-line SP.
6	∅FL-M∅DE-03.	Clear off-line memory areas.
7	CS-REST∅RE-AS cc. (7.01) (Omit if SPCS was not included.)	Diagnose units and return them to service if tests pass. Return system to normal configuration.
8	CS-REST∅RE-AB cc. (7.01) (Omit if SPCS bus was not included.)	
9	CS-REST∅RE-CS cc. (7.01)	
10	CS-REST∅RE-CB cc. (7.01)	
11	PS-REST∅RE-S aa. (7.01)	
12	CC-DGN-CCR.	
13	SP-DGN-ANR. (Omit if SP was not included.	
14	PS-N∅RMAL-.	

TABLE AA

USING ∅FL-EXEC-13 IN NON-SP OFFICES

STEP	TTY MESSAGE	SYSTEM ACTION
1	∅FL-C∅NFIG-aa b cc d. (3.02)	Establish minimum off-line configuration.
2	∅FL-M∅DE-05. (4.01)	Release MAC scratch pad.
3	∅FL-EXEC-13 00bbbbbb 00000000. (5.41)	The specified CS location is read repeatedly.
4	∅FL-M∅DE-02.	Stop off-line CC
5	∅FL-M∅DE-03.	Clear off-line memory areas.
6	CS-REST∅RE-CS cc. (7.01)	Diagnose units and return them to service if tests pass. Return system to normal configuration.
7	CS-REST∅RE-CB cc. (7.01)	
8	PS-REST∅RE-S aa. (7.01)	
9	CC-DGN-CCR.	
10	PS-N∅RMAL-.	

TABLE AB

USING ∅FL-EXEC-13 IN SP OFFICES

STEP	TTY MESSAGE	SYSTEM ACTION
1	∅FL-C∅NFIG-aa b cc d ee f. (3.02)	Establish minimum off-line configuration.
2	∅FL-M∅DE-05. (4.01)	Release MAC scratch pad.
3	∅FL-EXEC-13 00bbbbbb 00000000. (5.41)	The specified CS, SPCS, or SP location is read repeatedly.
4	∅FL-M∅DE-02.	Stop off-line CC.
5	∅FL-M∅DE-06. (Omit if an SP was not included in off-line operation.)	Stop off-line SP.
6	∅FL-M∅DE-03.	Clear off-line memory areas.
7	CS-REST∅RE-AS cc. (7.01) (Omit if SPCS was not included.)	Diagnose units and return them to service if tests pass. Return system to normal configuration.
8	CS-REST∅RE-AB cc. (7.01) (Omit if SPCS bus was not included.)	
9	CS-REST∅RE-CS cc. (7.01)	
10	CS-REST∅RE-CB cc. (7.01)	
11	PS-REST∅RE-S aa. (7.01)	
12	CC-DGN-CCR.	
13	SP-DGN-ANR. (Omit if SP was not included.)	
14	PS-N∅RMAL-.	

TABLE AC

USING ØFL-EXEC-14 (SP OFFICES ONLY)

STEP	TTY MESSAGE	SYSTEM ACTION
1	ØFL-CØNFIG-aa b cc d ee f. (3.02)	Establish minimum off-line configuration.
2	T-CPD-000017.	Set ØL3 flip-flop in CC.
3	ØFL-EXEC-08 007(0/1)*0022 07577100.	Initialize Special Control Group 1 flip-flops. *0 = SP0; 1 = SP1.
4	ØFL-EXEC-08 007(0/1)*0031 37777777.	Initialize SP Error Summary flop-flops. *0 = SP0; 1 = SP1.
5	ØFL-EXEC-14 00000000 00000000. (5.44)	Off-line SP starts executing the program (ØLCP14).
6	ØFL-MØDE-02.	Stop off-line CC.
7	ØFL-MØDE-06.	Stop off-line SP.
8	ØFL-MØDE-05.	Release MAC scratch pad.
9	T-CPD-000016.	Reset ØL3 flop-flop in CC.
10	ØFL-MØDE-03.	Clear off-line memory areas.
11	CS-RESTØRE-AS cc. (7.01)	Diagnose units and return them to service if tests pass. Return system to normal configuration.
12	CS-RESTØRE-AB cc. (7.01)	
13	CS-RESTØRE-CS cc. (7.01)	
14	CS-RESTØRE-CB cc. (7.01)	
15	PS-RESTØRE-S aa. (7.01)	
16	CC-DGN-CCR.	
17	SP-DGN-ANR.	
18	PS-NØRMAL-.	

TABLE AD

USING ∅FL-EXEC-15 (SP OFFICES ONLY)

STEP	TTY MESSAGE	SYSTEM ACTION
1	∅FL-CONFIG-aa b cc d ee f. (3.02)	Establish minimum off-line configuration.
2	T-CPD-000017.	Set ∅L3 flip-flop in CC.
3	∅FL-EXEC-15 aaaaaaaa bbbbbbbb/ 15 cccccccc dddddddd/ 15 xxxxxxxx 01600101.	The SP orders are loaded into the off-line SPCS for execution by the SP. Execution begins when the ∅FL-M∅DE-07. message is accepted as valid. *Note 1:* A maximum of 49 lines (98 instructions) may be entered. *Note 2:* The last order must be a transfer to the first.
4	∅FL-EXEC-08 007(0/1)*0022 07577100.	Initialize Special Control Group 1 flip-flops. *0 - SP0; 1 = SP1.
5	∅FL-EXEC-08 007(0/1)*0031 37777777.	Initialize SP Error Summary flip-flops. *0 - SP0; 1 = SP1.
6	∅FL-M∅DE-07. (4.01)	Off-line SP starts executing the program written in Step 3.
7	∅FL-M∅DE-02.	Stop off-line CC.
8	∅FL-M∅DE-06.	Stop off-line SP.
9	∅FL-M∅DE-05.	Release MAC scratch pad.
10	T-CPD-000016.	Reset ∅L3 flop-flop in CC.
11	∅FL-M∅DE-03.	Clear off-line memory areas.
12	CS-REST∅RE-AS cc. (7.01)	
13	CS-REST∅RE-AB cc. (7.01)	
14	CS-REST∅RE-CS cc. (7.01)	
15	CS-REST∅RE-CB cc. (7.01)	
16	PS-REST∅RE-S aa. (7.01)	Diagnose units and return them to service if tests pass. Return system to normal configuration.

TABLE AD (Cont)

USING ∅FL-EXEC-15 (SP OFFICES ONLY)

STEP	TTY MESSAGE	SYSTEM ACTION
17	CC-DGN-CCR.	
18	SP-DGN-ANR.	
19	PS-N∅RMAL-.	

Note 1: If the starting address of the program is not 101 or if the MAC scratch pad has been released, released, use the following messages to start the program instead of ∅FL-M∅DE-07:

∅FL-EXEC-08 007(0/1)*0004 00xxxxxx. *0 = SP0; 1 = SP1.
xxxxxx = starting address.

∅FL-EXEC-08 007(0/1)*0022 00000200. *0 = SP0; 1 = SP1.

Note 2: If off-line is no longer the MAC client (∅FL-M∅DE-05. was typed or a time-out occurred), use the following message to stop the off-line SP:

∅FL-EXEC-08 007(0/1)*0022 07577100. *0 = SP0; 1 = SP1.

TABLE AE

USING ∅FL-EXEC-16

STEP	TTY MESSAGE	SYSTEM ACTION
1	∅FL-EXEC-16 0bbbbbbb ccdddddd. ∅FL-EXEC-16 0bbbbbbb cc0000ee. (5.50)	The contents of up to 31 (decimal) consecutive CS or SPCS locations are dumped on a match of either a PS, a CS, or an SPCS. *Note 1:* An off-line configuration cannot exist while obtaining this dump. These messages may be repeated as many times as necessary. ∅FL-M∅DE-03. and CC-REST∅RE-. must be typed between each request. *Note 2:* Do not use ∅FL-M∅DE-02. after the ∅FL-EXEC-16 message.
2	∅FL-M∅DE-03. (4.01)	Clear off-line memory areas.
3	CC-REST∅RE-.	Return standby CC to system.

TABLE AF

USING ⊘FL-EXEC-17

STEP	TTY MESSAGE	SYSTEM ACTION
1	⊘FL-EXEC-17 00000000 00000000. (5.53)	TTY prints the contents of the CC and buffer bus registers when an error occurs. *Note 1:* An off-line configuration cannot exist while obtaining this dump. This message may be repeated as many times as necessary. ⊘FL-M⊘DE-03. and CC-REST⊘RE-. must be typed between each request. *Note 2:* Do not use ⊘FL-M⊘DE-02. after ⊘FL-EXEC-17 message. *Note 3:* Check the store error counter flip-flops (SECF) in the TW02 or CCINT output message to see what type of error occurred. *Note 4:* CCs are not in routine match mode while ⊘FL-EXEC-17 is active. Do not forget to deactivate this routine.
2	⊘FL-M⊘DE-03.	Clear off-line memory areas.
3	CC-REST⊘RE-.	Return standby CC to system.

TABLE AG

USING ∅FL-EXEC-18

STEP	TTY MESSAGE	SYSTEM ACTION
1	∅FL-EXEC-18 00000000 00000000. (5.57)	TTY prints the contents of the CC and buffer bus registers when an error occurs.
		Note 1: An off-line configuration cannot exist while obtaining this dump. This message may be repeated as many times as necessary. ∅FL-M∅DE-03. and CC-REST∅RE-. must be typed between each request.
		Note 2: Do not use ∅FL-M∅DE-02. after ∅FL-EXEC-18 message.
		Note 3: ∅FL-EXEC-18 will cause a dump if a bad PS word is read but not if control is transferred to a bad PS word.
		Note 4: Check store error counter flip-flops (SECF) in the TWO2 or CCINT output message to see what type of error occured.
		Note 5: CCs are not in routine match mode while ∅FL-EXEC-18 is active. Do not forget to deactivate this routine.
2	∅FL-M∅DE-03.	Clear off-line memory areas.
3	CC-REST∅RE-.	Return standby CC to system.

START (BY ØFL-EXEC-03, STOP BY ØFL-MØDE-02)

READ TEST ADDRESS
FROM LR AND STORE
IN XR

READ TEST PATTERN
FROM BB17, COMPLEMENT
AND STORE IN KR

INITIALIZE TEST
ADDRESS AND BR
TO ALL 1s

COPY COMPLEMENT
OF TEST PATTERN
FROM KR AND STORE
IN TEST ADDRESS

READ TEST ADDRESS
AND STORE IN BR

COMPARE BR TO KR

DOES
BR = KR

YES

NO

A FAULT HAS OCCURRED
IF THE PROGRAM
REACHES THIS POINT

TRANSFER FROM
ADDRESS 1027310
WHERE BIT MATCHER
IS SET

Fig. 4—Block Diagram of Program to Test A CS Word
Under Extreme Noise Conditions

TABLE AH

TEST PROGRAM FOR FAILING CS WORD

PS ADDRESS	OCTAL DATA	PROGRAM INSTRUCTION
1027300 5027300	00000003 00000000	Identifying Code
1027301 5027301	37777777 00000714	WX ⦰.37777777, ,PL
1027302 5027302	00004040 00010350	MK BB17, ,C
1027303 5027303	00000000 00015042	EZEM 0,X,C
1027304 5027304	00000000 00000000	EE
1027305 5027305	00000000 00005112	KM 0,X
1027306 5027306	00000000 00000000	EE
1027307 5027307	00000000 00015342	CMK 0,X
1027310 5027310	21027301 00000034	TCAZ 1027301
1027311 5027311	00000000 00000000	EE
1027312 5027312	01027301 00000000	T 1027301

START

```
┌─────────────────────┐
│                     │
│   SET BBI7 TO       │
│   ALL Is OR ALL Os  │
│                     │
└─────────────────────┘
```

```
           DID
NO      RST LAMP
◁───────ON BIT
        MATCHER
         LIGHT
           │
          YES
```

```
┌─────────────────────┐
│                     │
│   REVERSE ALL       │
│   BBI7 SWITCHES     │
│                     │
└─────────────────────┘
```

```
┌─────────────────────┐
│   RESET RST LAMP,   │
│   AT THIS TIME THE  │
│   LAMP SHOULD REMAIN OFF │
└─────────────────────┘
```

```
┌─────────────────────┐
│   CHANGE BBI7 SWITCHES │
│   ONE AT A TIME UNTIL  │
│   LAMP LIGHTS INDICATING │
│   FAILING CS BIT       │
└─────────────────────┘
```

```
┌─────────────────────┐
│   USE OSCILLOSCOPE  │
│   PROBE TO TEST     │
│   FAILING CS BIT    │
│   CIRCUITRY         │
└─────────────────────┘
```
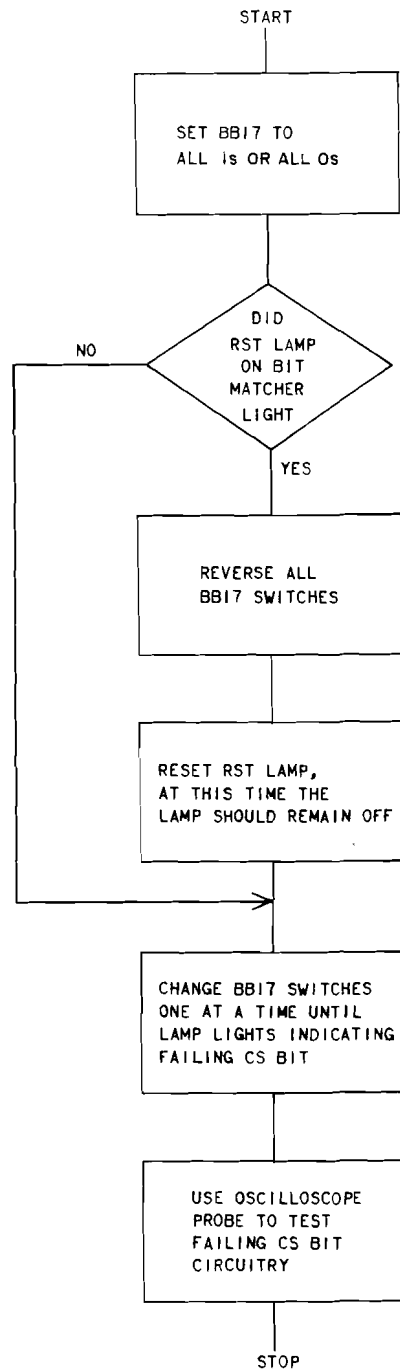
STOP

Fig. 5—Buffer Bus 17 Test Pattern For Locating Failing CS Bit

TABLE AI

TEST PROGRAM TO DETERMINE WHY
MK OR PMK ORDER IS NOT FUNCTIONING

PS ADDRESS	OCTAL DATA	PROGRAM INSTRUCTION
1027300 5027300	00000003 00000000	Identifying Code
1027301 5027301	00000007 00000720	WL 7
1027302 5027302	20004040 00000314	MX 4040, ,PL
1027303 5027303	01027310 00005350	MK 1027310,X
1027304 5027304	00000000 00000000	EE
1027305 5027305	00004040 00000242	PMK 4040
1027306 5027306	00000000 . 00000000	EE
1027307 5027307	01027301 00000010	T 1027301
1027310 5027310	00000000 00000000	Data 00000000
1027311 5027311	37777777 00000000	Data 37777777
1027312 5027312	12525252 00000000	Data 12525252
1027313 5027313	25252525 00000000	Data 25252525
1027314 5027314	35555555 00000000	Data 35555555
1027315 5027315	22222222 00000000	Data 22222222
1027316 5027316	37777777 00000000	Data 37777777
1027317 5027317	00000000 00000000	Data 00000000

TABLE AJ

EXAMPLE TEST PROGRAM (OLCP14)

PS ADDRESS	OCTAL DATA	PROGRAM INSTRUCTION
1027300	00000016	Identifying Code
1027301	00300232	MVDF 1,F2
1027302	00300231	MVDF 1,F1
1027303	01700112	TM 112,J
1027304	00300032	MVDF 0,F2
1027305	00300233	MVDF 1,F3
1027306	00300031	MVDF 0,F1
1027307	01700112	TM 112,J
1027310	00300033	MVDF 0,F3
1027311	01600101	TM 101
1027312	00300234	MVDF 1,F4
1027313	00300040	MVFK F1,K0
1027314	00300042	MVFK F1,K2
1027315	00300044	MVFK F1,K4
1027316	00300046	MVFK F1,K6
1027317	00300050	MVFK F1,F8
1027320	00300052	MVFK F1,K10
1027321	00300054	MVFK F1,K12
1027322	00300056	MVFK F1,K14
1027323	00300060	MVFK F1,K16
1027324	00300062	MVFK F1,K18
1027325	00300064	MVFK F1,K20
1027326	00300066	MVFK F1,K22
1027327	00300041	MVFK F1,K1
1027330	00300043	MVFK F1,K3
1027331	00300045	MVFK F1,K5
1027332	00300047	MVFK F1,K7
1027333	00300051	MVFK F1,K9
1027334	00300053	MVFK F1,K11
1027335	00300055	MVFK F1,K13
1027336	00300057	MVFK F1,K15
1027337	00300061	MVFK F1,K17
1027340	00300063	MVFK F1,K19
1027341	00300065	MVFK F1,K21
1027342	00300034	MVDF 0,F4
1027343	02041000	TR (J)

(2) The following list contains the SP program orders in octal form for the example test program:

SP ORDERS	OCTAL CODE
MVDR E.5,Q	07200040
MVDF 1,F4	00300234
ROTRT 5	34601016
MVDF 0,F4	00300034
TM 101	01600101

Load the SP orders into the off-line SPCS for execution by the off-line SP with the following ØFL-EXEC-15 message:

ØFL-EXEC-15 07200040 00300234/
15 34601016 00300034/
15 01600101 01600101.

Note: The program must contain an even number of program orders. This is the reason the TM 101 order which equals 01600101 is repeated. The NOOP order could have been

used in place of the first TM 101 order. The NOOP order uses up one cycle of time.

(3) The test program loads bit 5 of the Q register and rotates it into bit 0. The program also sets and resets flip-flop 4 to provide a sync pulse for testing the contents of the Q register and its associated circuitry with the dual trace oscilloscope.

(4) Refer to Table AD for the sequence of messages necessary to terminate the off-line operation.

9. ABBREVIATIONS

9.01 The following abbreviations are used in this section:

CC	Central control
CS	Call store
ESS	Electronic switching system
MAC	Maintenance control
MCC	Master control center
MØCR	Mode control register
PAR	Program address register
PMT	Permanent magnet register
PS	Program store
SP	Signal processor
SPCS	Signal processor call store
TTY	Teletypewriter