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BOOK #2A

Systems

Operator's Library: IBM 4331 Processor Operating Procedures and Problem Determination Guide

IBM

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IBM

Second Edition, June 1979

Information contained in this manual is subject to change from time to time. Any such change will be reported in subsequent revisions or through the System Library Subscription Service. This edition contains minor changes throughout the whole manual. Important changes have only been made in sections 'Program Load' and 'Communication Lines SDLC'.

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Preface

This manual describes how to operate the IBM 4331 Processor. You are assumed to have a knowledge of Introduction to IBM Data Processing Systems, GC20-1684, and some experience in operating a similar computing system. The information in this manual is organized in the following way:

- Chapter 1 contains emergency and first aid procedures.
- Chapter 2 describes the parts of the IBM 4331 Processor that you need to know about in order to be able to communicate with, and control the system. It describes the operator console and related facilities.
- Chapter 3 explains how to operate the IBM 4331 Processor.
- Chapter 4 provides restart procedures for the IBM 5424 Multi-Function Card Unit.
- Chapter 6 of the manual contains a glossary.

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Chapter 1. Emergency Procedures

General

If people are endangered, or if equipment could be damaged, disconnect power to the system by pressing the relevant EMERGENCY POWER-OFF switch in the computer room.

Electric Shock

1. If the casualty is still in contact with the electrical supply:

   a. Disconnect the electrical supply, or

   b. Remove the casualty from contact with the electrical supply by pulling on his dry clothing. Do not move the casualty unless it is necessary.

2. If the casualty has stopped breathing, apply mouth-to-mouth resuscitation immediately (see artificial respiration below).

3. Call for help.

Artificial Respiration

1. Clear throat of water, food or foreign matter.

2. Tilt head back to open air passage.

3. Lift jaw up to keep tongue out of air passage.

4. Pinch nostrils to prevent air leakage when you blow.

5. Take a deep breath. Seal your mouth around casualty's mouth, blow until you see chest rise.

6. Remove your lips and allow lungs to empty.

7. Listen for snoring and gurglings, signs of throat obstruction.

8. Repeat mouth to mouth breathing 10 to 20 times a minute. Continue rescue breathing until casualty breathes unaided.

Fire

Do not use water to fight a fire in electrical equipment. Use only a fire extinguisher approved for this purpose, for example one that contains carbon dioxide (CO2). Follow the instructions on the extinguisher and call for help.

Chapter 2. Communicating with the System

This section describes the parts of the IBM 4331 Processor that you, as an operator, will use in your work.

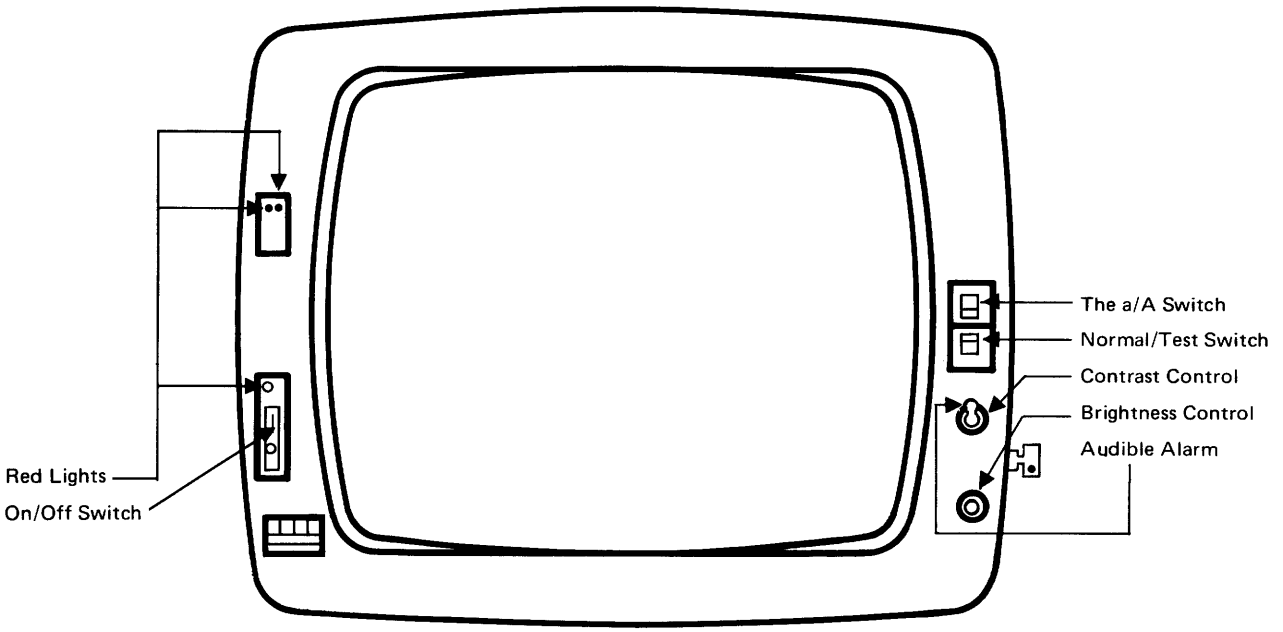
Operator's Console

The operator's console is a device used to control the IBM 4331 Processor.

It consists of:

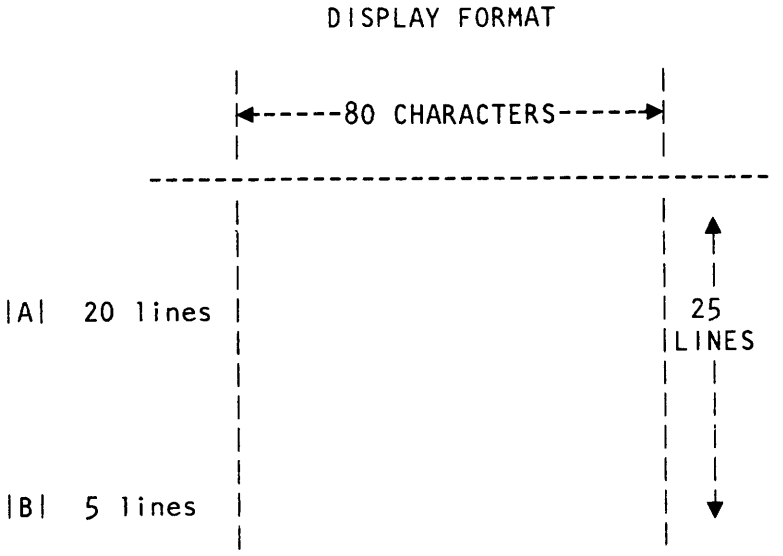
- Video Screen - to provide information from the system, in the form of messages and displays. The information that you enter into the system also appears on the screen. A permanent display of the status of the IBM 4331 Processor is shown in the lower part of the screen.
- Console Keyboard - for entering commands and data into the system.
- Control Panel - with lights and buttons for functions that cannot conveniently be handled by the keyboard and video screen.

The operator console does not provide printed output. An optional matrix printer may be used to supply printouts of messages.



Video Screen

The video screen displays numeric characters, alphabetic characters and special symbols. It is equipped with an audible alarm that alerts you to messages requiring your attention. The format of the screen is shown below.



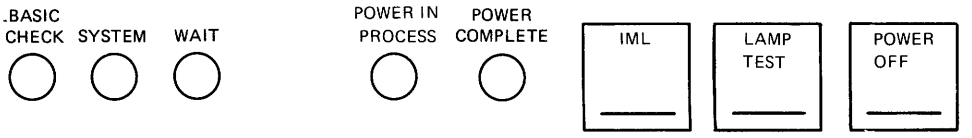
|A| System Area

The system area of the screen displays messages from the system. It is also used to display the various operating modes that can be selected.

|B| Machine Status Area

This area displays information about the status of the IBM 4331 Processor.

The control panel contains lights and switches that allow you to check and control basic machine functions. These functions are described below.



Control Panel Lights

Basic Check
The red BASIC CHECK light indicates a failure requiring attention by service personnel. This light is also on when the power-service mode switch is in 'service' position. The power-service mode switch is located in the IBM 4331 processor and can be operated only by service personnel.

System
The green SYSTEM light is on when instructions are being processed.

Wait
The amber WAIT light is on when the wait bit in the current PSW is set. This means that the processor is idle, that is, not processing instructions. The setting of the wait state is controlled by the operating system. Usually the processor awaits the completion of data transfer from an I/O device. The processor leaves the wait state upon an interruption.

Power in Process
The POWER IN PROCESS light indicates that a power-on, or power-off sequence is in progress.

Power Complete
The green POWER COMPLETE light comes on when the power-on sequence is completed.

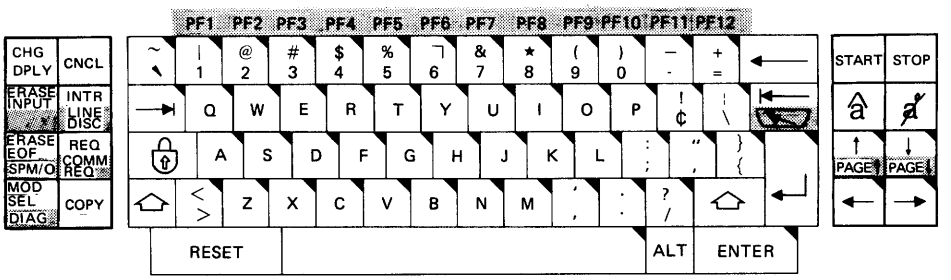
IML
Pressing this button while power is on starts the IML sequence.

Power Off
The POWER OFF button starts the power-off sequence. If during power-off sequence a power failure is detected, a reference code is displayed and the power-off sequence is halted, however, power is not turned off. Note the reference code for the service representative's use and press POWER OFF a second time to complete the power-off sequence.

The power-off sequence can also be initiated by operating the POWER-ON/OFF toggle switch located at the right side of the IBM 4331 Processor. Note: The power-off sequence clears the contents of all storages. Power off is complete after 5 - 7 seconds.

Lamp Test
The LAMP TEST button tests the control panel lights and (if installed) the lights of the IBM 5424 (MFCU). When this button is pressed, the check lights on the panel go on. The lights go out when the button is released.

The console keyboard enables you to enter commands and data into the system. It has the following layout:



The keyboard consists of three types of keys:

- Alphameric keys
- Cursor and tabulator keys, backspace key, and space bar
- Function keys

The positions of these keys, and their functions, are described on the following pages.

Alphameric Keys

The alphameric keys are used to enter messages and data, and to call up displays. These keys are typamatic, that is, they repeat their function as long as they are held down. The second character on some alphameric keys can only be used in conjunction with the SHIFT or the ALTER (ALTER=Keyface) key (see "Function Keys"). The position of the alphameric keys on the keyboard is shown above.

Cursor

The cursor is a light-marker on the screen that indicates where the next character to be entered will appear.

- When a character is entered, it appears just above the cursor.
- The cursor is automatically positioned ready for the next entry.
- You can position the cursor manually by means of the five cursor keys. To prevent interference to internal

operations, these keys can be locked. For example, during IML, or when the cross indicator (see "Machine Status Display", line 25) is on the screen; you cannot free these keys. The system returns them to your control when the internal operation is completed.

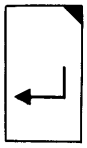
- The five cursor keys are typamatic, which means you can "run" the cursor by holding the key down. When the cursor reaches the edge of the screen, it returns (or wraps around) to the opposite edge of the screen and continues moving in the same direction as long as the key is held down.

- To alter data displayed on the screen, position the cursor under the data to be changed, type in the new data and press ENTER.

- The cursor can be moved by the space bar and the backspace key.

Cursor Keys

The cursor can be moved in the following ways:



CURSOR TO NEW LINE

The cursor moves to the first unprotected character position in the next lower line, traversing all protected lines before finally returning to the first line with an unprotected character position.

CURSOR UP

The cursor moves upward in the same character column. Finally it returns to the bottom of the screen and repeats the same path upwards.

CURSOR DOWN

The cursor moves downward in the same character column. Finally it returns to the top of the screen and repeats the same path downwards.

CURSOR TO LEFT

The cursor moves right to left and line by line upwards. Finally it returns to the bottom right-hand corner of the screen and repeats the same path. The backspace key performs the same function as the cursor-to left key.

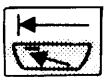
CURSOR TO RIGHT

The cursor moves left to right and line by line downward. Finally it returns to the top left hand corner of the screen and repeats the same path.

Tabulator keys, Backspace key, Space bar

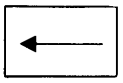
These keys cause the cursor to move in the following ways:

TABULATOR
The cursor moves right to the first unprotected character position. If held down it traverses all first character positions of unprotected fields in a left-to-right, top-to-bottom direction. Finally it returns to the leftmost character position of the topmost unprotected field.



BACK TABULATOR
The current position of the cursor affects the operation of the back tabulator key. When the cursor is in an input field at a location other than the first character location, the back tabulator key repositions it to the first character position in the field. When the cursor is in a protected field, or at the first character position of the input field, the back tabulator key repositions it to the first character position of the first input to the left of the present field.

Using this key together with the ALT key repositions the cursor to the home position, that is to the first unprotected position on the total display.



BACKSPACE
The cursor moves right to left and line by line upwards. Finally it returns to the bottom right-hand corner of the screen and repeats the same path. The cursor-to-left key performs the same function as the backspace key.

SPACE BAR
The cursor moves to the right and inserts a blank character.

MODE SEL/DIAG

Pressing MODE SEL causes the mode selection display to appear on the screen. This display lists the available operating modes. These modes, and how to use them, are described in the section "Procedures".

Mode selection can be requested at any time; it does not affect the state of the machine other than breaking into a chain of messages that is about to be written onto the screen (if any). The display on the screen when MODE SEL is pressed is automatically stored by the system and can be recalled later. Do not, however, keep this display, nor any other manual operations display, on the screen any longer than necessary as, during this time, the system can neither use the screen nor record errors.

The DIAG (diagnostic) function of this key is for service personnel only.

CNCL

CNCL (cancel) is used to stop operations that have been started but not completed (the ENTER key has not been pressed). The operation is terminated according to the mode that the screen was in when data entry started:

- If the screen was under control of the system, and if the command set is 3270, the message or reply is deleted. If the command set is 1052, the message or reply is marked with an asterisk.

- If the screen was in manual operations mode, the display is deleted, control returns to the system and the last full picture that was displayed before manual operations began is restored to the screen.

CHG DPLY

The CHG DPLY (change display) key causes the screen display to change from the system message buffer to the manual operations buffer, and vice versa. During manual operation, the screen and keyboard are made available to the operating system. During system operation the screen and keyboard (except START, STOP and INTR) are made available for manual operation.

INTR/LINE DISC

The INTR (interrupt) key is used to request an external interruption.

The LINE DISC (line disconnect) function of this key is for service personnel only.

ERASE INPUT

Pressing the ERASE INPUT key erases all input fields on the screen. The cursor moves to the first character location available for entering data.

ERASE EOF / SPM/O

Pressing the ERASE EOF (Erase End of Field) key erases character positions in the input field in which the cursor is located. All character positions from the cursor location to the end of the field are erased. The cursor does not move. The SPM/O function of this key is for service personnel only.

REQ / COMM REQ

The function of the REQ (request) key depends upon the command set being used:

- When the 1052 command set is being used, the keyboard is normally locked. It is freed when the system executes a read inquiry command which is invoked by hitting the REQ key.

- When the 3270 command set is being used, the REQ key requests an Attention Interrupt.

The COMM REQ (communication request) function of this key is for service personnel only.

COPY

Pressing the COPY key copies the contents of the screen (all lines except line 25) when in MAN op mode onto the 3287 console printer (if attached).

Note: Programmed operations on the 3287 terminal printer have priority over the COPY key function. This means that the COPY key has no effect when the print buffer contains data that has not yet been printed. The COPY key becomes effective as soon as data in the print buffer has been printed. If there is a dead-lock (such as, the print program hangs, or a similar error), the power switch on the printer should be turned off and on again. This action resets the entire print buffer and enables the COPY key function.

SHIFT

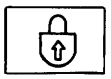
There is a SHIFT key on each side of the keyboard. Both SHIFT keys serve the same purpose. Pressing a SHIFT key causes:

- The upper character of a key with two characters to be entered.

- The upper case of an alphabetic character to be entered. The shift symbol is displayed in line 25 when this key is

depressed.

LOCK



Press the LOCK key to shift and lock the keyboard in upper case. To release the shift lock, press one of the SHIFT keys. The shift symbol is displayed in shift lock mode.

RESET

RESET

Press RESET to free the keyboard when it has been inhibited. When the WAIT indicator is shown (because some action was initiated), the reset key will cancel this action. See also Problem Determination Guide located in the Keyboard.

START

START

Press START to start the processor. Instructions are processed in two modes:

- Instruction step mode - one instruction is processed each time START is pressed (See Instruction Step Mode under "Procedures").
- Continuous processing, for example when START is pressed after a normal pause in system operation.

STOP

STOP

Press STOP to stop the system normally, that is, when processing of the current instruction and any I/O operation in progress is completed and after waiting interrupts have been serviced.

Insert Mode

Use this key before you insert characters into information typed into the screen. ^ is displayed in line 25. Thereafter, characters can be inserted into already existing text whereby all characters to the right of the insert mark are automatically shifted as additional characters are typed in. This allows for entering characters without retyping the entire text. Hit RESET key, ENTER key, or any program function (PF) key.

Delete

This key is used to delete characters from displays without leaving a blank. Nulls are inserted into the end of the field.

ALT

ALT

Use ALT when the alternative function of keys with functions on keyface is required. Hold down ALT and press the appropriate function key.

ENTER

ENTER

When you press ENTER, the data that you have typed into the display is accepted by the system. Until you press ENTER, the data can be changed.

Keyboard Lock and Keyboard Inhibition

The status of the keyboard depends mainly on the mode of operation.

- 3270 Mode

  In 3270 mode the keyboard is normally free to type in data until the operator initiates a system operation, which inhibits the keyboard, that is, the keyboard does not accept any further input until the initiated operation has occurred. The keyboard is also inhibited when data entry into a protected field is attempted. The reason for inhibition is shown on line 25. The reset key is used to reset the inhibition.

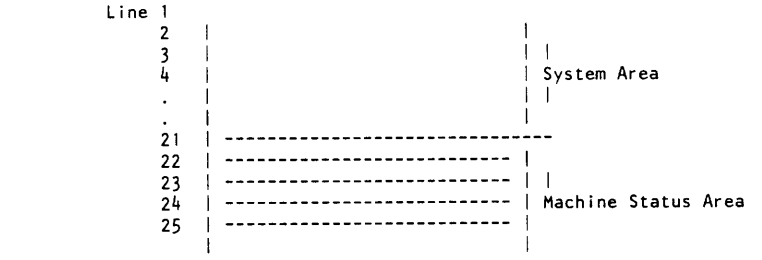
- 1052 Mode

  In 1052 mode, the keyboard is normally locked and it must be reset by a read inquiry command which is usually issued by the operating system when the REQ Key is operated. In locked state, no cursor is displayed. Operating the RESET Key does not change the locked state. The read inquiry command displays the cursor in line 19 position 2, sounds the audible alarm and the word 'proceed' is displayed. Any inhibit state of the keyboard is displayed on line 25. Inhibition due to errors (such as writing into a protected field) may be reset by the RESET Key. However, when an action has been initiated (e.g. the REQ key has been pressed) and the wait indicator is on, the RESET key resets not only the keyboard but also cancels the requested action. The following system keys are never locked or inhibited:

  - START
  - STOP
  - INTR

Machine Status Display

The last five lines on the display screen show the status of the system. Some indicators in the display remain constant, and some change during processing, but the machine status is always on the screen (except during maintenance displays). The machine status area is a protected area. Its layout is shown below, followed by a table explaining each status indicator.



```
Line 1
     2   |                                |
     3   |                                | |
     4   |                                | System Area
     .   |                                | |
     .   |                                |
    21   | ------------------------------
    22   | --------------------------- |
    23   | --------------------------- | |
    24   | --------------------------- | Machine Status Area
    25   | --------------------------- |
         |                             |

Line 21|    MAN    ][TEST][LOAD][ 1MB][370 ]TIMER:[OFF]SYSDSK COMP DATA:XXXXADDR:XXXXXX |
       |[CHECKSTOP][bbbb][SAVE][ 2MB][VSE ]      [ON ]DISK   bbbb                      |
       |[IPL-ERROR]      [bbbb][ 4MB]                                                  |
       |                       [ 8MB]                                                  |
       |                       [16MB]                                                  |
       |                       [REAL]                                                  |
       |                                                                               |
-------------------------------------------------------------------------------------- |
LINE 22|RATE:I-STEP CHK-CTL:HARD TOD:[SEC]ADDR-COMP:[STOP]TYPE:[ANYREF] [R-ADDR:]XXXXXX|
       |                             [ENBL]         [SYNC]     [I/OREF] [ADDR:]        |
       |                                                       [D-STOR]                |
       |                                                       [I-CNTR]                |
-------------------------------------------------------------------------------------- |
LINE 23|[SP MESSAGES]                          CA/ILT    STATUS, REF.CODE              |
       |[LOG PENDING]  RESERVED FOR SERVICE PERSONNEL                                  |
-------------------------------------------------------------------------------------- |
LINE 24|              RESERVED FOR SERVICE PERSONNEL                                   |
       |                                                                               |
-------------------------------------------------------------------------------------|
LINE 25|    1 - 6     9 - 15     16 - 19     30 - 37     39 - 41     44     58 - 64   |
       |-------------------------------------------------------------------------------|
       |   IA TEST    X ⌒        X ? +       3270        NUM         ^      X ▭-▭⌒    |
       |              X -S                   1052         ⇧                 X ▭-▭\    |
       |              X c-f       Canadian   MANOP                            ▭-▬     |
       |              X ←⚷→       French                                              |
       |              X ⚷>        Symbols                                             |
       |              X ⊶                                                             |
       |                                                                               |
```

MAN
The system has been stopped by:
- Pressing STOP
- Manual operations

(for example, Instruction Step or Address Compare).

MAN does not appear under the following conditions:
1. When the system is running.
2. When the system is in wait state (unless STOP is pressed).
3. When the system is in check 'stop state'. After a maintenance display, MAN does not have the same status as before the display.

CHECK STOP
A check-stop has occurred.

The next instruction address can be seen by displaying the PSW. After a maintenance display, CHECK STOP does not show the same status as before the display.

IPL ERROR
A valid PSW cannot be loaded (for example, when the load device is not ready, or an invalid address was specified).

If an IPL number is displayed, go to the IPL malfunction flowchart for details.

TEST
TEST appears when:
- Instruction step mode is set
- Address compare mode is set
- Check control mode other than 'normal' is set
- An in-line test is running

TEST does not appear for program initiated tests such as online tests (OLTs) or the stand-alone executive program (OLTSEP), or program event recording. It is also off during log operations.

LOAD
An IPL Load operation has been started.

LOAD remains on the screen until a valid PSW has been loaded.

SAVE
Machine SAVE has been completed successfully.

1MB, 2MB, 4MB, 8MB, 16MB, REAL
Gives the address range when IML is performed in VSE mode.

Storage size appears only for VSE mode after Power On, Reset, or Reset Clear.

TIMER:OFF/ON
The timer is enabled (ON) or disabled (OFF)

SYSDSK
The system diskette requires attention.

DISK
The diskette drive requires attention.

COMP
The processor has stopped because 'Address Compare' mode is on and the matching address has been found.

DATA:
Shows the half-word stored at the storage location indicated by ADDR.

After a maintenance display, ADDR and DATA do not show the same status as before the display.

ADDR:
Shows storage address of the next instruction to be executed.

Line 22 Display

RATE: I-STEP
Instruction step mode is set.

CHK-CTL: HARD
Check control mode is set.

TOD:SEC/ENBL
The time of day clock is secure/enabled.

Secure indicates that the TOD clock cannot be altered by the SET CLOCK instruction. Enabled means that the TOD Clock can be altered.

ADDR-COMP: STOP, SYNC
Indicates the type of action to be performed when the address match occurs.

TYPE: ANY REF, I/O REF, D-STOR, I-CNTR
Indicates the type of address to be used for address comparison.

R-ADDR:
ADDR:
Indicates the address to be used for the address comparison.

ADDR appears if the processor is in ECPS:DOS/VS mode. R-ADDR appears if the processor is in System/370 compatibility mode.

Line 23 Display

SP MESSAGES
LOG PENDING
Messages to service personnel Appears when customer manual ops are performed and a log is pending

Can be any message to service personnel originating in the processor hardware.

CA/ILT
Shows the status of the communications adapter.

See CA Inline Tests for details of this display. Reserved for service personnel.

STATUS, REF CODE
Shows status and reference code of current diagnostic program. This information is for service personnel.

Line 25 Display

Insert Indicator

^ The operator console is in insert mode.

This indicator goes on when you press INSERT. Press RESET or ENTER or any of the PF keys to turn it off.

Wrong Place Indicator

X ←→ The keyboard is inhibited (except for the RESET key).

An attempt has been made to enter, insert, or delete a character when the cursor is in a protected field on the screen. Press RESET to free the keyboard.

Wait Indicator

X The system has locked the keyboard because CNCL, REQ, or PF1-12 has been pressed but the corresponding program interruption has not yet occurred.

Before the interruption has occurred you can still free the keyboard by pressing RESET.

Shift Indicator

⇧ The shift key is depressed.

Release the SHIFT key, or reset the SHIFT LOCK to terminate

the function.

IA

Online Indicator
The operator console is ready and connected to the system under A rules as defined by the 3270 system.

The indicator stays on whenever the screen is on line.

Minus Symbol
✖ -S
The symbol keyed in is not available.

RESET to restore the keyboard

Minus Function
✖ c-f
Requested function is not available.

RESET to restore the keyboard

Security Key
✖ 🔑
When this symbol is displayed no operator input can be accepted.

Too Much Data
✖ 웃>
An attempt has been made to enter too much information into a field.

RESET and retry

Numeric
✖ 웃NUM
Appears when numeric lock feature is installed and a non-numeric entry was made at a display screen location reserved for numeric information

What?
✖ ?+
The last input was not accepted.

Because of uncertainty about what was accepted, the screen contents should be checked before repeating the operation.

✖ 웃´+?
✖ 웃`+?
✖ 웃^+?
✖ 웃¨+?
✖ 웃¸+?

Accent Plus What
An invalid deadkey/character key combination was entered (Canadian French Keyboard)

RESET and retry

3270
3270

3270 is on screen when the console works in 3270 operation mode.

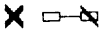
1052
1052

1052 is on screen when the console works in /360 1052 emulation mode.

MANOP

MANOP

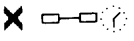
MANOP is on screen when the console works in manual operation mode.



Printer Not Working

The assigned printer is not functioning (such as, unplugged, out of paper or has failed during printing). Does not come up for print operations requested by pressing the COPY key.

Resets with Power-On-Reset of the attached printer.



Printer Busy

Appears when a new print operation is requested while the printer is printing any data from a previous operation. Does not come up for print operations requested by pressing the COPY key.

Wait until indicator is removed when the printer becomes free.

Printing

Appears as long as the printer is printing. Does not come up for print operations requested by pressing the COPY key.

System Diskette

The system diskette is a device that services the system with control, test, diagnostic and logging codes. This code is contained on two diskettes:

- Control Diskette
- Diagnostic Diskette

These diskettes contain information that is vital to the correct functioning of the system. To ensure that this information is properly safeguarded, avoid the following:

- Rough handling of the diskette.
- Handwriting on the diskette (do not write on the diskette cover with the diskette inside it).
- Pressure on any part of the diskette.
- Strong, direct sunlight on the diskette.
- Attempts to clean the diskette in any way.
- Exposing the diskette to magnetic fields (Keep it away from metal objects).
- Touching exposed surfaces of the diskette.

Inform the service representative if the diskette is damaged in any way.

Under normal conditions the system diskette remains in the drive unit and any handling of the system diskette is not required.

Chapter 3. Procedures

This section tells how to operate the IBM 4331 Processor. The information presented here is divided into procedures, which are explained on the following pages.

Loading the Diskette

For machines without the "diskette drive" feature, the system diskette is located in the drive unit accessible from the table top of the IBM 4331 Processor. Any handling of the system diskette is not required except by the service representative. The system diskette must never be removed while the system is in operation.

For machines with the "diskette drive" feature, the system diskette is under the covers of the IBM 4331 Processor, while the drive unit accessible from the table top is available for I/O operations.

Before loading the diskette, check that it is undamaged. Do not use a damaged diskette until a service representative has inspected it.

1. Open the sliding door at the table top.

2. Open the mounting plate.

3. Grasp the diskette by the white label and remove it from its envelope.

4. Lower the diskette carefully into position behind the mounting plate until it comes to rest on the locating surfaces.

5. Close the mounting plate carefully. The centering cone must slide freely into the center of the diskette. If not, check that the diskette is seated against the locating surfaces and that it is undamaged.

6. Store the empty diskette envelope where it will not become damaged or dirty.

7. If a diskette has been exposed to temperatures outside the machine's environmental range, allow 5 minutes before use.

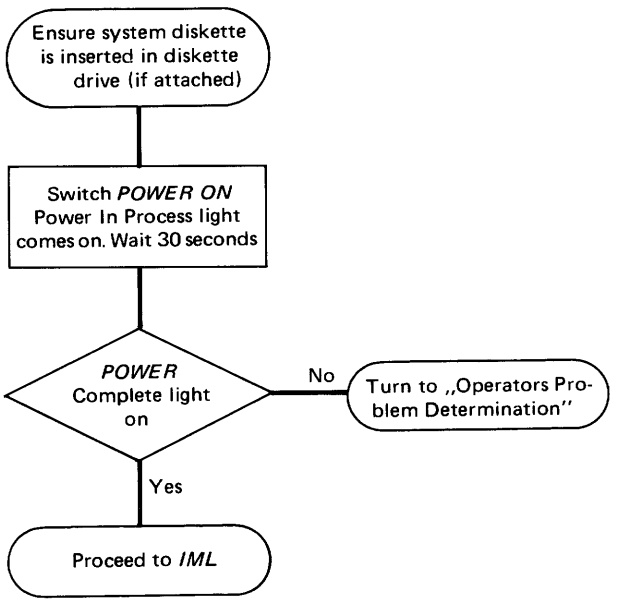
8. When receiving diskettes, check for carton and diskette damage.

Switching Power On

Before switching power on, ensure that no person is exposed to risk and that all equipment covers are shut. The power on toggle switch is located at the right side of the IBM 4331 Processor. The power switch at the Video Screen of the IBM 3278 Model 2A must be in 'on' position and the Normal/Test switch must be set to 'Normal'. If the Normal/Test switch is in 'Test' position the IBM 3278-2A is not available for the program and forces a 'wait' condition.

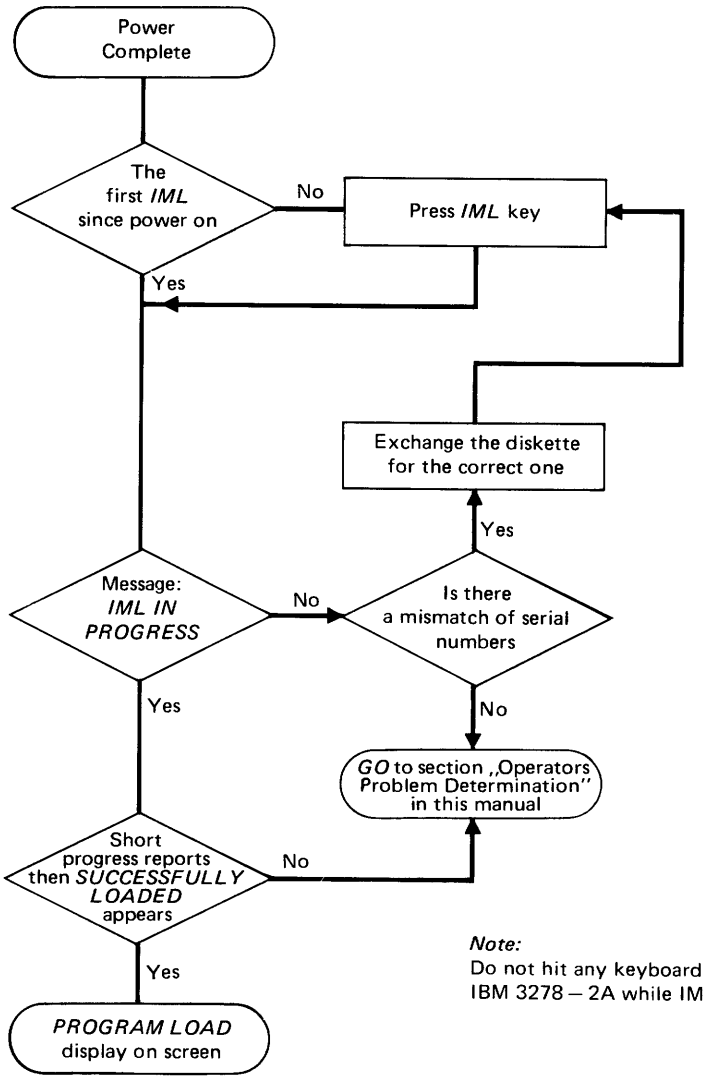
The 4331 Processor does not distribute AC primary power to the attached I/O devices. Each piece of type-numbered equipment has its own power-on switch and its own power-cord which will connect to a wall outlet. In most cases it is required to turn on power at each unit individually (except when the power interface feature is installed, in which case the connected units power-up together with the processor). On some units, such as the 3310 disk drives or the 8809 tape drives, the optional power interface cannot be installed. You must turn on power at the power switches of these units.

Note: It is possible to turn power off separately at each piece of equipment. However, if this is done while an operation involving this piece of equipment is in progress, the results are unpredictable.



Loading the Microcode (IML)

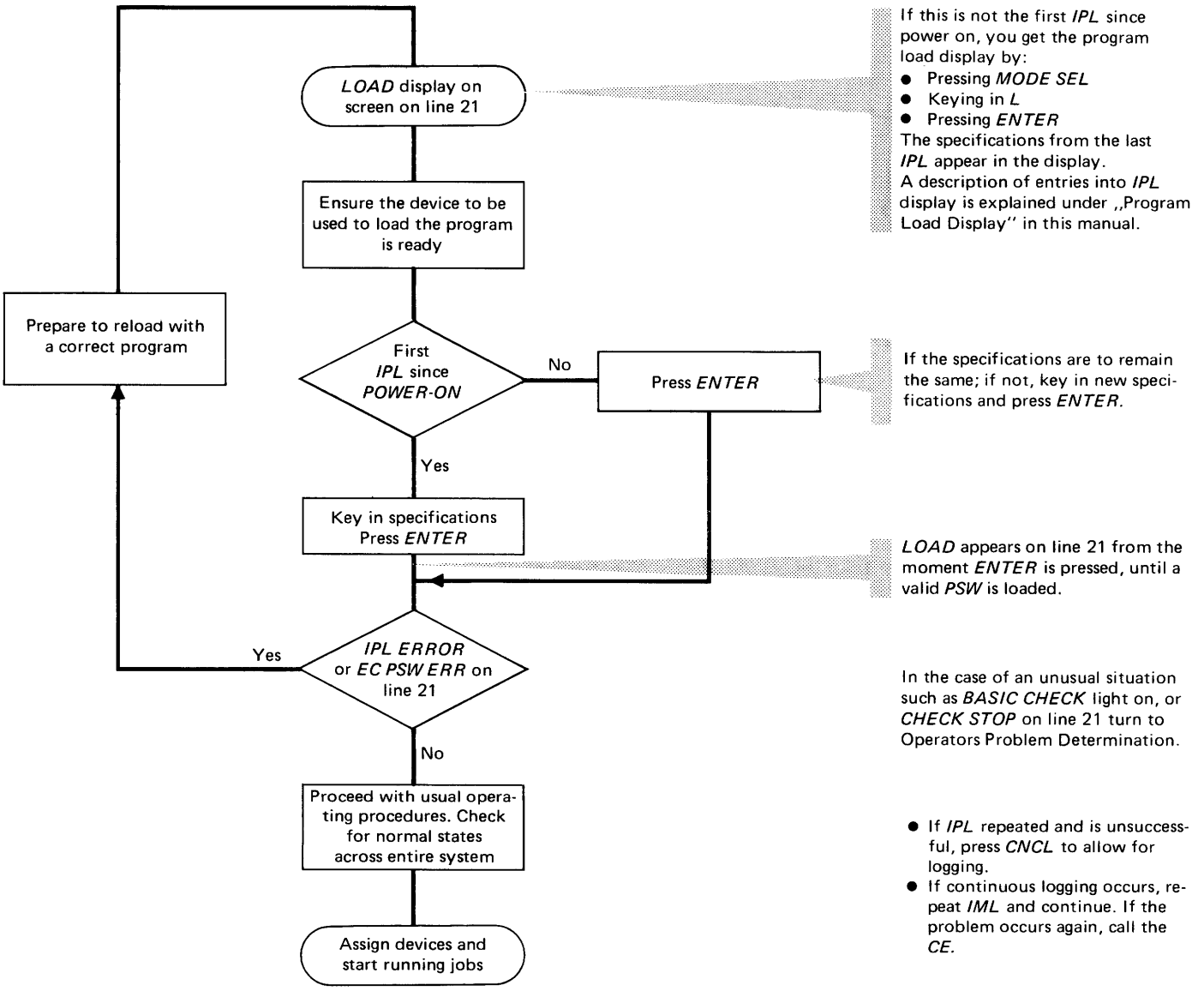
The microcode controls processor operations and must be loaded into control storage before any other program can be loaded. All microcode is contained on the system diskette and is loaded when you switch POWER ON or press the IML key on the control panel.



Note:
Do not hit any keyboard key at the IBM 3278 – 2A while IML is in process.

Initial Program Load

The initial program load (IPL) procedure causes the operating system to be loaded. The IPL procedure can also be used for loading stand-alone programs.



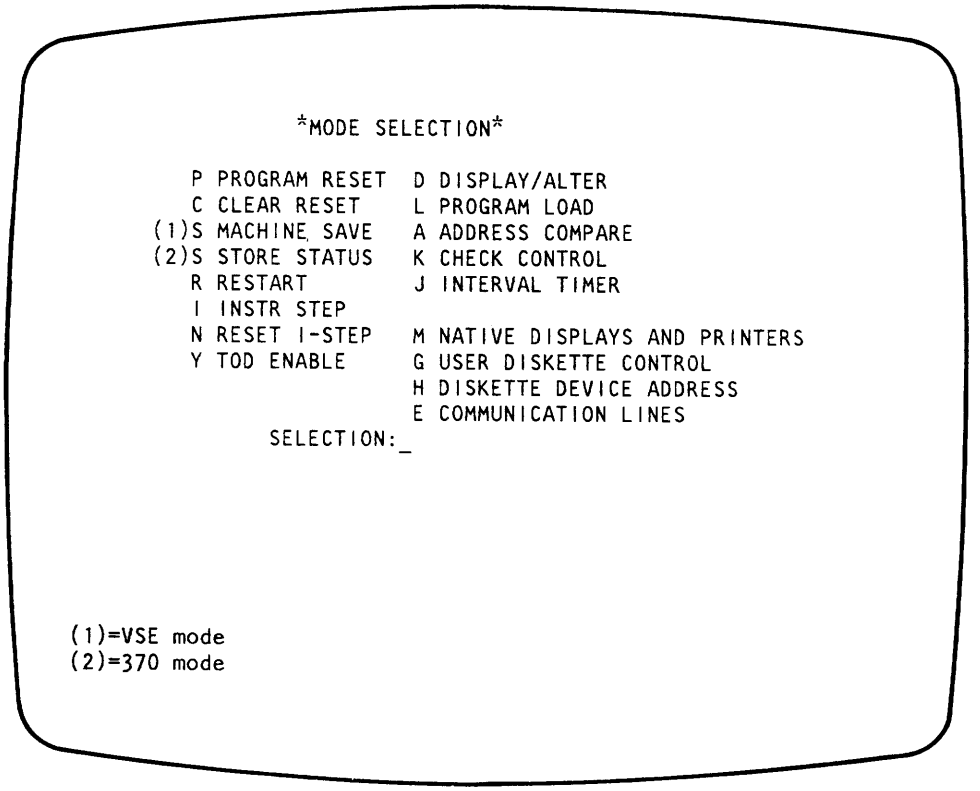
Mode Selection

The modes described in this section allow you to display and change certain control information and data. These modes are listed below and the relevant operating procedures are given on the following pages. Column 1 in the list gives the name of the mode; column 2 shows the selector character used to call up the mode display. Columns 3 and 4 show the modes that apply to 370 and VSE.

Col 1	Col 2	Col 3	Col 4
Mode of Operation	Selector Char	370	VSE
Address Compare	A	X	X
Check Control	K	X	X
Display/Alter	D	X	X
Capacity Counts	S	X	-
Control Registers	C	X	X
Current PSW	P	X	X
Floating Point Regs	F	X	X
General Registers	G	X	X
Storage Key	K	-	X
Main Storage	V	X	-
Main Storage Real	M	-	X
Main Storage Virtual	V	-	X
Page Description	D	X	-
Page Down	+	X	X
Page Up	-	X	X
Main Storage Size	S	-	X
Communication Lines	E	X	X
Instruction Step	I	X	X
Interval Timer	J	X	X
Machine Save	S	X	-
Native Displays and Printers	M	X	X
Program Load	L	X	X
Restart	R	X	X
Clear Reset	C	X	X
Reset Instruction Step	N	X	X
Program Reset	P	X	X
Store Status	S	-	X
TOD Enable	Y	X	X
User Diskette Control	G	X	X
Diskette Device Address	H	X	X

To call up a display, first press MODE SEL. This brings the 'mode selection' display to the screen. Listed in this display are the modes used to operate the IBM 4331 Processor, and next to each is a selector character.

Here is an example of the mode selection display:



Type the selector character for the desired mode into the 'mode selection' display after the word SELECTION at the bottom of the screen and press ENTER.

For the modes listed on the left of the screen, entry is now complete. The mode is operational.

For the modes listed on the right of the screen, the above procedure calls up a separate display in which additional selection characters may be entered. The following pages describe how to use these displays.

Errors Made During Mode Selection

When you have pressed ENTER the system checks your entries and displays the following messages if it detects an error:

- INVALID CHARACTER: the first character entered is not one of the selector characters shown in the display. The 'MODE SELECTION' display remains on the screen and the cursor indicates the error To complete selection enter the correct selector character.

- INCOMPLETE ENTRY: No character was entered, or fast selection was attempted but the input was incomplete. To correct the error, enter the complete specification.

Fast Mode Selection

'Fast Mode Selection' enables you to type in all specifications for a mode at once without going through the selection procedure picture by picture.

1. Press MODE SEL. The 'mode selection' display will appear.
2. Type in the mode selector character (col 1 in list).
3. Type in your mode specifications (one character from each group in col 2 plus an address if required).
4. Press ENTER.

A quick-reference list of the specifications is given below.

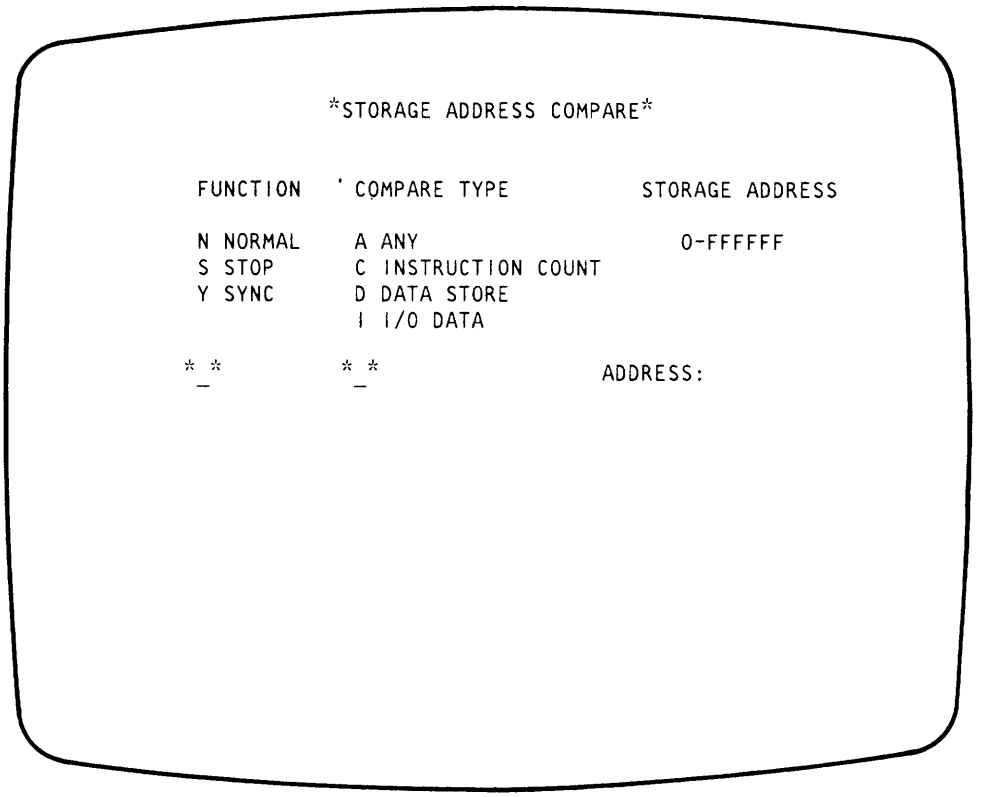
Note: Do not insert blanks or commas between characters.

MODE	Mode Specification Characters	
	Col1	Col2
Address Compare	A	1. N=Normal S=Stop Y=Sync 2. A=Any C=Instruction Count D=Data Store I=I/O Data 3. Storage Address= Six-digit hexadecimal number Example: AS15FA0 Tells the system to compare address 005FA0 to the addresses used during I/O data transfer, and to stop when a match occurs.
Check Control	K	N=Normal S=Hardstop Example: KS Tells the system to enter the check stop state when a machine or channel check occurs.
Commun. Lines	E	Allows to change the values of certain options for communication lines.
Interval Timer	J	N=On F=Off Example: JN Tells the system to turn on the interval timer.

MODE		Mode Specification Characters
	Col1	Col2
Display/ Alter	D	1. G=General Registers C=Control Registers P=Current PSW F=Floating Point Registers *D=Page description (VSE mode only) *K=Storage Key (370 mode only) S=Capacity Counts (VSE mode only) S=Main Storage Size (370 mode only) *V=Main Storage *M=Main Storage Real (370 mode only) *V=Main Storage Virtual (370 mode) *Plus six-digit hexadecimal storage address.
		Example: DV0019FA
Program Load	L	1. 0-5=Channel 2. 0-F=Control Unit 3. 0-F=Device 4. P=Reset Program C=Reset Clear 5. G=VSE Mode H=370 Mode 6. M=Maximum Storage Size R=Storage equals real storage size 1,2,4,8=Megabytes of storage 7. Y=1052 Mode N=No 1052 support 8. 1-8=Functional Adapter Buffers 0-8=Emulator Buffers 9. R=3211 Emulation S=2314 Emulation 10. Six-digit hexadecimal address for host for emulated device. 11. Y=Log N=No log
		Example: 'L09CP' Tells the system to load from device 09C with program (P) reset.

Address Compare

The 'address compare' display allows you to stop the machine when a reference to a specific main storage location is made during normal processing. This feature is useful, for example, in finding and diagnosing system errors. An example of the display is given below.



To select and set 'address compare':

1. Press MODE SEL to call up the 'mode selection display' and enter an A after the word SELECTION at the bottom of the screen.

2. Press ENTER.

3. Enter one of the following three codes under FUNCTION:
   - N (Normal) The address compare mode is turned off and normal processing continues.
   - S (Stop) The machine stops when the address has been found (see 'Compare Type', step 4 below, for the search conditions).
   - Y (Sync) A synchronization pulse is issued when the address match occurs. The machine does not stop.

4. Enter one of the following four codes under COMPARE

TYPE:

- A (Any) The search address given in column 3 is compared with all addresses used in the system.
- C (Instr Count) The search address is compared with addresses used for fetching instructions only.
- D (Data Store) The search address is compared only with addresses used to store data.
- I (I/O Data) The search address is compared only with addresses used in transferring data between main storage and I/O devices.

5. Enter the search address under STORAGE ADDRESS. This can be up to six hexadecimal characters. If you enter less than six digits, the processor supplies the appropriate number of leading zeros to make a six-digit number.

Error Messages:

- INVALID CHARACTER is displayed if you enter either an incorrect selector character or a non-hexadecimal character as address.
- INVALID ADDRESS appears if you specify an address that is outside main storage size.
- INCOMPLETE ENTRY is displayed, and the cursor is set below the next character if, during fast selection, you specify incomplete specifications.

6. Press ENTER. The 'address compare' display disappears from the screen, and your specifications are displayed in line 22 of the Machine Status Area as a reminder that address compare mode is set.

7. The processor stops after completion of the instruction that was in progress when the address match occurred. The effect is the same as if the stop key had been pressed. When the start key is subsequently pressed, processing continues with the next sequential instruction.

   With instruction count mode set as address compare criterion, the processor stops always at the completion of the instruction that caused the address match.

   When the location of a branch instruction is the address compare target, the stop occurs at the completion of the branch instruction, that is, after the branch (if any) is taken. When the start key is subsequently pressed, operations resume at the next sequential instruction if no branch was taken, or at the branch address when the branch was taken.

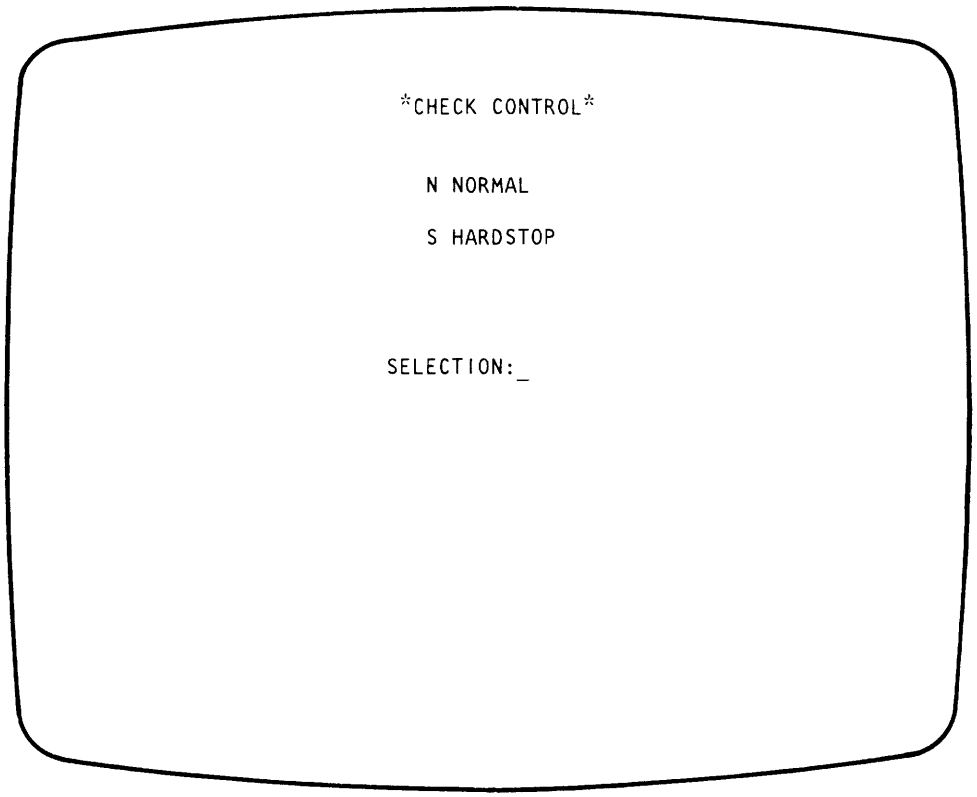
Note: When the location of the instruction that immediately follows the branch instruction is the address compare target, then two stops are provided for the seven most commonly used branch instructions. The first stop occurs after the branch is taken (provided the instruction does branch). The second stop occurs at the actual address compare target, that is, at the instruction that would have been executed next if no branch had occurred. The stop occurs at the completion of that instruction.

The following branch instructions have two stops:

BAL, BALR, BCR, BXH, BXLE, BCT, BCTR

Check Control

The 'check control' mode allows you to preset the system's response to machine checks. The current check control mode is shown in line 22 of the machine status area.



To select 'check control' mode:

1. Type K into the 'mode selection' display after the word to SELECTION.

2. Press ENTER. The screen picture changes to the 'check control' display (see example above).

3. Enter one of the following selector characters into the display:

   N (Normal) This code causes the previously selected check control mode to be turned off and allows the waiting log (if any) to be recorded.

   S (Hardstop) This code causes the machine to enter the 'checkstop' state as soon as possible after the detection of a machine-check or channel-check condition. A machine-check interruption is any machine error that would cause a machine check

interruption in normal mode. A channel check is any machine error that would cause an I/O interruption indicating Channel Check, Interface Control Check or Channel Data Check in normal mode.

(Notice that a check-stop requires a program or clear reset to recover.

Error Message

INVALID CHARACTER indicates a selector character other than 'N' or 'S'.

'Display/Alter' mode allows you to display and/or alter values in the processor. The values that you can display and alter are listed as options shown in the example below. The procedure following it explains how to use the display.

```
*DISPLAY/ALTER*      VSE mode

G GENERAL REGISTERS
C CONTROL REGISTERS
P CURRENT PSW
F FLOATING POINT REGISTERS
D PAGE DESCRIPTION
S CAPACITY COUNTS
V MAIN STORAGE

                     370 mode
G GENERAL REGISTERS
C CONTROL REGISTERS
P CURRENT PSW
F FLOATING POINT REGISTERS
K STORAGE KEY
S MAIN STORAGE SIZE
V MAIN STORAGE VIRTUAL
M MAIN STORAGE REAL

*MAIN STORAGE DISPLAY*
+ PAGE UP
- PAGE DOWN

  SELECTION:  ADDRESS:
```

To select 'display/alter':

1. Type D after the word SELECTION.

2. Press ENTER.

The program stops and the 'display/alter' menu appears on the screen.

To call up a specific option:

- Type the selector character for the option into the display after the word SELECTION, for example G for the general registers.

- Press ENTER.

The display for the selected option appears on the right of the screen while the 'alter/display' menu remains on the left.

Data is displayed in two fields:

Data Field - The current data in the system appears on the screen in the data field.

Alter Field - New data entered from the keyboard appears in the alter field, which is one line below the data field (and appears blank prior to any data insertion).

To change data in a selected option:

1. Position the cursor in the alter field and under the character to be changed, that is, one line below the character displayed.

2. Type in the new character. It will appear underneath the current character which continues to be displayed.

3. Press ENTER. The new character moves up from the alter field into the display field and replaces the old character. At the same time it is stored in the system.

Note: Selecting any of the options causes the processor to stop. For this reason START must be pressed to resume operations, regardless of whether any alterations have been made or not.

Error Messages:

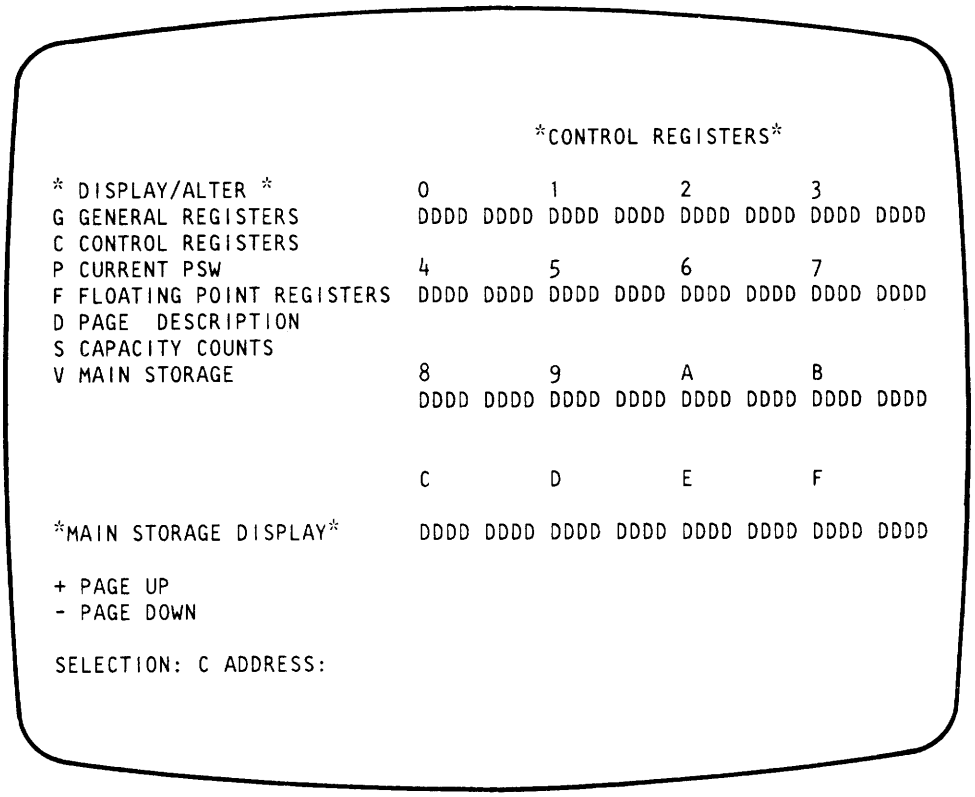
INVALID CHARACTER indicates an invalid selector, hexadecimal or binary character.

INCOMPLETE ENTRY appears and the cursor is set below the next character to be specified if, during fast selection, you entered incomplete specifications.

INVALID ADDRESS indicates an address that exceeds the storage size of your machine.

CHECK STOP. If a CHECK STOP occurs and the selected function was not reset it may be caused by a PSW loop. You can recognize a PSW loop only by two symptoms which are "lack of activity with SYS indicator on ..." and "the stop key does not work". In this case perform PROGRAM RESET and check the PSWs.

The 'control registers' display allows you to examine and change the contents of the control registers.



The picture above appears in VSE mode.

To select the control registers display:

1. Type C next to SELECTION in the 'display/alter' display.

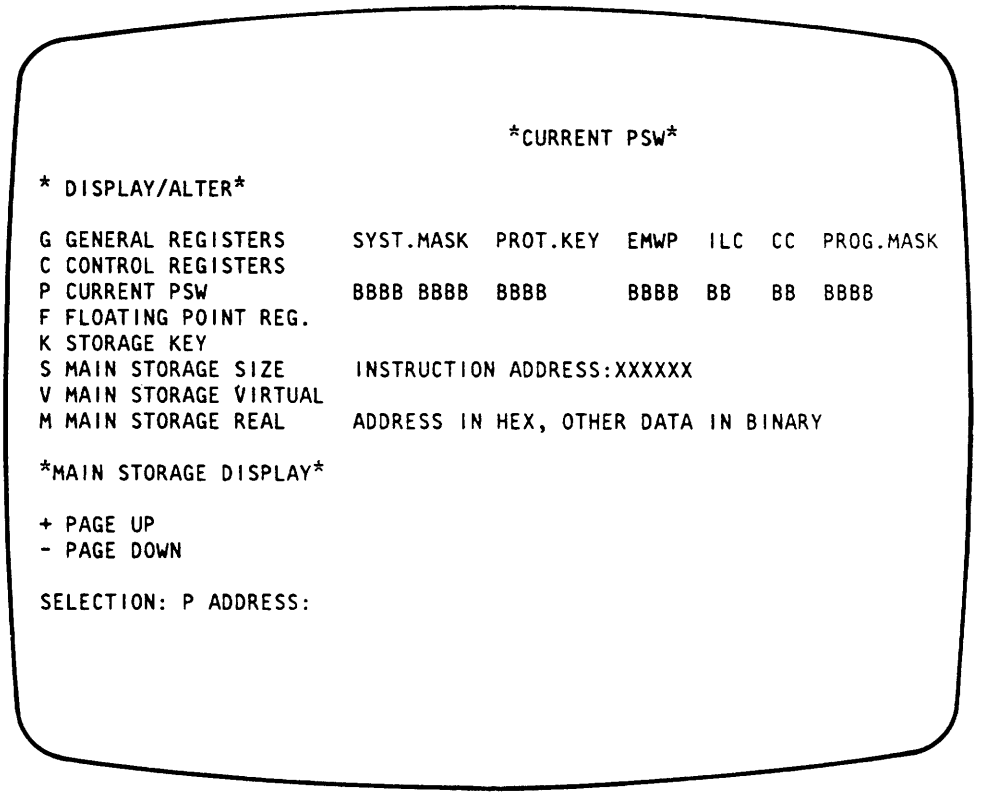
2. Press ENTER.

All 16 control registers appear in the display. Their contents are represented as eight hexadecimal characters in the display field ('D' in the example above). Below each display field is the corresponding alter field, which is blank unless data is being altered.

To direct the cursor to a register, type the register number (0-F) after ADDRESS and press ENTER. The cursor will appear below the first (alter) character position in the specified register.

Current PSW

This display allows you to change the contents of the current PSW.



Note: Above is a 'Current PSW' display as it appears when the system is in 370/BC mode. The ILC (instruction length code) appears only for a system in BC mode. In EC mode the ILC is in a fixed storage location.

To select the current PSW display:

1. Type P after the word SELECTION in the display.

2. Press ENTER.

When you press ENTER, the machine stops and the PSW is displayed in binary notation, except for the instruction address, which appears in hexadecimal notation.

The logical meaning of the data that appears in the 'current PSW' display depends on whether your machine is in VSE or 370 mode, and also on whether it is in Basic Control (BC) or Extended Control (EC) mode. The control mode currently in effect for your machine, 370 or VSE, is shown in line 21 of the machine status area, and the EC or BC mode is distinguished by the E-bit in the PSW being one for EC mode, 0 for BC mode.

The contents of each bit position in the PSW are represented as binary 1 or 0 ('B' in the example above). Below each display field is the corresponding alter field, which is blank unless data is being altered.

With the exception of the system mask (SYST.MASK), the contents of the current PSW may be altered in any binary (or hex for the instruction address) combination. The allowed combinations for the system mask are as follows:

BBBB BBBB	
xxxx xxxx	VSE BC Mode
xxxx xxxx	370 BC Mode
0x00 00xx	VSE EC Mode
0x00 0xxx	370 EC Mode

where 'X' may be 0 or 1.

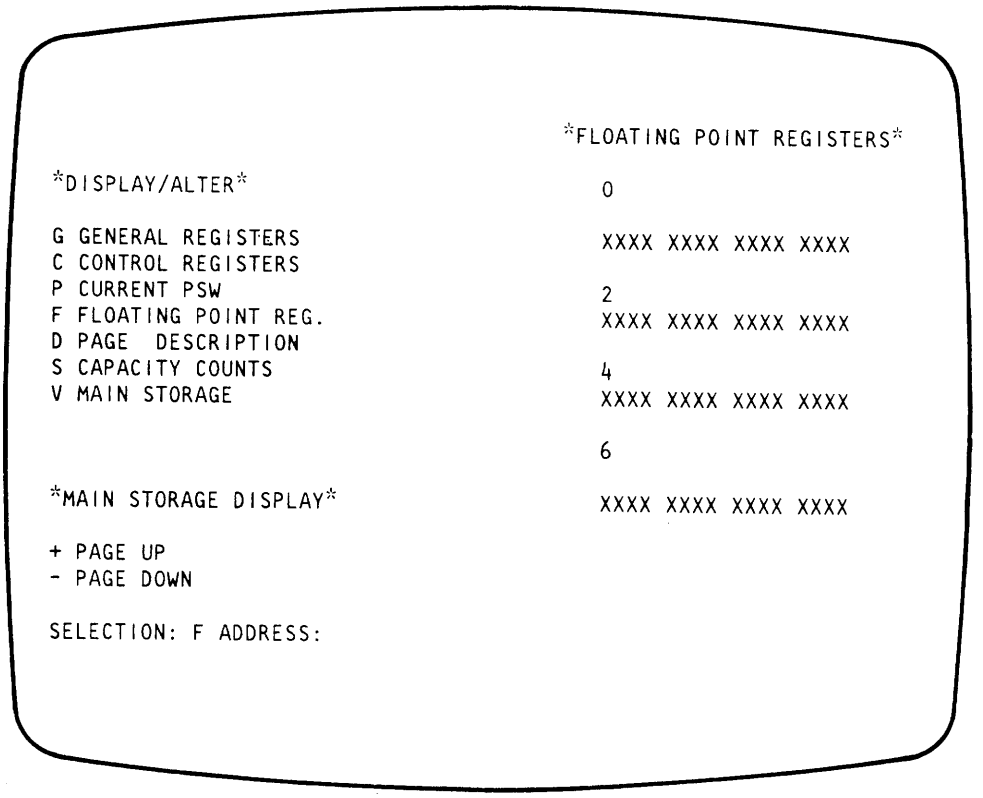
Any other combination results in the error message 'Invalid Syst. Mask'.

If logical errors are made while altering the current PSW, the errors are accepted and loaded with the PSW. The following is a logical error:

- When in BC mode the address exceeds the storage size, INVALID ADDR LOADED appears; but the address is still loaded into the PSW. If the program uses an invalid address, the message PSW ADR ERROR appears on line 21.

Floating Point Registers

This display enables you to examine the contents of the floating point registers.



The picture above appears in VSE mode.

To select the 'floating point registers' display:

1. Type in F after the word SELECTION.

2. Press ENTER.

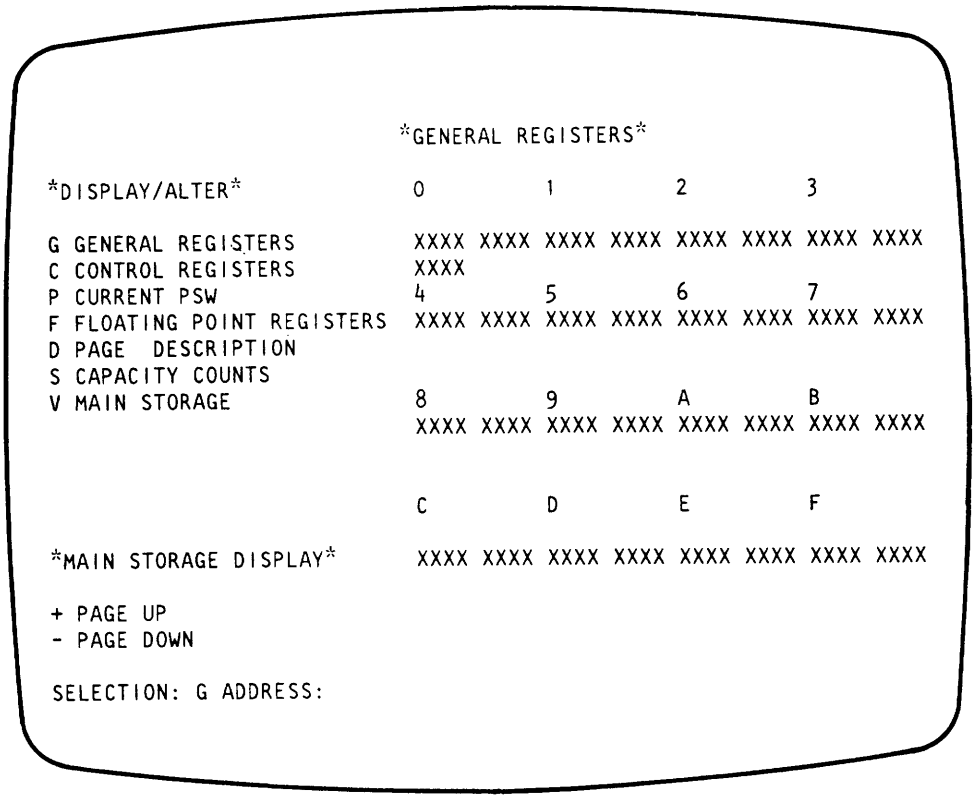
The four floating point registers appear in the display. In the example given above, each X represents a hexadecimal digit. Beneath each display field is the corresponding alter field, which is blank unless data is being altered.

To direct the cursor to the first half of a register, type the register number (0, 2, 4, 6) next to ADDRESS and press ENTER. To select the second half of the register, specify 1, 3, 5 or 7. The cursor will appear below the first (alter) character position in the specified fullword.

The procedure for altering is described under 'General Registers'.

General Registers

This display causes all 16 general registers to be displayed.



This picture is shown in VSE mode

To select the 'general registers' display:

1. Type G into the 'display/alter' display next to SELECTION.

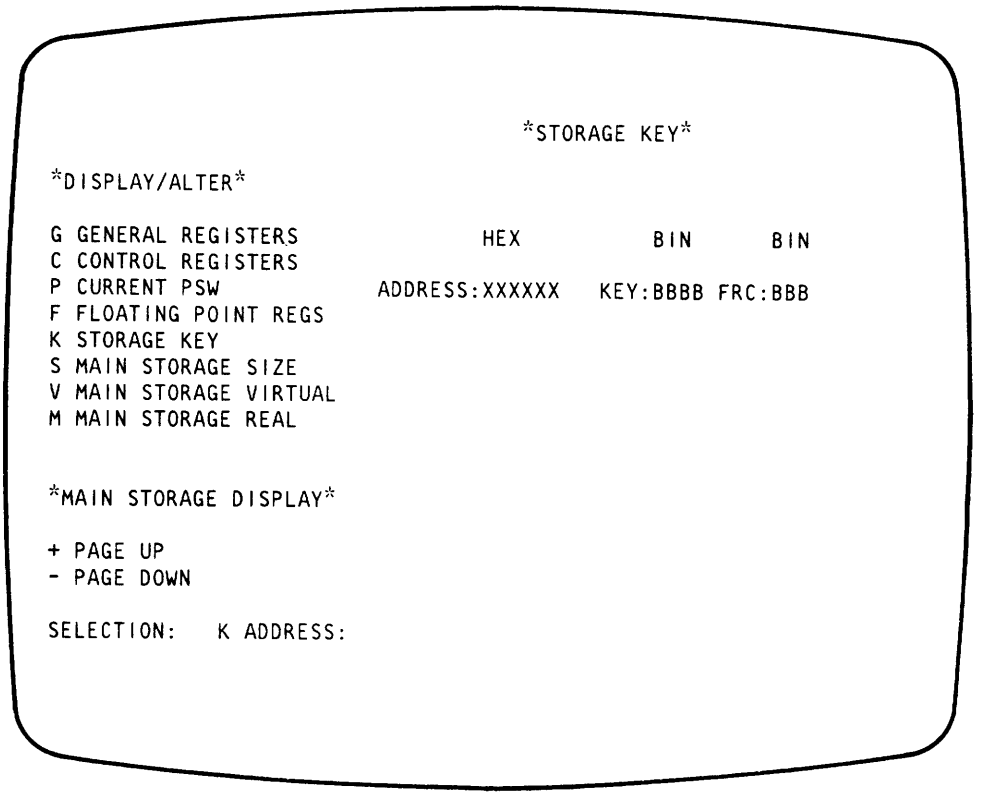
2. Press ENTER.

To direct the cursor to a register, type the register number (0-F) next to ADDRESS and press ENTER. The cursor will appear below the first (alter) character position in the specified register.

The contents of each register in the display are represented as eight hexadecimal characters in the display field (X in the example above). Below each display field is the corresponding alter field, which is blank unless data is being altered.
After an alteration, START must be pressed to resume operation. During processing, the 'general registers' display remains on the screen. If the operator then presses STOP, processing stops and the current contents of the general registers are displayed.

Storage Key

The 'storage key' display enables you to determine the protection key of any given main storage address. An example of this display is given below. (This display is operational only in 370 mode).

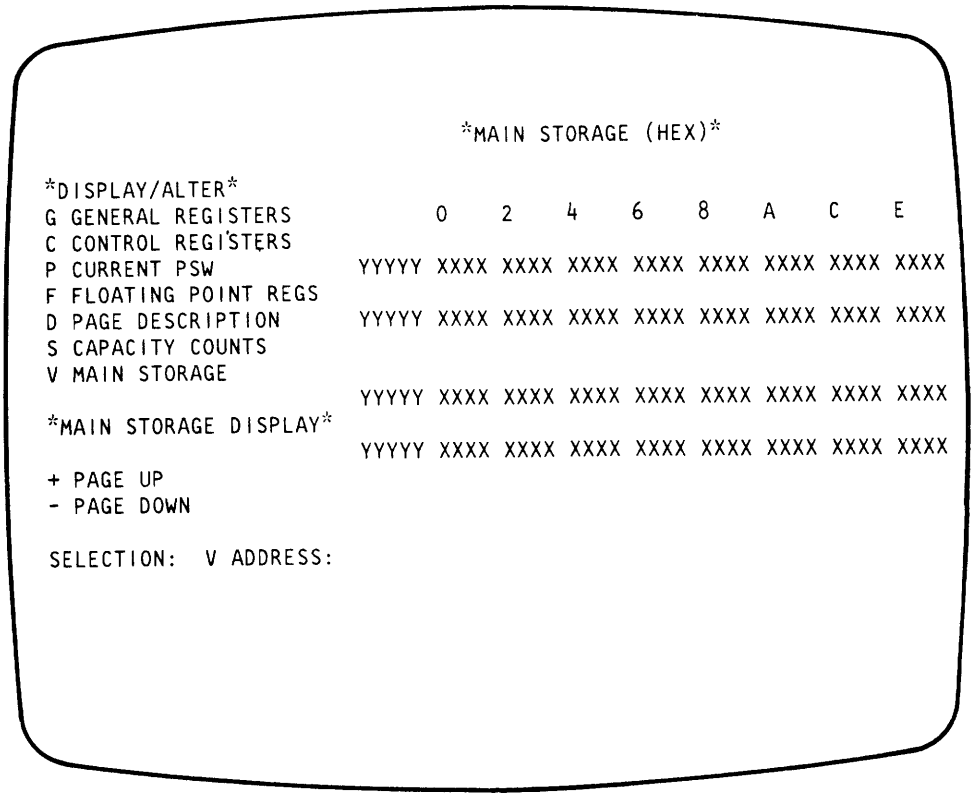


To select the 'storage key' display:

1. Type K into the 'display/alter' display next to SELECTION.
2. Type in the main storage address in hexadecimal notation.
3. Press ENTER.

Note that the address is in hexadecimal notation and the key is in binary notation. The reference (R), the change (C) and the fetch (F) protection bits are shown in binary notation.

The 'main storage' display enables you to show a block of 32 halfwords of main storage on the screen.



This picture is shown in VSE mode.

To select the 'main storage' display:

1. Type V into the 'display/alter' display next to SELECTION.
2. Type in the main storage address in hexadecimal. The leading zeros are supplied by the system.
3. Press ENTER.

The Y characters in the example display represent in hexadecimal notation the main storage address without its low order digit. Each X represents a hexadecimal digit. The low-order digit of the address is shown above the left-most byte of each halfword (0,2,4,6,8,A,C,E). To display another p art of storage, enter V and the new address next to SELECTION.

The block of storage displayed on the screen may be in one of the following three states:

- Addressable (Processor addressable)
- Connected (Channel only addressable)
- Disconnected (not addressable)

The status is shown in the message area on the screen. If a block is disconnected, the data area on the screen is blank.

The PAGE function displayed on the screen above SELECTION enables you to display the adjacent storage section, that is, the next 64 bytes in either descending or ascending order of address. To get the next higher section press the '+' key, to get the next lower section press the '-' key.

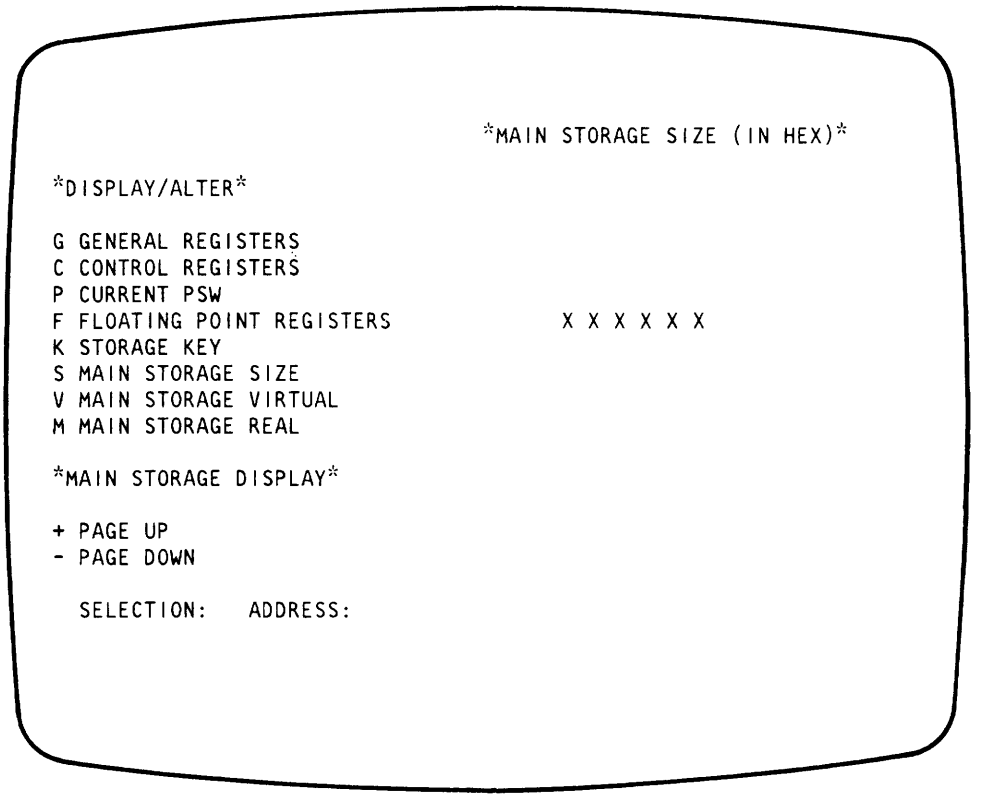
Another possibility to scroll pages is:

PAGE UP - Hold the ALT key down and press PAGE ↑

PAGE DOWN - Hold the ALT key down and press PAGE ↓

Main Storage Size

The 'main storage size' display enables to display the size of the physical storage which is actually available for Operating System and Application Program residence. (370 mode only).



To select the 'main storage size' display:

1. Type S into the 'display/alter' display after the word SELECTION.

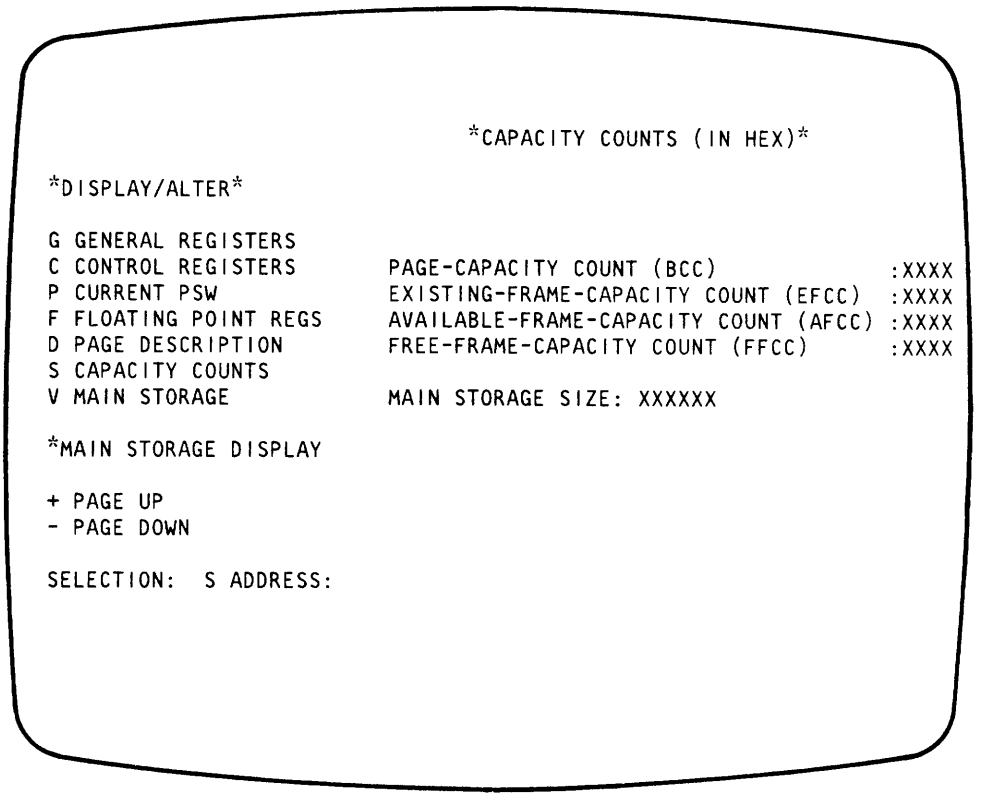
2. Press ENTER.

The main storage size is displayed as six hexadecimal characters.

Note: The main storage size can only be displayed, not altered.

Capacity Counts

This display allows to display the capacity counts and the physical storage size actually available to the operating system and application program residence (in VSE mode only).



To select the 'capacity counts' display:

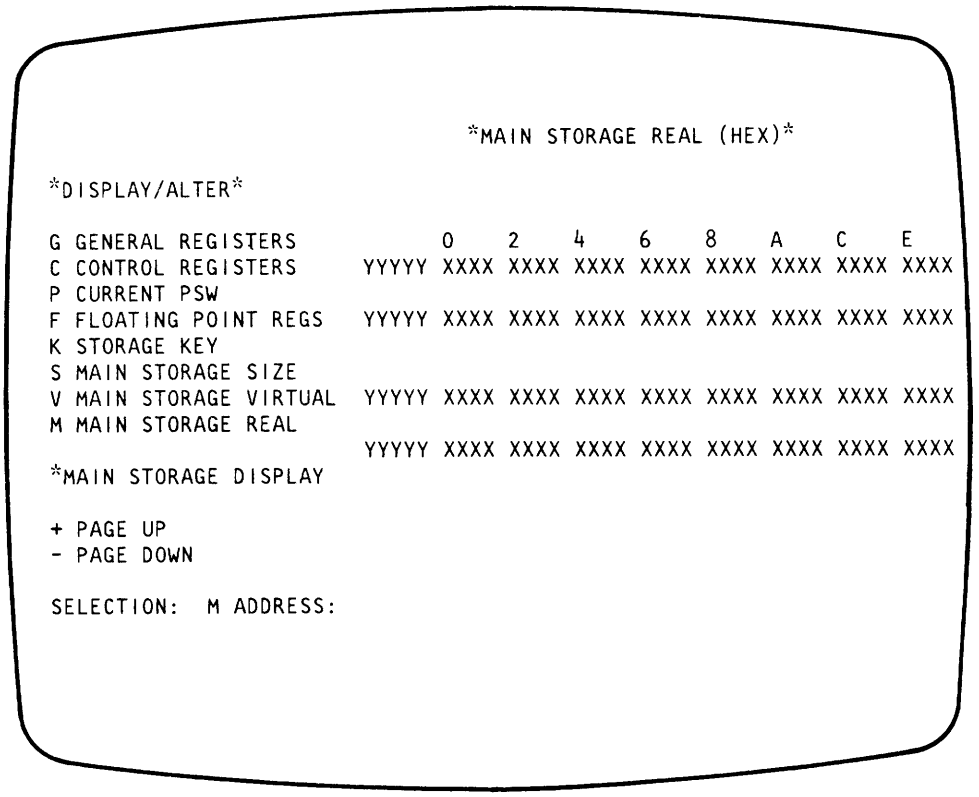
1. Type S into the 'display/alter' display next to SELECTION
2. Press ENTER.

The capacity counts are displayed as four hexadecimal characters, the machine storage size as six hexadecimal characters.

Note: Capacity counts and available storage can only be displayed, not altered.

Main Storage Real

This display allows you to display a block of 32 halfwords of real main storage (in 370 mode only).



To select the 'main storage real' display:

1. Type M into the 'display/alter' display next to SELECTION.
2. Type in the main storage address in hexadecimal notation. The leading zeros are supplied by the system.
3. Press ENTER. The system stops and the 'main storage real' display appears on the screen.

The Y characters in this display represent, in hexadecimal notation, the real main storage address without its low order digit. Each X represents a hexadecimal digit. The low-order digit of the address is shown above the left-most byte of each halfword.

The PAGE function displayed on the screen above SELECTION enables you to display the adjacent part of real storage by moving the display address backwards or forwards by 64

bytes.

PAGE UP - Hold the ALT key down and press PAGE ↑
PAGE DOWN - Hold the ALT key down and press PAGE ↓

This display enables you to show a block of 32 halfwords of virtual storage on the screen (in 370 mode only).

```
                                *MAIN STORAGE VIRTUAL (HEX)*

*DISPLAY/ALTER*                   REAL ADDRESS: RRRRR

G GENERAL REGISTERS
C CONTROL REGISTERS
P CURRENT PSW
F FLOATING POINT REGS          0    2    4    6    8    A    C    E
K STORAGE KEY             YYYYY XXXX XXXX XXXX XXXX XXXX XXXX XXXX XXXX
S MAIN STORAGE SIZE
V MAIN STORAGE VIRTUAL
M MAIN STORAGE REAL       YYYYY XXXX XXXX XXXX XXXX XXXX XXXX XXXX XXXX

*MAIN STORAGE DISPLAY*    YYYYY XXXX XXXX XXXX XXXX XXXX XXXX XXXX XXXX

+ PAGE UP
- PAGE DOWN               YYYYY XXXX XXXX XXXX XXXX XXXX XXXX XXXX XXXX

SELECTION: V ADDRESS:
```

To select the 'main storage virtual' display:

1. Type V into the 'display/alter' display next to SELECTION.

2. Type in the virtual main storage address in hexadecimal notation. The leading zeros are supplied by the system.

3. Press ENTER.

The Y characters in this display represent in hexadecimal notation the virtual main storage address without its low-order digit. Each X represents a hexadecimal digit. The low-order hexadecimal digit of the address is shown above the left-most byte of each halfword (0,2,4,6,8,A,C and E). The R characters represent, in hexadecimal notation, the translation of the virtual address which you entered to get this display.

The PAGE function displayed on the screen above SELECTION allows you to display an adjacent part of virtual storage

by moving the display address backwards or forwards 64 bytes:

PAGE UP - Hold the ALT key down and press PAGE ↑
PAGE DOWN - Hold the ALT key down and press PAGE ↓

If one of the following messages appears, the main storage section of the display does not appear:

OUTSIDE PAGE TABLE - The specified address is outside the page table.

OUTSIDE SEGMENT TABLE - The specified address is outside the segment table.

PAGE OR SEGMENT ENTRY INVALID - The specified address is not in physical storage.

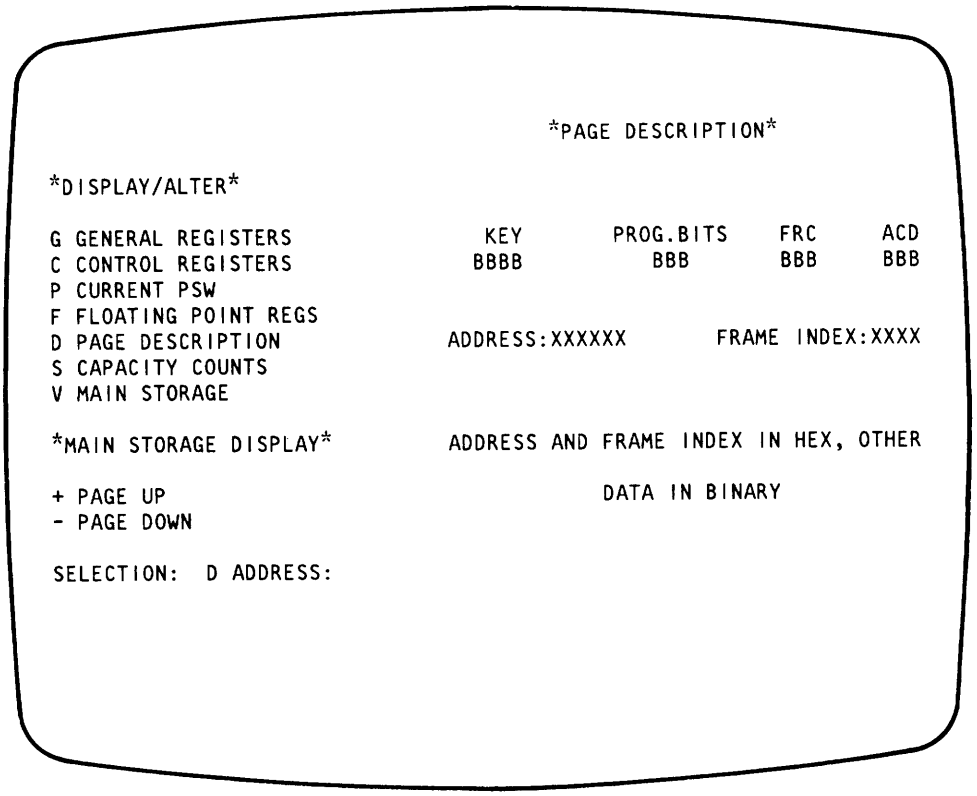
SPECIFICATION EXCEPTION - Specification error: zeros are missing from the prescribed bit positions in the specified page or segment entry.

ADDRESSING EXCEPTION - The page or segment entry address is outside processor storage.

ADDRESS NOT TRANSLATABLE - The system is in BC mode.

Page Description

The 'page description' display enables you to display and, in some cases, alter selected data in page frames in main storage (in VSE mode only).



To select this display:

1. Type D into the 'display/alter' display next to SELECTION.
2. Type in the main storage address in hexadecimal notation. The leading zeros must be included.
3. Press ENTER.

The following data in the page description can be altered:

- Storage key
- Programmable bits
- Fetch protection (F) bit
- Reference (R) bit
- Change (C) bit

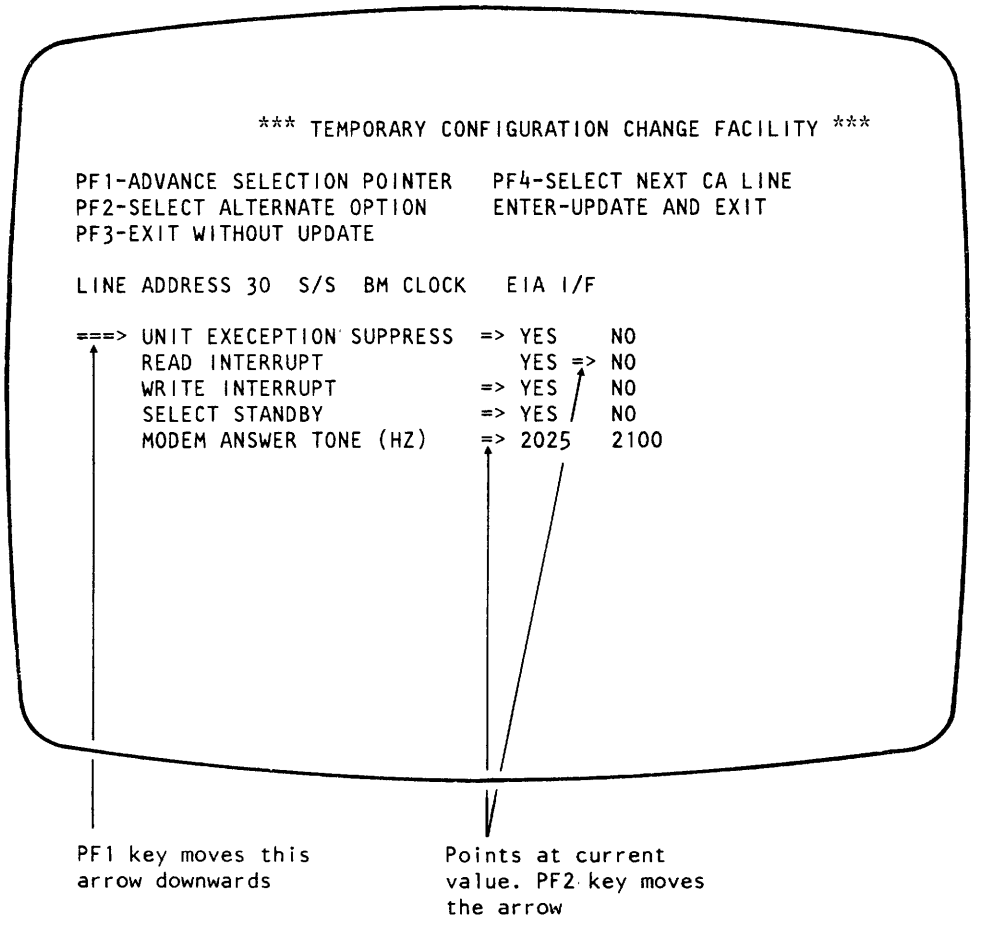
The following data is displayed but cannot be altered:

- Frame index
- Address
- Addressable bit (A) (Processor addressable)
- Connected bit (C) (Channel Only addressable)
- Disconnected bit (D) (Not addressable)

The communication lines display allows you to temporarily change some operating parameters of your communication lines so as to improve the operation or to achieve compatibility with the terminal at the other end. Among the items that can be changed are the transmission speed, the way in which the modem answers, the line code used, and others explained in the following text. The changes are temporary because they are automatically revoked upon the next IML or any type of system reset.

Start / Stop Lines

This display allows you to change the values of certain options for the telecommunication lines under S/S control.



To select the display:

1. Type E into the 'MODE SELECTION' display after SELECTION.
2. Press ENTER.

The display appears containing the configuration for the telecommunication line. The top portion of the display explains how to select the various items, how to get the next line, etc. Underneath, the currently selected line is specified in the following terms:

1. Line address

2. Line control procedure:

   - S/S (Start/Stop)
   - BSC (Binary Synchronous Communication)
   - SDLC (Synchronous Data Link Control)

3. Type of clock:

   - BM (Business Machine) clock
   - Mod (External Modem) clock

4. Type of interface:

   - EIA I/F - EIA/CCITT V24 interface
   - V35 I/F - CCITT high speed interface
   - DDS I/F - DDS interface
   - LOC ATT - local attachment
   - INT MODEM - integrated modem

The remaining lines on the screen contain items for which usually two options are offered. To change these values, proceed as follows:

1. Press the PF1 key to move the large arrow in the left margin of the screen to point at the item you wish to change. Actually you must hold down the ALT key then press the numeric key 1 (this activates the PF1 function).

2. Press the PF2 key to move the small arrow pointing at one of the options (in the right-hand columns) to the required value. If the small arrow is missing, the associated parameter is not relevant to this configuration. Some combinations of parameter values are invalid. If such a combination is selected, a warning message is given and the change is rejected.

3. When you have finished updating the options for the line presently displayed, press the PF4 key and the display for the next line will appear. A message appears if the equipment corresponding to the next line is not installed. If the present display was for the last line the display for the first line appears again.

4. When all updating is finished, press ENTER. When you intend to finish the procedure without changing

anything press PF3.

Changes in the displayed configuration are required only when your installation uses switched lines where you may have communications with various different types of terminals and you may have to adjust your equipment to the needs of the remote terminal. The following describes the start/stop line parameters and when they are required.

Unit Exception Suppress must be set to yes when the remote station is a 2741 or equivalent. The 2741 sends a circle-C character as the only ending character it "knows" and this would always cause a unit exception which breaks a command chain unless suppressed as recommended.

Read Interrupt should be set to yes when the program (in your system) is to be authorized to issue a break command to the remote station to stop this station's transmission. If read interrupt is set to "no", a break command is rejected. The issuing of a break command is possible only on duplex facilities (4-wire line or duplex modem on 2-wire line).

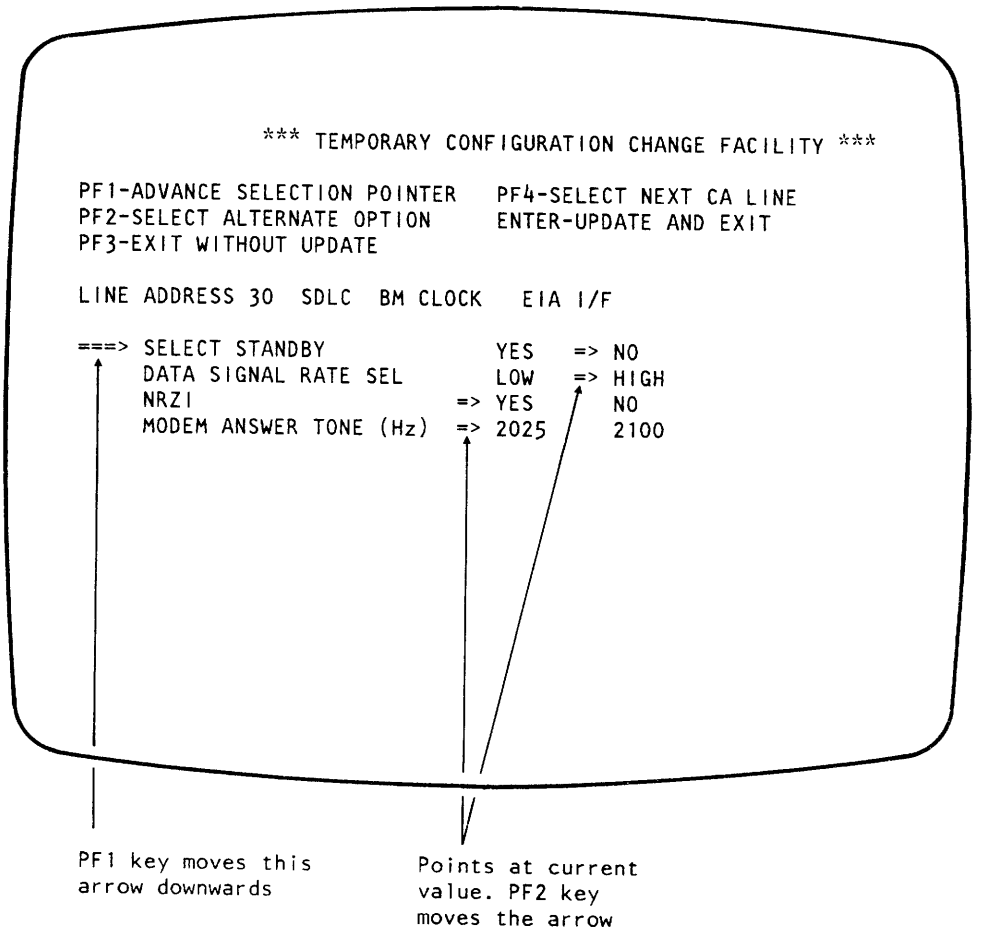
Write Interrupt should be set to yes when you want to authorize the remote station to stop your line's transmission. By setting yes, your line will accept the break signal from the remote station. This requires duplex facilities (same as for read interrupt).

Select Standby should be set to yes when your leased or privately owned line is damaged and you are forced to change to a switched line to sustain communication. The standby can be used only when the modem has the switched network backup capability.

Answer Tone should be set to 2025 Hz if the modem of the remote station is a WE 202 (Western Electric) type modem. This selection sets the integrated modem in the 4331 to provide the answer tone which the WE 202 requires. Select 2100 Hz in all other cases, or when the modem of the other station is unknown.

Note: The answer tone selection appears in the display only when your line is equipped with the integrated modem, otherwise the bottom line of the display is omitted.

This display allows you to change the values of certain options for the telecommunication lines under SDLC control.



To select the display:

1. Type E into the 'MODE SELECTION' display next to SELECTION.

2. Press ENTER.

The display appears containing the configuration for the telecommunication line. The top portion of the display explains how to select the various items, how to get the next line, etc. Underneath, the currently selected line is specified in the following terms:

1. Line address

2. Line control procedure:

   - S/S (Start/Stop)
   - BSC (Binary Synchronous Communication)
   - SDLC (Synchronous Data Link Control)

3. Type of clock:

   - BM (Business Machine) clock
   - Mod (External Modem) clock

4. Type of interface:

   - EIA I/F - EIA/CCITT interface
   - V35 I/F - CCITT high speed interface
   - DDS I/F - DDS interface
   - LOC ATT - local attachment
   - INT MODEM - integrated modem

The remaining lines on the screen contain items for which usually two options are offered. To change these values, proceed as follows:

1. Press the PF1 key to move the large arrow in the left margin of the screen to point at the item you wish to change. Actually you must hold down the ALT key then press the numeric key 1 (this activates the PF1 function).

2. Press the PF2 key to move the small arrow pointing at one of the options (in the right-hand columns) to the required value. If the small arrow is missing, the associated parameter is not relevant to this configuration. Some combinations of parameter values are invalid. If such a combination is selected, a warning message is given and the change is rejected.

3. When you have finished updating the options for the line presently displayed, press the PF4 key and the display for the next line will appear. A message appears if the equipment corresponding to the next line is not installed. If the present display was for the last line the display for the first line appears again.

4. When all updating is finished, press ENTER. When you intend to finish the procedure without changing anything press PF3.

The following describes the SDLC line parameters and when they are required.

Select Standby allows you to select the switched network backup facility of your modem (provided the modem is so equipped). By selecting yes, the modem uses a switched line instead of the normally used leased or privately owned line. Select yes when the normally used line is damaged.

Data Signaling Rate Selector allows you to set the modem to

the higher or lower of two clocking speeds if the modem is properly equipped. Normally the higher speed is set. However, if the number of error incidents and therefore the number of recovery or retransmission actions becomes excessive, you should select the lower speed. With a lower speed a "noisy" line can still be used. You may also have to change the speed (the signaling rate) to adjust to the speed of a remote station.

NRZI allows you to change from the normal non-return-to-zero inverted (NRZI) method of encoding digital signals to a method where the signal is not inverted when successive zero bits appear.
Some modems are sensitive to certain steady bit patterns and may thus require either NRZI or not-NRZI to function properly (check the modem manufacturers information for the applicable mode). Crypto-units which encypher/decypher data may linkewise require one or the other mode. Because SDLC-transmission is bit-oriented, bit synchronization is important. Therefore, in case of too many errors, check which type of mode is required, you may have to change.

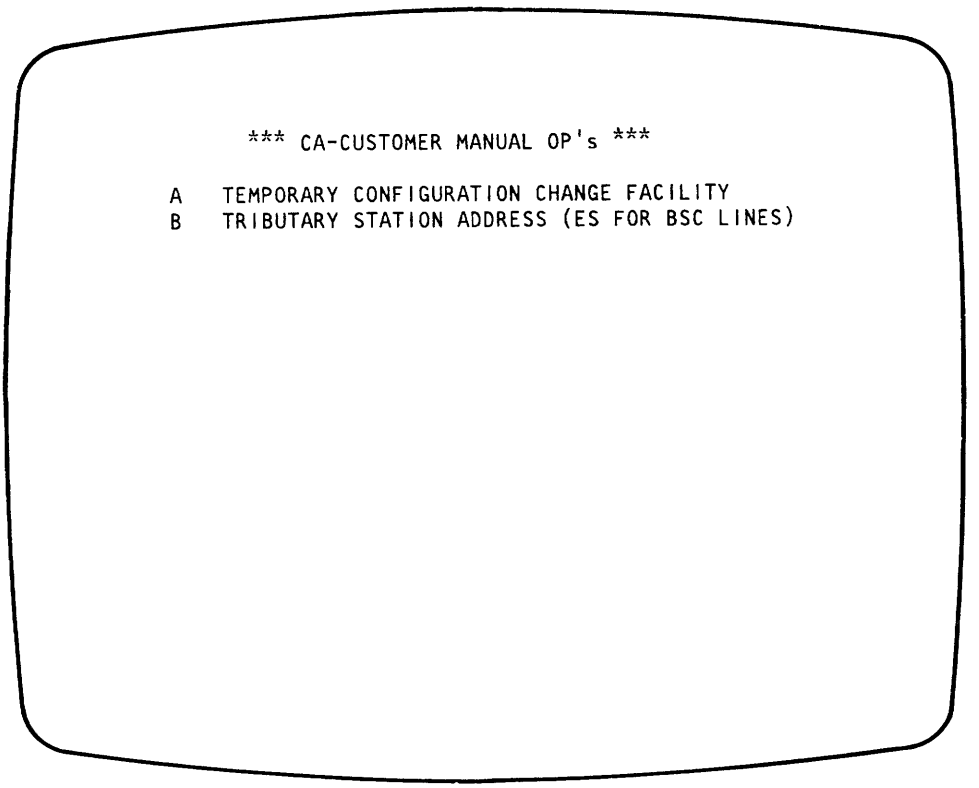
Answer Tone should be set to 2025 Hz if the modem of the remote station is a WE 202 (Western Electric) type modem. This selection sets the integrated modem in the 4331 to provide the answer tone which the WE 202 requires. Select 2100 Hz in all other cases, or when the modem of the other station is unknown.

Note: The answer tone selection appears in the display only when your line is equipped with the integrated modem, otherwise the bottom line of the display is omitted.

This display allows you to change the values of certain options for the telecommunication lines under BSC control.

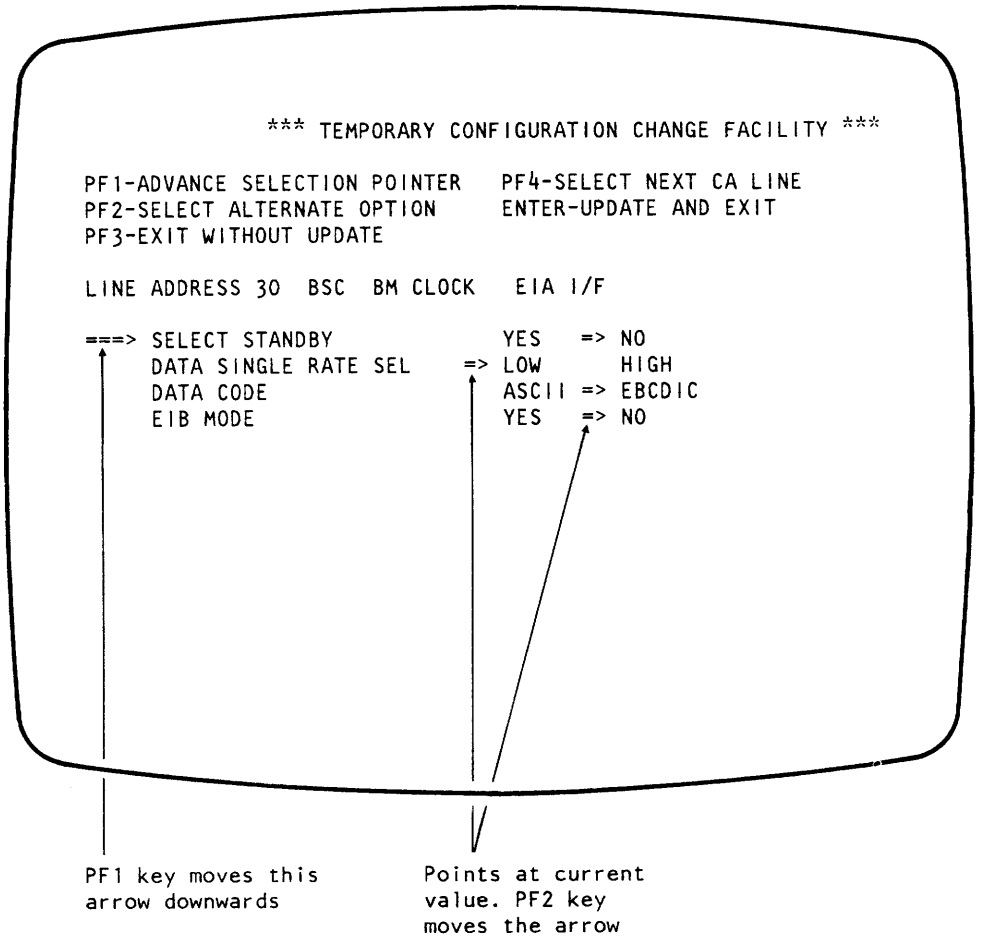
To select the display:

1. Type E into the 'MODE SELECTION' display next to SELECTION.
2. Press ENTER.
3. The following display will appear on the screen:



This display allows you to directly select either the temporary configuration change facility or the display for changing the tributary station addresses for all BSC lines.

Type "A" for the Temporary Configuration Change or "B" for the Tributary Station Address and press ENTER. The associated displays will appear on the screen.



The display appears containing the configuration for the telecommunication line. The top portion of the display explains how to select the various items, how to get the next line, etc. Underneath, the currently selected line is specified in the following terms:

1. Line address

2. Line control procedure:

   - S/S (Start/Stop)
   - BSC (Binary Synchronous Communication)
   - SDLC (Synchronous Data Link Control)

3. Type of clock:

   - BM (Business Machine) clock
   - Mod (External Modem) clock

4. Type of interface:

   - EIA I/F - EIA/CCITT interface
   - V35 I/F - CCITT high speed interface
   - DDS I/F - DDS interface
   - LOC ATT - local attachment

- INT MODEM - integrated modem

The remaining lines on the screen contain items for which usually two options are offered. To change these values, proceed as follows:

1. Press the PF1 key to move the large arrow in the left margin of the screen to point at the item you wish to change. Actually you must hold down the ALT key then press the numeric key 1 (this activates the PF1 function).

2. Press the PF2 key to move the small arrow pointing at one of the options (in the right-hand columns) to the required value. If the small arrow is missing, the associated parameter is not relevant to this configuration. Some combinations of parameter values are invalid. If such a combination is selected, a warning message is given and the change is rejected.

3. When you have finished updating the options for the line presently displayed, press the PF4 key and the display for the next line will appear. A message appears if the equipment corresponding to the next line is not installed. If the present display was for the last line the display for the first line appears again.

4. When all updating is finished, press ENTER. When you intend to finish the procedure without changing anything press PF3.

The following describes the BSC parameters and when they are required:

Select Standby allows you to select the switched network backup facility of your modem (provided the modem is so equipped). By selecting yes, the modem uses a switched line instead of the normally used leased or privately owned line. Select yes when the normally used line is damaged.

Data Signaling Rate Selector allows you to set the modem to the higher or lower of two clocking speeds if the modem is properly equipped. Normally the higher speed is set. However, if the number of error incidents and therefore the number of recovery or retransmission actions becomes excessive, you should select the lower speed. With a lower speed a "noisy" line can still be used. You may also have to change the speed (the signaling rate) to adjust to the speed fo a remote station.

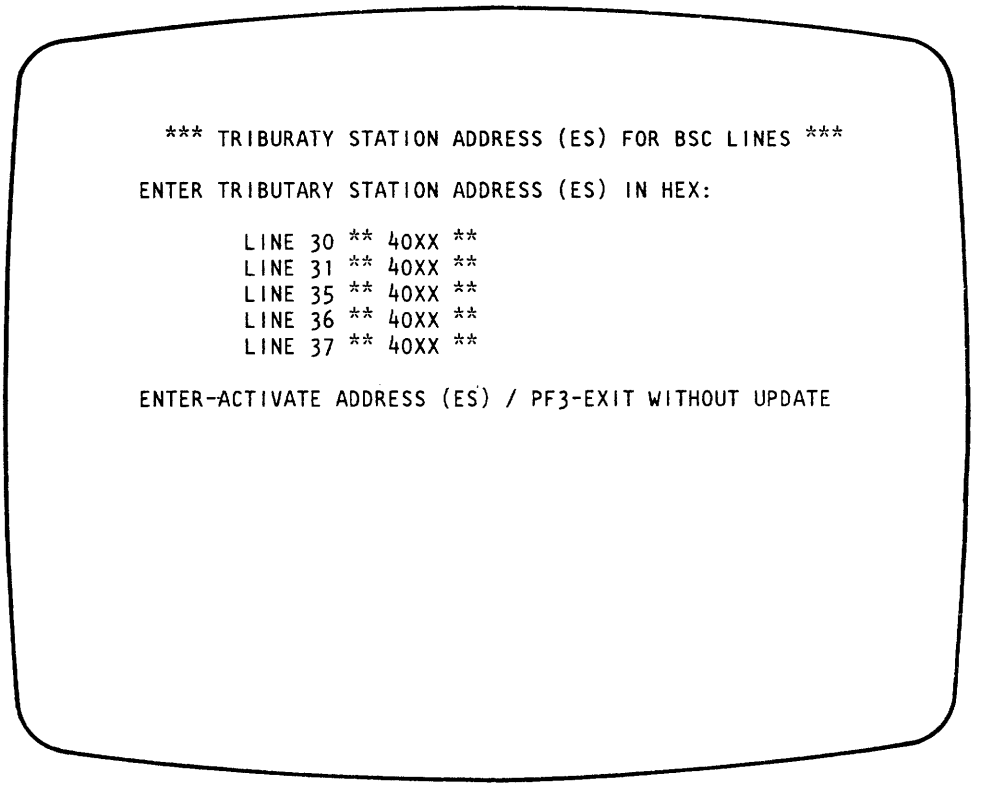
Data Code. ASCII code should be selected whenever the

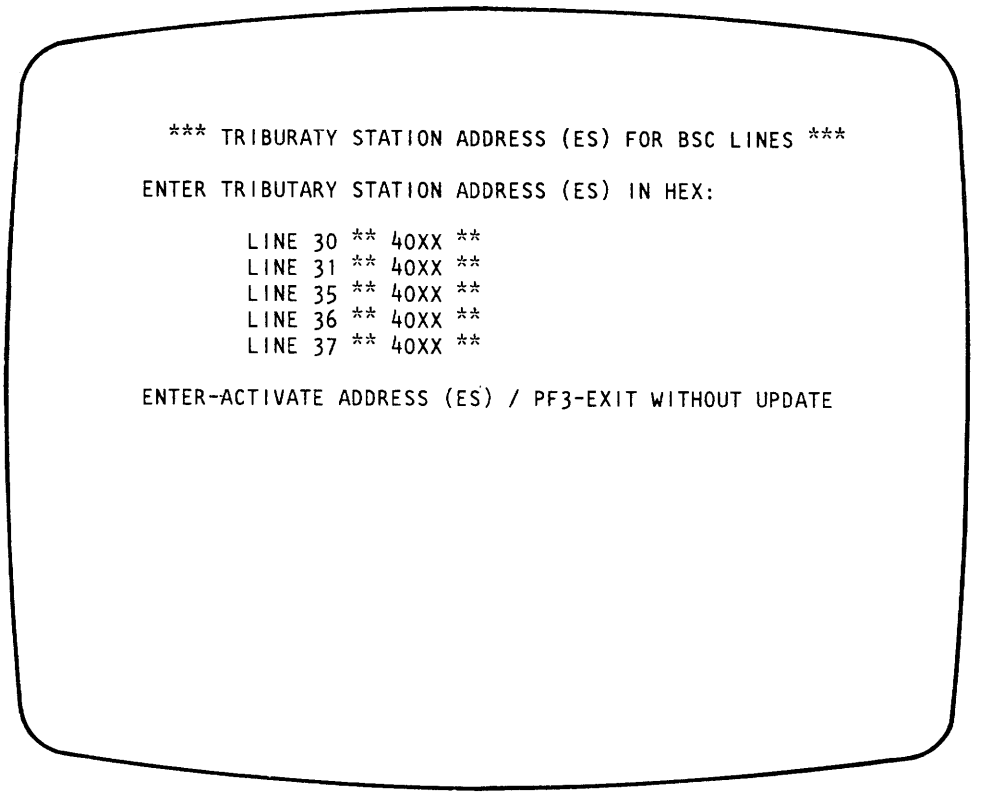
remote station requires this type of line code, otherwise EBCDIC should be used. Ask the system programmer when in doubt or ask the operator at the remote location.

EIB Mode allows you to specify that an error index byte (EIB) is to be set into storage adjacent to each ITB, ETB, and ETX character that is received. The intermediate text block (ITB), end of text block (ETB), and end of text (ETX) character are inserted into the message by the remote station to divide the transmission into smaller portions. In this way EIB mode reduces the amount of code that is to be retransmitted for recovery because only the text up to the last index byte must be sent again (ask the system programmer for details as to when to use EIB mode).

Tributary Station Address

The tributary station addresses appear only when your installation includes BSC-lines and you have entered B in the CA-Customer Manual Ops display. This selection brings the following display to the screen:





The display lists all lines that use BSC protocol but only those lines. This explains why the addresses do not necessarily run in sequence (in our example, line 31 is followed by line 35 because lines 32, 33, 34 are Non-BSC or do not exist).

The display is required only when your communication lines are part of a multi-point network and participate as tributary stations. Tributary stations can be selected or polled from a master (remote) station. For this reason they must be "known" by an address and this address is normally assigned once at installation time.

Every line has two tributary station addresses which may (but need not) both be used. The idea is to give a group of lines a group address, for example address 40. If address 40 is given to four lines, these four lines could simultaneously receive data from the master station (when addressed by their group address). The display contains the group address 40 as default value for each line. You may leave these addresses or change them, as you like. Besides such a group address, each line can get an individual tributary station address, for example 41, 42, 43, etc, and will then be separately addressable. The place to enter such addresses is blank in the display, but marked XX in our example for clarity.

You may enter the first address (leftmost two digits) as group address and the next two digits (marked XX) may

represent the individual station address, or vice versa. The addresses are accepted in either position. If you enter only one address (either left or right) for a line, that address is automatically assumed to apply to both address slots. For example, if you keep the default address 40, the individual address is also 40 (eventhough the space marked XX is blank in the display).

The cursor is located underneath the first line's left address. You may enter the addresses in sequence (the cursor moves along) or you may pick a specific address via the cursor movement keys.

Note: Only specific codes are valid as tributary station addresses and the display accepts only valid codes. You may either assign the address by trial and error or go by the following validity rules:

1) Do not use any of the following control characters: SOH (Hex 01), STX (Hex 02), ETX (Hex 03), EOT (Hex 37), ETB (Hex 26), ENQ (Hex 2D), DLE (Hex 10), NAK (Hex 3D), SYN (Hex 32), or ITB (Hex 1F). The Hex codes listed here are FBCDIC. For ASCII, see the /370 reference card.

2) If the line code is ASCII (which is a 7-bit code) no value higher than hex 7F can be used (i.e. bit 0 in the byte must be 0).

3) Bit number 2 (counting from left to right) in the byte must not be 1. This rules out all addresses that begin with 2, 3, 5, 6, A or F. This rule ensures that bit 2 can be used to distinguisch polling and selection during addressing.

When you have typed in all addresses, you may either press the PF3-key to exit without changing anything or the ENTER key to put the change to work.

After ENTER key depression you will first see the message "update in process" and after a while this message changes to "update done". As of this instant, the changes are recorded on the system diskette and the changes are in effect for any program. No IML is required.

To return to the operating system either press CANCEL or PF3.

Instruction Step

Instruction step mode allows you to direct the processor to execute one instruction with each depression of the START key. The changes in data that occur for each instruction executed are shown on the screen so that you can follow them. This mode has no multiple choice display, it is set from the mode selection display.

To select instruction step mode:

1 Type I into the mode selection display next to SELECTION.

2. Press ENTER.

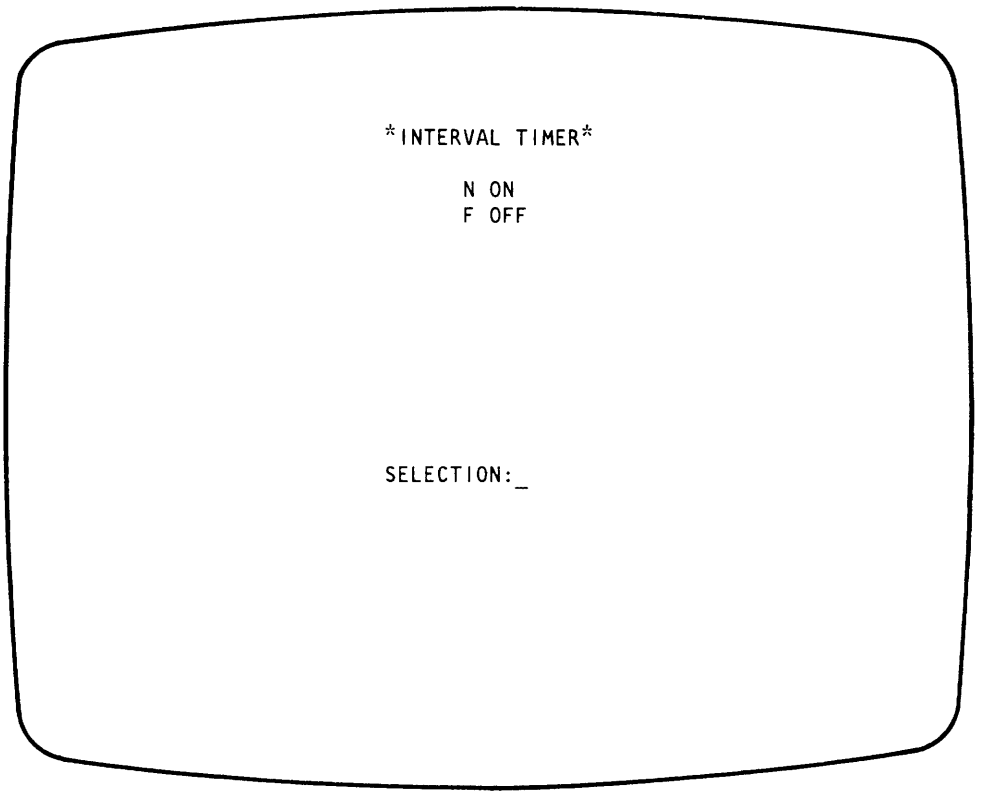
When instruction step mode has been set, one instruction is executed each time you press START. The address of each instruction, and the contents of storage at this address, appear in line 21 of the machine status area. Line 22 of the machine status area indicates when instruction step mode is in effect.

Instruction step mode remains in effect even if other modes are subsequently selected, such as 'display/alter' mode.

To terminate 'Instruction Step' mode see 'Reset I-step' mode.

Interval Timer

This display enables you to set the interval timer. The setting of the interval timer is shown in line 21 of the machine status area.



To select the interval timer display:

1. Type J into the mode selection display next to SELECTION.

2. Press ENTER.

To set the interval timer, type one of the following into the display next to SELECTION:

N - To set the timer on.
F - To set the timer off.

The interval timer is automatically disabled (off) at power-on time.

The 'machine save' mode enables you to make a record of the current state of the processor (VSE mode only). This mode has no display.

To specify machine save:

1. Type S into the 'mode selection' display next to SELECTION.

2. Press ENTER.

When machine save is specified, the following actions occur in the system:

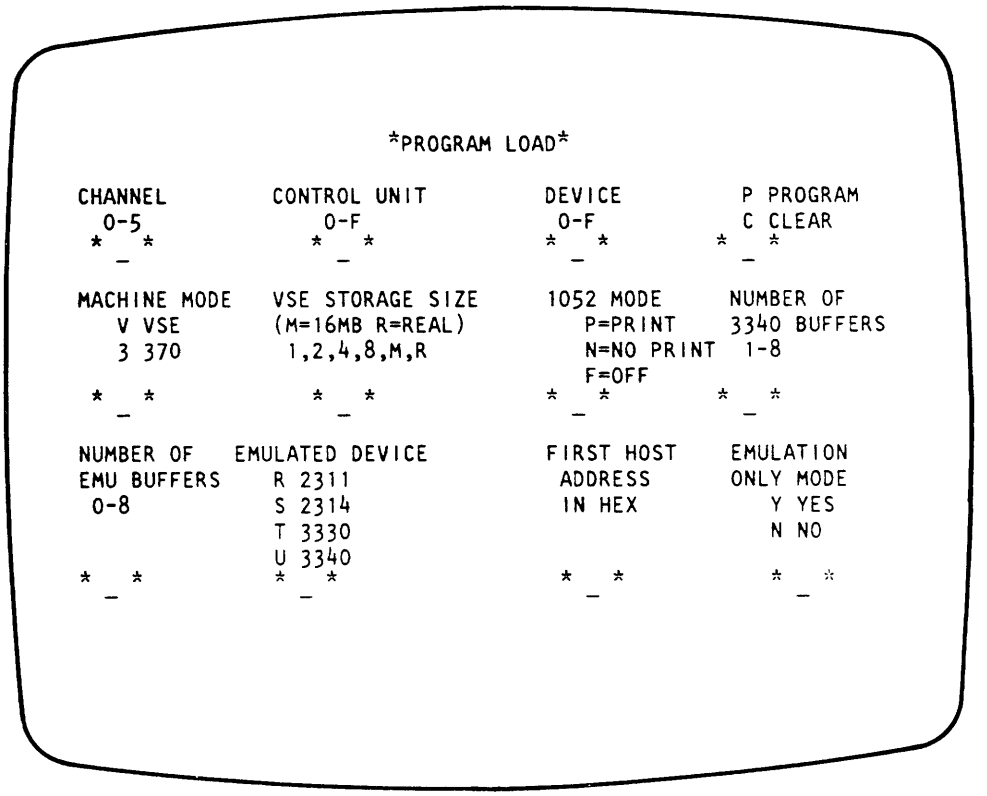
- The processor stops.
- The contents of page 0, that is, the 2048 bytes at addresses 0 to 2047, and all registers and timers are saved in internal storage.

When a save operation has been completed successfully, the save indicator in the machine status area is turned on. A reset, IPL or power off during 'machine save' terminates the operation.

A save operation is especially recommended prior to loading any dump programs or other diagnostic means that use internal facilities (such as registers). The save operation preserves the processor state as it was when the error occurred.

Program Load

The 'program load' display enables you to load the programs to be run on your system. It appears automatically when IML has been completed successfully. If IML is unsuccessful, a progress report remains on the screen and the LOAD indicator in line 21 does not turn off.



NOTE: The following legends appear on the screen only when the corresponding compatibility features are installed:

- 1052 MODE
- NUMBER OF 3340 BUFFERS
- NUMBER OF EMU BUFFERS
- EMULATED DEVICE
- FIRST HOST ADDRESS
- EMULATION ONLY MODE

To select the program load display:

1. Type L into the 'mode selection' display after SELECTION.

2. Press ENTER.

The program load display appears on the screen, showing the specification entered for the previous load operation. If

you wish to repeat this specification, press ENTER and proceed. If you wish to perform a different load operation, specify as follows:

1. Enter the address of the device from which you want to load your programs in the CHANNEL, CONTROL UNIT, and DEVICE fields

2. Type in either P or C under the program reset field:

   P PROGRAM specifies an initial program reset and clears the following controls to zero with valid parity: PSW, CPU timer, clock comparator and control registers.

   C CLEAR causes a clear reset (see the "Clear Reset" procedure) and must be specified when STORAGE SIZE, NUMBER OF BUFFERS, EMULATED DEVICE or FIRST HOST ADDRESS are changed or this is the first load operation after power-on.

3. Specify under MACHINE MODE in which mode the system is to run: V for VSE mode, or 3 for 370 mode.

4. If you select VSE mode, specify under STORAGE SIZE the size of storage required. The entries '1', '2', '4', or '8' provide 1, 2, 4, or 8 megabytes of storage. You may also specify 'M', which gives you the maximum storage size (16 megabytes), or 'R', which means that the (virtual) processor storage equals the machine storage size of the model you are using.

5. If the console is to operate in /360 1052 emulation mode, the operator must define whether this mode should include the 3287 terminal printer or not. If no printer is installed or if the printer is required for other than console message printing, 'N' for no has to be entered. The 1052 mode will then use the screen as the only means for message output. If the 3287 terminal printer is to be used for console message printing, 'P' for print has to be entered. If 'F' for off or a blank is entered, the console operates in 3270 operation mode. 1052 mode is required for all DOS releases prior to DOS/VS.

6. If the 3340 direct attachment is installed, it is always operational and you must specify the number of buffers required (1 to 8).

7. Zero to 8 buffers may be specified under EMU if the disk compatibility feature is installed (at least one buffer must be specified for the feature to become operational).

8. If you have made the disk compatibility feature operational (by specifying EMU buffers), select one of the devices listed under EMULATED DEVICE.

9. If the disk compatibility feature is operational, specify the address (three hexadecimal characters) of the device that is host to the first emulated disk pack under FIRST HOST ADDRESS.

10. If the 3310 or 3370 disk devices contain only emulated CKD data sets, EMULATION-ONLY MODE = YES must be specified to indicate to the compatibility feature that it has to perform the error logging for the host device. This is because with nothing but count/key/data type disks it is safe to assume that an old operating system is used and this system does not "know" the new fixed block devices.

    If FBA and CKD data sets are intermixed on 3310 or 3370 disk devices it is assumed that the operating system has fixed block device support. In this case, EMULATION-ONLY Mode = NO must be specified to indicate to the compatibility feature that it need not perform the error logging, that is, that the operating system takes care of the error logging for the host device. (Applies to DOS-VSE.)

    Note:

    After specifiying (or changing) the disk compatibility feature specifications, a clear reset must be performed.

If you make an error while entering program load specifications the following messages are displayed on the screen:

- 'Invalid Character' is displayed when an incorrect selector character has been entered.

- 'Invalid Address' is displayed if an invalid 'channel', 'control unit', 'device', or 'host device' address is specified.

- 'Incomplete Entry' appears on the screen if no character was entered or if in case of fast selection, the set of characters keyed in is incomplete.

- 'Invalid Reset, Select *C*' appears on the screen and the cursor is set below the reset specification, if one of the specifications 'storage size', 'number of buffers', 'emulated device', 'host device' or 'emulation-only mode' are changed and reset program (character 'P') is specified. This occurs also if P is

specified for the first load operation after power-on.

- 'Invalid Host Device Address' appears on the screen and the cursor is set below the host device address specification, if the host device address has a valid hex value, but the address is not configured (no host exists).

- 'No Console Printer Configured' appears on the screen when 1052 emulation mode with console printer is selected ('P') and no 3287 console printer is configured (is not installed).

Clear Reset

Clear reset mode enables you to reset the entire system and clears the storage. This mode does not have its own display, it is set from the mode selection display.

To set clear reset:

1. Type C into the 'mode selection' display.

2. Press ENTER.

When clear reset is entered, execution of the current instruction (if any), is halted. Any pending interrupts or machine checks are cleared, and the CPU stops. The following system resources also stop:

- All channels and their control units
- All adapters
- All I/O devices (channel and natively attached)

Clear reset resets the channels and the CPU and initializes the control registers. It also clears to zero the values of the following:

- Current PSW
- CPU timer
- Clock comparator
- General registers
- Floating point registers
- Main storage
- Keys in main storage
- Page description

The TOD clock is not altered and its parity remains unchanged. The mode selection display remains on the screen and, when processor reset has been completed, RESET COMPLETE appears.

Reset I-Step

'Reset I-step' mode allows you to reset the I-step mode of the system. This mode has no display, it is set from the 'mode selection' display.

To set 'reset I-step':

1. Type N into the 'mode selection' display after SELECTION.

2. Press ENTER.

When 'reset I-step' has been set, the instruction step indicator in line 22 of the machine status area is turned off and the screen is returned to the operating system. To continue processing, press START.

Program Reset

'Program reset' mode enables you to reset certain system resources. This mode does not have its own display, it is set from the mode selection display.

To specify 'program reset':

1. Type P into the 'mode selection' display next to SELECTION.

2. Press ENTER.

When 'Program reset' is entered, execution of the current instruction (if any)is halted, anypending interrupts are cleared and the CPU stops.

The following system resources also stop:

- All channels and their control units
- All adapters
- All I/O devices (channel and natively attached)

'Program reset' resets the channels and the CPU, but it does not affect the values of the following:

- Current PSW
- CPU timer
- Clock comparator
- General registers
- Floating point registers
- Control registers
- Main storage
- Keys in main storage
- Page description

Note: 'Reset complete' appears on the screen when processor reset has been completed.
Program reset should only be used prior to loading a stand-alone dump program.
Program reset should not be used indiscriminately because it leaves the registers and the storage loaded with values from previous activities and this may not be suited for a restart.

'Restart' mode is used to restart processing. This mode has no display, it is specified from the mode selection display.

To specify 'restart':

1. Type R into the 'mode selection' display next to the word SELECTION.

2. Press ENTER.

When 'restart' has been entered, the system takes control of the screen. If the machine is in the stopped state when 'restart' is entered, processing starts with the program restart PSW (a fixed location in storage). If the machine is in the operating state, the exchange of PSWs occurs when the current instruction has been executed and after all interrupts for which the CPU is enabled have been handled.

A 'restart' is successful only when an Operating System is used that takes advantage of the restart PSW or prepares a restart PSW for the explicit purpose of restarting the system at a meaningful point.

Store Status

A 'Store status' mode enables you to make a record of the current status of certain system resources. The 'store status' mode is set from the mode selection display. (370 mode only.)

Store status applies only to a machine in 370 mode. If an error occurs during the operation, the CPU enters the check-stop state.

The 'store status' operation stops the processor, then causes the following to be stored in a fixed location in main storage:

- CPU timer
- Clock comparator
- Current PSW
- Floating point register
- Control registers
- General registers

The contents of the registers are not changed.

When ENTER is pressed, the mode selection display remains on the screen and the message STATUS STORED appears. The system goes into the stopped state.

To specify store status:

1. Type S into the 'mode selection' display next to SELECTION.

2. Press ENTER.

Note: STATUS STORED appears on the screen when store status has been completed.
Store status is recommended prior to loading a stand-alone dump program because it saves the contents of the general registers before they are being used by the stand-alone dump program.

TOD Enable

This mode allows you to determine the instant when the time of day (TOD) clock is set. 'TOD enable' mode has no display, it is set from the mode selection display.

To set 'TOD enable':

1. Type Y into the 'mode selection' display after SELECTION.

2. Press ENTER.

The time-of-day clock is normally in the "secure" state which means that the program cannot set the clock. This secure state is removed when you press the ENTER key, and the program will set the clock at this instant (with a previously prepared value).

The status of the TOD clock is indicated in line 22 of the machine status area. The TOD enters secure state automatically after TOD Enable.

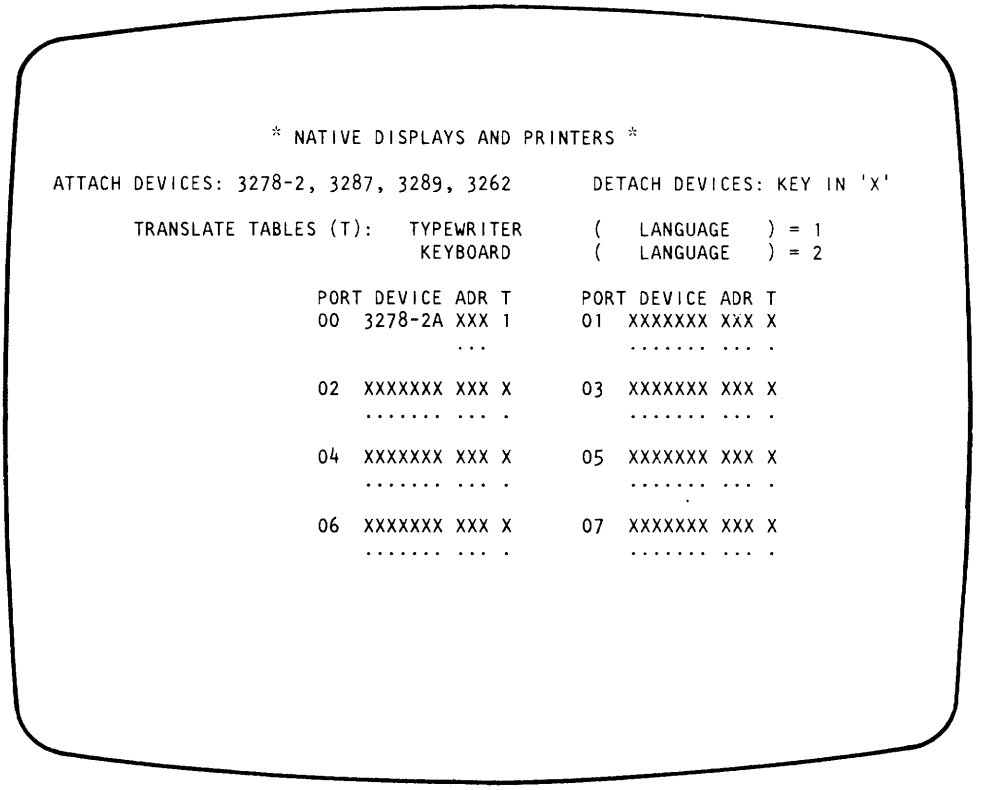
This display allows you to specify what types of devices are connected to the system, how these devices are equipped, and which addresses are assigned to them. The display allows you to "remove" devices without physically disconnecting them, and it allows you to change device addresses or assign new devices.

To select Native Displays and Printer Configurator:

1. Type M into the 'mode selection' display next to SELECTION.

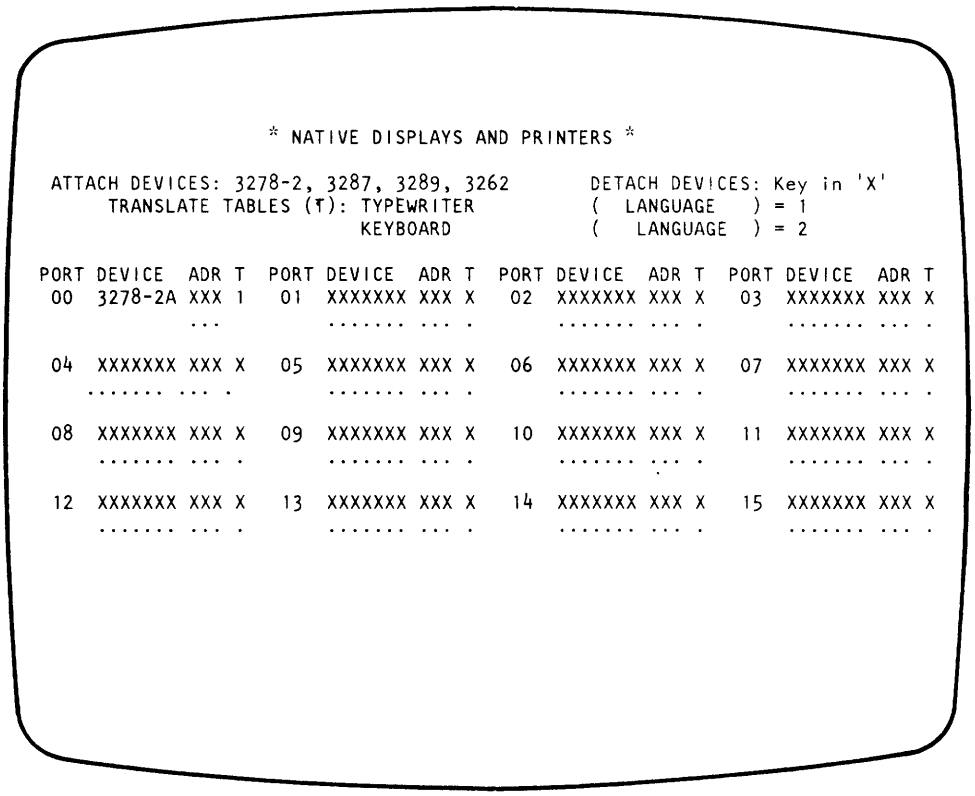
2. Press ENTER.

With standard feature (ports 0-7) the picture below appears.



See explanations on the following pages.

With optional feature (ports 0-15) the following picture appears:



The following display and printer devices can be attached by using addresses from X'009 through X'01F:

- 3278-2 Display station
- 3287 Matrix Printer
- 3289 Printer
- 3262 Printer

The third line of the display shows, following the heading "translate tables (T)", the keyboard layouts chosen when the terminals were ordered, and the National Language associated with each layout. Two different layouts may have been ordered: the mandatory typewriter layout and either the data entry 1 or data entry 2 type layout (these are key punch-like keyboards). Each keyboard type may have its own language associated or both may have the same. It is also possible that only one type of keyboard (the typewriter) was ordered for all terminals but two different languages.

Whatever the choice may have been, the mandatory typewriter layout with its associated language is denoted as "1" and the other type keyboard (if any) is denoted as "2" in the

display. For example:

```
TRANSLATE TABLES(T): TYPEWRITER (FRENCH) = 1
                     DATA ENTRY 2 (U.S. ENGLISH) = 2
```

This makes it easy for you to define the language and keyboard combination of a terminal which you want to connect because you only need to enter a 1 or a 2 (as applicable) in the "T" column of the terminal field. The terminal field consists of four columns which define (from left to right) the port number, the device type, the device address, and the keyboard/language combination, as follows:

```
PORT    DEVICE    ADR    T
```

The number entered under "port" defines into which receptacle the terminal's coax cable will be plugged. The cable receptacles are numbered sequentially 00, 01, 02, etc. The system expects to find the operator console at port 00, that is, it routes the operating system messages automatically to the device connected to port 00 (using the device address associated with port 00). The number entered under device specifies whether the terminal is a display or a matrix printer or a line printer (e.g. 3278-2, 3262, etc.). The device address (ADR) defines the number under which the program can address this device, and the T column defines the keyboard/ language combination (when applicable).

Note: For matrix printers, only the language portion of the keyboard/language combination is taken when a 1 or a 2 is entered. For line printers (e.g. 3289-4 or 3262) no language need be specified because line printers receive their language character set via the "load USCB operation" (operating system). For line printers, the X may remain in the T column.

The display shows the current configuration, and you may enter your changes underneath.

In order to logically attach a device, position the cursor under the alter field (identified by '....') of the corresponding DEVICE (type) field and key in the applicable device type number (3278-2, 3287, 3289 or 3262 as applicable).

In order to logically detach a device from the system, the operator has to key 'X' into any position of the alter field of the corresponding DEVICE display field. When the operator then presses the ENTER key, Xs appear in the DEVICE display field and (automatically) in the corresponding translate language (T) and device address (ADR) fields.

Notes:

- After changing the configuration, a re-IML must be done!

- A device may be configured even if it is not physically attached. If it is addressed during system operation, 'intervention required' is presented, and nothing else happens.

Configuration Rules and Limitations

- Port 0 is always reserved for the 3278-2A operator console.

- A maximum of two system printers (3289 and/or 3262) may be attached (in any combination).

Specification Errors/Messages

The following messages may appear on the screen:

- 'Invalid Device Name'
  Appears if an invalid DEVICE name has been specified, that is, if you enter device type numbers other than those shown in the top of the display, following the heading "ATTACH DEVICES:".

- 'Invalid Keyboard Language'
  Appears if a character other than '1' or '2' has been entered for TRANSLATE LANGUAGE.

- 'Duplicate Device Address'
  Appears if the same DEVICE ADDRESS has been entered twice.

- 'Duplicate Diskette Address'
  Appears if one of the duplicate addresses is a diskette device address (the native user diskette address is also in the range X'009' to X'01F').

- 'Invalid Configuration'
  Appears if the "Configuration Rules and Limitations" (listed above) have been violated.

- 'Configuration Update Complete'
  Appears when the system has finished processing of the configuration update specified by the operator.

When the diskette drive requires operator attention, it is indicated in line 21 of the machine status area either by the legend DISK, or (if, at the same time, the system diskette also requires attention) by SYSDSK.

When you then invoke the mode selection display onto the screen and enter selector character 'G' against 'Selection', the screen picture changes to the 'user diskette control' display.

The 'user diskette control' display shows the status, and allows for control, of the natively attached diskette drive. The DEVICE STATUS displayed may be:

READY/NOT READY
LOAD NEXT DISKETTE
DEFECTIVE DISKETTE

READY indicates that the diskette device can accept commands from the source program. NOT READY indicates that the device could not accept commands from the source program at the time the command was given.

Note: The READY and NOT READY indications do not immediately reflect any manual interference; they show the state of the diskette I/O as it was when the device was last addressed. For example, when the device is ready and you remove the diskette, the status will still show READY until the device is addressed. Only then will the indication change to NOT READY.

LOAD NEXT DISKETTE indicates to the operator to load a new diskette.

DEFECTIVE DISKETTE indicates that machine-internal error recovery failed and that, to recover, the diskette has to be replaced or the service representative to be called.

Information to be Specified by the Operator

In order to control the device, the following command codes may be specified:

'N' for START
'S' for STOP
'R' for RESET

The command specified is executed when the operator presses the ENTER key.

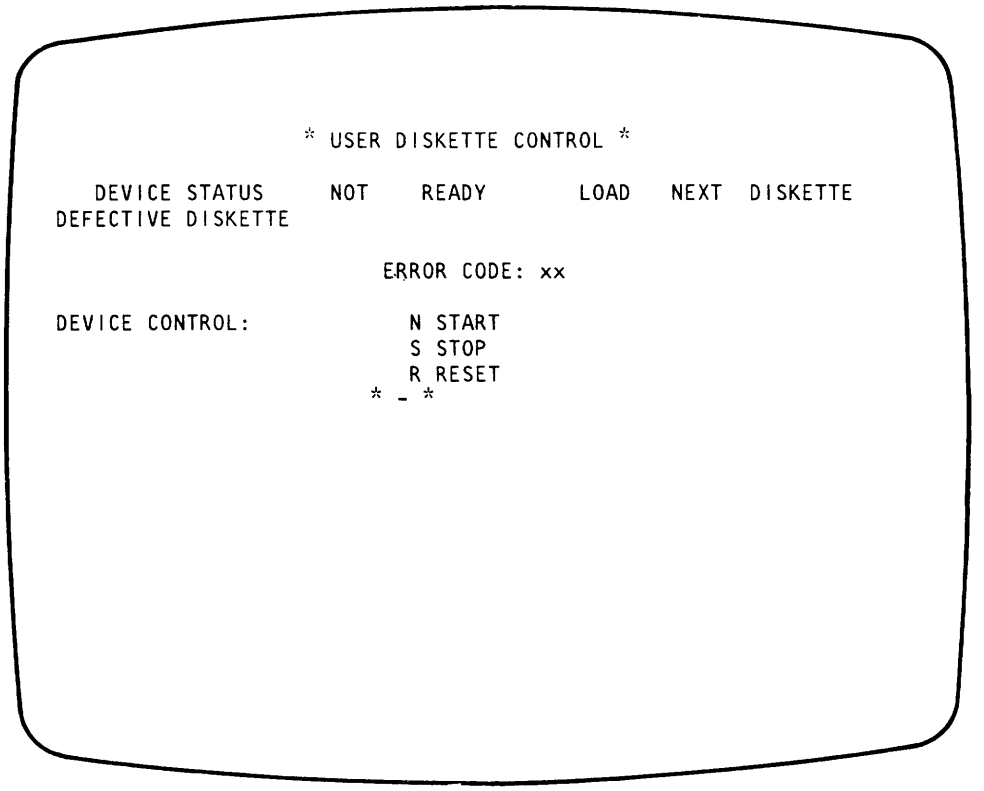
START

When a diskette has been loaded on the drive, but the

device is NOT READY (e.g. STOP has been issued before), issuing the START command makes the device READY again (enables it to accept commands). When the diskette is properly mounted and the drive has reached operational speed, the device becomes automatically ready.

STOP
This command halts the device at the completion of the current operation and makes the device NOT READY.

RESET
This command moves the access mechanism of the device to its home position, and then performs the actions of the START command.



The following message appears on the screen if the operator has made an error in his keyed-in specification:

- 'INVALID CHARACTER'

  This message appears when an invalid selector character has been entered.

Diskette Device Address

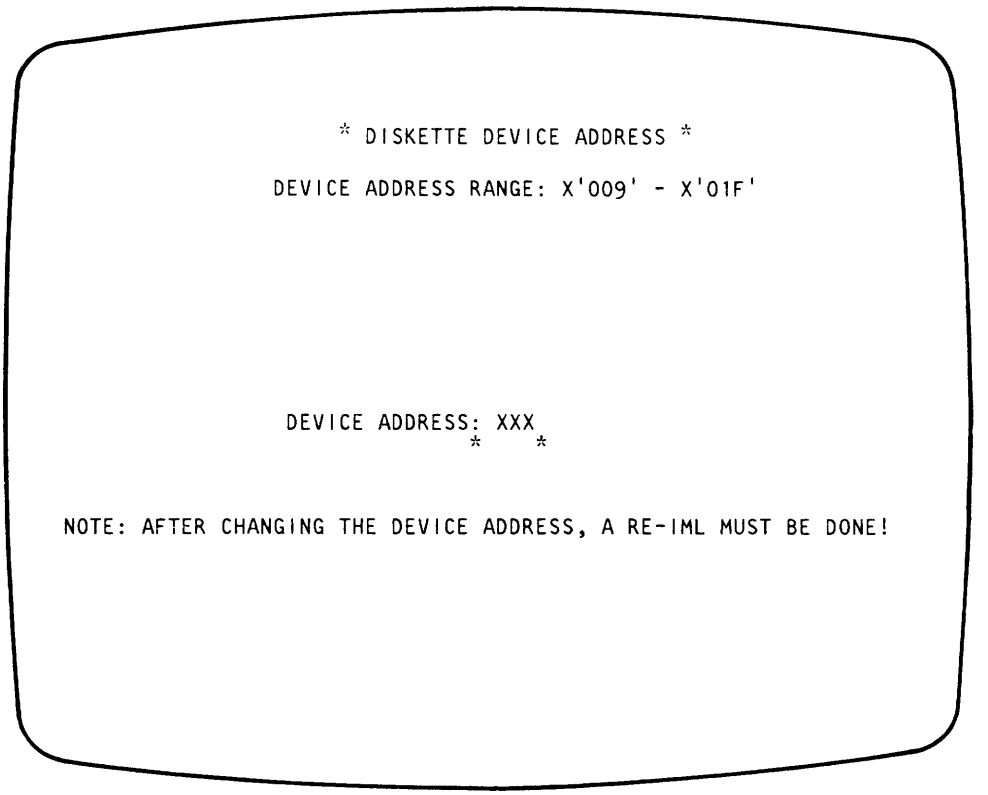
The diskette device address display allows to change the device address of the diskette I/O.

To select 'Diskette Device Address':

1. Type 'H' into the mode selection display next to 'SELECTION'

2. Press ENTER

The display appears containing the current device address.



The address, which must be within the range of X'009' through X'01F', must be entered into the alter field (*...*) of the address display field. When ENTER is pressed, the new (valid) address replaces the old address.

Note: The diskette drive may be configured even if it is not physically attached. If it is addressed during system operation, 'intervention required' is presented.

Specification Errors/Messages

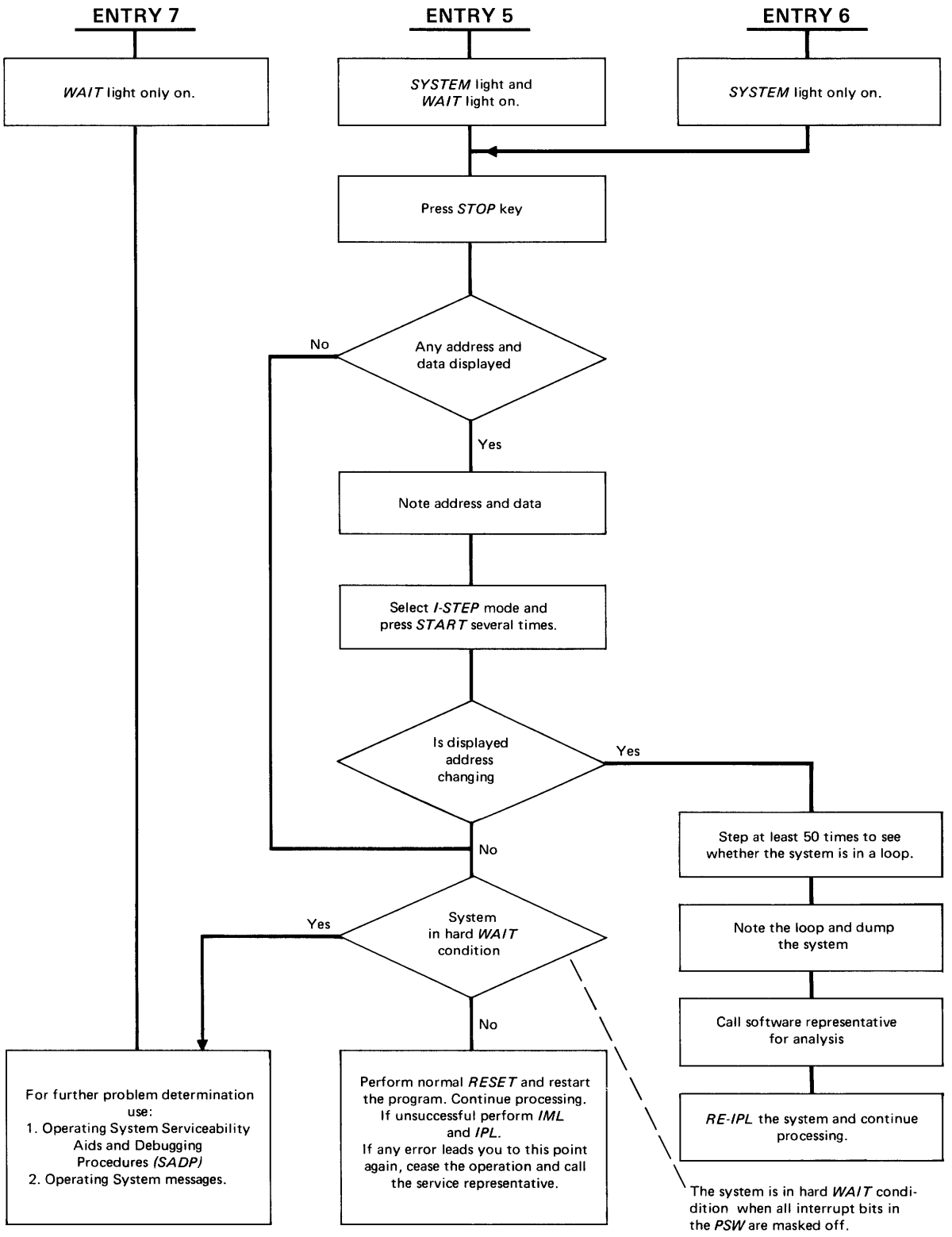
- 'Invalid Device Address'
  Appears if an invalid device address has been specified.

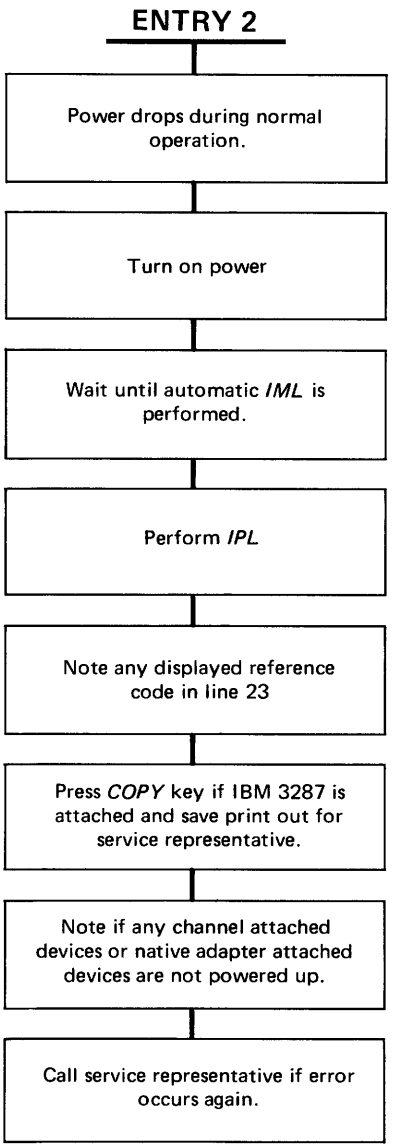
- 'Duplicate Device Address'
  Appears if the same address has already been specified for one of the native displays or printers.

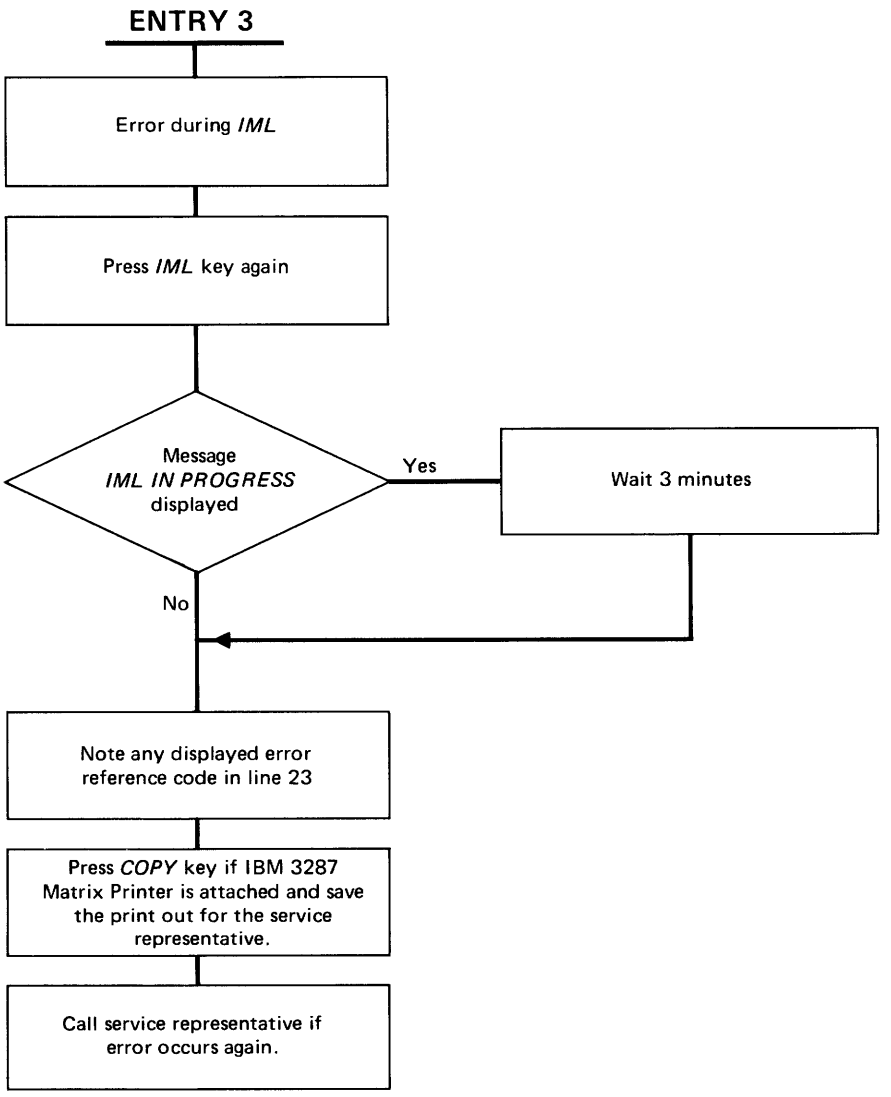
- 'Configuration Update Complete'
  Appears when the system has finished processing of the configuration update specified by the operator.

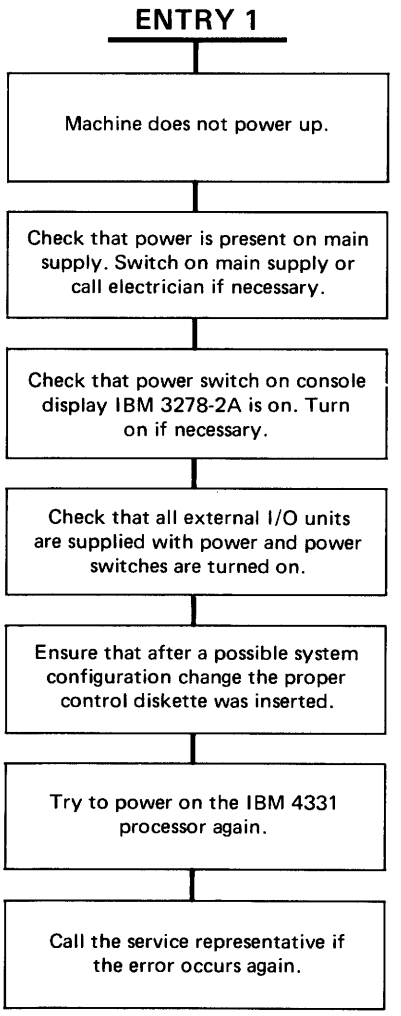
Chapter 4. Operators Problem Determination

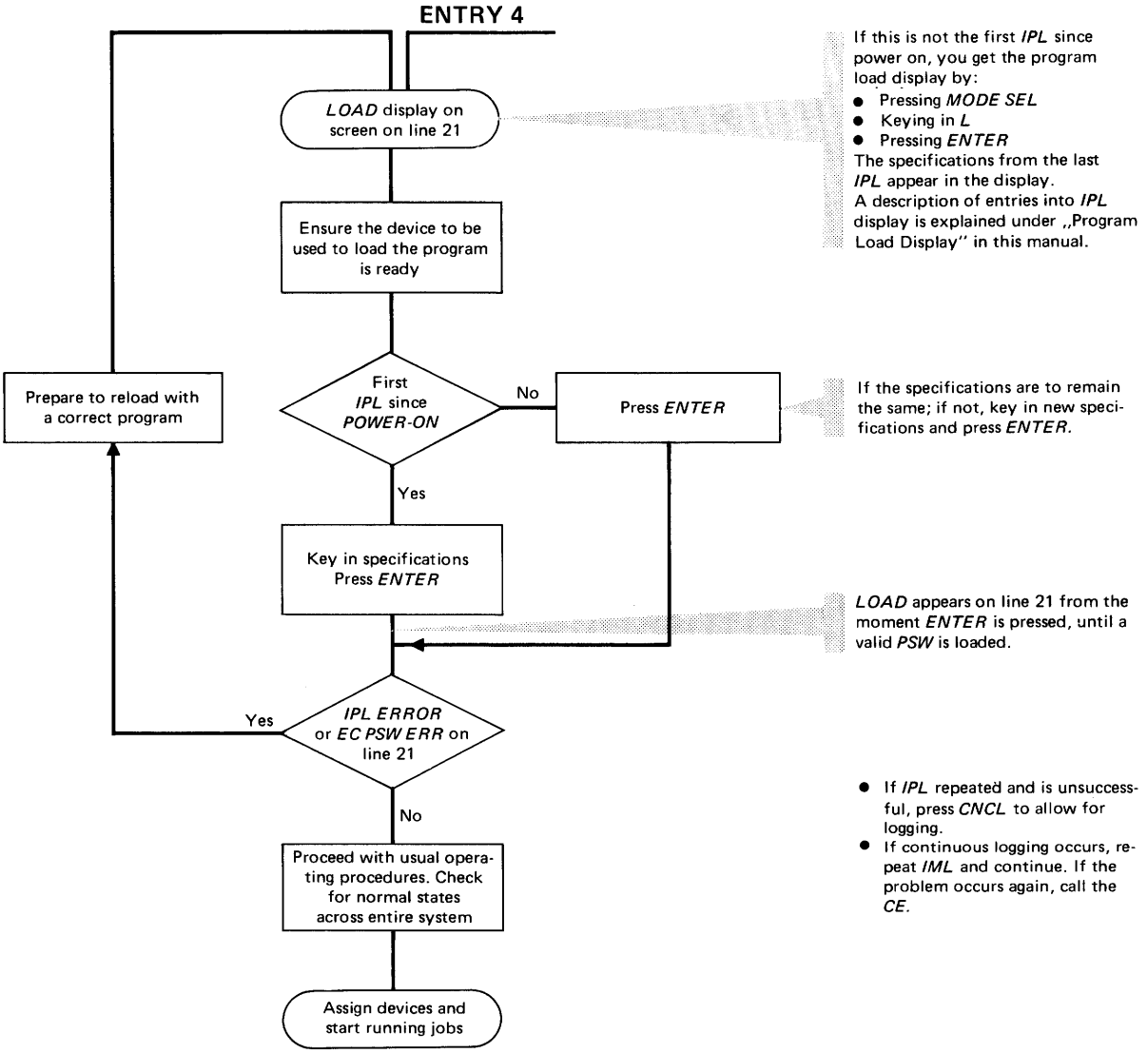
ERROR SYMPTOM	PROCEED WITH STEP INDICATED BELOW	ON PAGE OF THIS MANUAL
After pressing Power On the *'POWER COMPLETE'* light does not come on.	**ENTRY 1**	**PAGE 4–5**
Power drops during normal operation.	**ENTRY 2**	**PAGE 4–3**
'PROGRAM LOAD' display is not displayed after *'IML'*.	**ENTRY 3**	**PAGE 4–4**
Error during *IPL* after *IML* was successful performed.	**ENTRY 4**	**PAGE 4–6**
Operating System message displayed pointing to a faulty area or I/O unit.	Follow the instructions in the *OPERATING SYSTEM OPERATORS GUIDE.*	
System stops with *'BASIC CHECK'* light on or with reference code in line 23 displayed.	The error might be intermittent. Try to continue processing after performing *IML* and *IPL*. If error returns note the error reference code displayed in line 23 and call the service representative.	
SYSTEM light and *WAIT* light on.	**ENTRY 5**	**PAGE 4–2**
SYSTEM light only on	**ENTRY 6**	**PAGE 4–2**
WAIT light only on.	**ENTRY 7**	**PAGE 4–2**


ENTRY 7
ENTRY 5
ENTRY 6
WAIT light only on.
SYSTEM light and WAIT light on.
SYSTEM light only on.
Press STOP key
Any address and data displayed
No
Yes
Note address and data
Select I-STEP mode and press START several times.
Is displayed address changing
Yes
No
Step at least 50 times to see whether the system is in a loop.
Note the loop and dump the system
Call software representative for analysis
RE-IPL the system and continue processing.
System in hard WAIT condition
Yes
No
For further problem determination use:
1. Operating System Serviceability Aids and Debugging Procedures (SADP)
2. Operating System messages.
Perform normal RESET and restart the program. Continue processing.
If unsuccessful perform IML and IPL.
If any error leads you to this point again, cease the operation and call the service representative.
The system is in hard WAIT condition when all interrupt bits in the PSW are masked off.


ENTRY 2
Power drops during normal operation.
Turn on power
Wait until automatic IML is performed.
Perform IPL
Note any displayed reference code in line 23
Press COPY key if IBM 3287 is attached and save print out for service representative.
Note if any channel attached devices or native adapter attached devices are not powered up.
Call service representative if error occurs again.


ENTRY 3
Error during IML
Press IML key again
Message
IML IN PROGRESS
displayed
Yes
Wait 3 minutes
No
Note any displayed error reference code in line 23
Press COPY key if IBM 3287 Matrix Printer is attached and save the print out for the service representative.
Call service representative if error occurs again.


ENTRY 1
Machine does not power up.
Check that power is present on main supply. Switch on main supply or call electrician if necessary.
Check that power switch on console display IBM 3278-2A is on. Turn on if necessary.
Check that all external I/O units are supplied with power and power switches are turned on.
Ensure that after a possible system configuration change the proper control diskette was inserted.
Try to power on the IBM 4331 processor again.
Call the service representative if the error occurs again.


ENTRY 4
LOAD display on screen on line 21
Ensure the device to be used to load the program is ready
First IPL since POWER-ON
No
Press ENTER
Prepare to reload with a correct program
Yes
Key in specifications Press ENTER
IPL ERROR or EC PSW ERR on line 21
Yes
No
Proceed with usual operating procedures. Check for normal states across entire system
Assign devices and start running jobs
If this is not the first IPL since power on, you get the program load display by:
• Pressing MODE SEL
• Keying in L
• Pressing ENTER
The specifications from the last IPL appear in the display.
A description of entries into IPL display is explained under „Program Load Display" in this manual.
If the specifications are to remain the same; if not, key in new specifications and press ENTER.
LOAD appears on line 21 from the moment ENTER is pressed, until a valid PSW is loaded.
• If IPL repeated and is unsuccessful, press CNCL to allow for logging.
• If continuous logging occurs, repeat IML and continue. If the problem occurs again, call the CE.

Chapter 5. Reference Information

Restart Procedures for the IBM 5424 Multi-Function Card Unit (MFCU)

There are no separate operating procedures for the 5424 MFCU Attachment. Operating procedures for the 5424 MFCU are contained in:

System/370 5424 Multifunction Card Unit Programmer's Reference and Operator's Guide, GA21-9167.

There are a number of restart procedures for the 5424 which are given as operator codes and are issued at the end of operating messages. These codes and restart procedures are explained in the following pages.

The restart code (RS) numbers are:

00 Not ready
10 Read check
12 Read check and print check
20 Punch check
21 Punch check and read check
22 Punch check and print check
23 Punch check, read check and print check
30 Print check
40 Hopper check
42 Hopper check and print check
50 Feed check
51 Feed check and hopper check
54 Feed check and punch check
55 Feed check, hopper check and punch check
60 Error on recovery

When the second digit is a number other than 0, a second, simultaneous check has occurred.

Restart Information Field

For the IBM 5424 (MFCU) the error messages provided by the operating system are extended by the ''Restart Information Field''. This field is present only when a permanent error

that requires operator action has occurred.

There are four formats, each depending on the type of check.

Feed check format:

RS =□□H□S□N =□

Read equipment check format:

RS =□□H□C =□□

Punch equipment check format:

RS =□□H□S□

All other check formats:

RS =□□H□

Legend:
□ Indicates a number
RS: Indicates the beginning of the restart information field.
H : Indicates the hopper field. The number given is that of the affected hopper.
S : Indicates the stacker field. The number given is that of the affected stacker.
N : Indicates the number of cards involved in the feed check.
C : Indicates the column field. The number given is that of the affected column(s) where the first read check occurred.

After pressing NPRO, the cards in the primary feed path enter stacker 1, and the cards in the secondary feed path enter stacker 4. Normally stackers 1 and 2 are used for the primary feed path, and stackers 3 and 4 for the secondary feed path.

CODE AND CODE NUMBERS HAVE TO BE INSERTED

Procedure

Device not Ready

Reasons for not-ready can be:
- Specified feed not ready
- Hopper empty
- Stacker full
- Chip box full or out
- Cover open
- Stop key pressed

1. Determine the cause of the not-ready message by inspecting the indicators on the MFCU operator panel, then correct the condition.
2. Press the MFCU start key to continue the job. If the specified feed is not ready, press the MFCU stop key, then the start key.

Read Check

1. Press MFCU stop key.
2. Lift the cards in the hopper indicated by the error message and press the NPRO key. One card is fed into stacker 1. If the NPRO key does not work, remove the card manually.
3. Ensure that this card was placed in the hopper correctly, and was not off-punched, or damaged. If the card is off-punched or damaged, re-punch card. Place the card ahead of the deck in the specified hopper.
4. Press MFCU start key to continue the job.

Read Check and Print Check

1. Press MFCU stop key.
2 Mark the last card in each stacker that is being used for output. If in doubt, mark the last card in every stacker.
3. Lift the cards in the hopper indicated by the error message and press the NPRO key. One card is fed into stacker 1. If the NPRO key does not work, remove the card manually.
4. Ensure that this card was placed in the hopper correctly, and was not incorrectly punched or damaged. If the card is off-punched or damaged, re-punch card. Place the card ahead of the deck in the specified hopper.
5. Press MFCU start key to continue the job.
6. Upon completion of the run, identify the output files with 'print check'. The cards to be checked for print errors are the marked cards and the two cards

immediately preceding each marked card.

Punch Check

1. Press MFCU stop key
2. Remove the last card from the stacker indicated in the error message, mark the card and return it to the stacker.
3. Lift the cards in the hopper indicated by the error message and press the NPRO key. One card is fed into stacker 1. If the NPRO key does not work, remove the card.
4. Place this card under the other cards of the hopper indicated in the error message.
5. If blank cards are being punched, press MFCU start key to continue the job.
6. If pre-punched cards are being punched, place an additional blank card under all cards in the hopper indicated in the error message.
7. Press MFCU start key to continue the job.
8. When job is completed, punch and verify the prepunched information from the marked card into the card immediately following it. Discard the marked card or save it for the CE.

Punch Check and Read Check

1. Press MFCU stop key.
2. Remove the last card from the stacker indicated by the error message, mark the card and return it to the stacker.
3. Lift the cards in the hopper indicated in the error message and press the NPRO key. One card is fed into stacker 1. If the NPRO key does not work, remove the card.
4. Ensure that this card was placed in the hopper correctly, and was not off-punched, or damaged. If card is off-punched or damaged, re-punch card. Place the card ahead of deck in specified hopper.
5. Place an additional blank card under all cards in the hopper indicated by the error message.
6. Press MFCU start key to continue the job.
7. When the job is completed, punch and verify the pre-punched information from the marked card into the card immediately following it. Discard the marked card or save it for the CE.

Punch Check and Print Check

1. Press MFCU stop key.
2. Mark the last card in each stacker being used for output. If in doubt, mark the last card in every stacker. The marked card(s) or each immediately preceding card may be misprinted.
3. Remove the last card from the stacker indicated in the error message, mark the card and return it to the

stacker.

4. Lift the cards in the hopper indicated in the error message and press the NPRO key. One card is fed into stacker 1. If the NPRO key does not work, remove the card manually.
5. Place this card under the other cards of the hopper indicated in the error message.
6. If blank cards are being punched, press MFCU start key to continue the job.
7. If pre-punched cards are being punched, place an additional blank card under all cards in the hopper indicated in the error message.
8. Press MFCU start key to continue the job.
9. When the job is completed, punch and verify the pre-punched information from the marked card into the card immediately following it. Discard the marked card or save it for the CE.

Punch Check, Read Check and Print Check

1. Press MFCU stop key.
2. Mark the last card in each stacker that is being used for output. If in doubt, mark the last card in every stacker. The marked card(s) or each immediately preceding card may be misprinted.
3. Remove the last card from the stacker indicated in the error message, mark the card, and return it to the stacker.
4. Lift the cards in the hopper indicated by the error message and press the NPRO key. One card is fed into stacker 1. If the NPRO key does not work, remove the card manually.
5. Ensure that this card was placed in the hopper correctly, and was not off-punched, or damaged. If the card is off-punched or damaged, re-punch card. Place card ahead of deck in the specified hopper.
6. Place an additional blank card under each card in the hopper indicated by the error message.
7. Press MFCU start key to continue the job.
8. When the job is completed, punch and verify the pre-punched information from the marked card into the card immediately following it. Discard the marked card or save it for the CE.

Print Check

1. Press MFCU stop key.
2. Mark the last card in each stacker that is being used for output. If in doubt, mark the last card in every stacker.
3. Press MFCU start key to continue the job.
4. Upon completion of the run, identify the output files with 'print check'. The cards to check for print errors are the marked cards and the two cards immediately preceeding each marked card.

Hopper Check

1. Straighten and place cards correctly in the specified hopper.
2. Press MFCU start key to continue job.

Hopper Check and Print Check

1. Press MFCU stop key.
2. Mark the last card in each stacker that is being used for output. If in doubt, mark the last card in every stacker.
3. Straighten or place cards correctly in the specified hopper.
4. Press MFCU start key to continue the job.
5. Upon completion of the run, identify the output files with 'print check'. The cards to check for print errors are the marked cards and the card immediately preceeding each marked card.

Feed Check

1. Open MFCU top cover.
2. If the error message indicates a secondary feed check, remove the card from the primary (upper) wait station and place it under the cards (if any) in the primary hopper. If the error message indicates a primary feed check, remove the card from the secondary (lower) wait station and place it under the cards (if any) in the secondary hopper.
3. Remove all remaining cards from the card feed path starting at the area between the hopper and wait station and progressing through the punch and print statins. Keep cards face down and in order.
4. Check the number of cards removed with the card number displayed in the error message. If equal go to step 6.
5. If the number of cards removed is smaller than the message indicates, remove the number of missing cards from the stacker indicated in the error message and place them on the bottom of the stack of cards removed in step 3.
6. Place removed cards under the cards (if any) in the indicated hopper and close the MFCU cover.
7. Lift cards in the primary hopper and press the NPRO key to turn off error indicator on MFCU panel. If error indicator does not turn off, raise the cards in the secondary hopper and press the NPRO key. If the NPRO key does not work, check that the card path is clear, because a wrongly positioned card can inhibit the NPRO key.
8. Press MFCU start key to continue the job.

Feed Check and Hopper Check

1. Open MFCU top cover.
2. If the error message indicates a secondary feed check, remove the card from the primary (upper) wait station and place it under the cards (if any) in the primary

hopper. If the error message indicates a primary feed check, remove the card from the secondary (lower) wait station and place it under the cards (if any) in the secondary hopper.

3. Remove all remaining cards from the card feed path starting at the area between the hopper and wait station and progressing through the punch and print station. Keep cards face down and in order.
4. Remove the card that has not been ejected from the hopper. This card is either completely or partly located in the hopper.
5. Check the number of cards removed with the card number displayed in the error message. If equal go to step 6.
6. If the number of cards removed is smaller than the message indicates, remove the number of missing cards from the stacker indicated by the error message and place them on the bottom of the stack of cards removed in step 3.
7. Place removed cards under the cards (if any) in the indicated hopper and close MFCU cover.
8. Lift cards in the primary hopper and press the NPRO key to turn off the error indicator on MFCU panel. If the error indicator does not turn off, raise the cards in the secondary hopper and press the NPRO key. If the NPRO key does not work, check that the card path is clear, because a wrongly positioned card can inhibit the NPRO key.
9. Press MFCU start key to continue the job.

Feed Check and Punch Check

1. Open MFCU top cover.
2. If the error message indicates a secondary feed check, remove the card from the primary (upper) wait station and place it under the cards (if any) in the primary hopper. If the error message indicates a primary feed check, remove the card from the secondary (lower) wait station and place it under the cards (if any) in the secondary hopper.
3. Remove all remaining cards from the card feed path starting at the area between the hopper and wait station and progressing through the punch and print stations. Keep cards face down and in order. If there is a card in the punch station or corner station, replace it with a blank card or a pre-punched card as required.
4. Check the number of cards removed with the card number displayed in the error message. If equal go to step 6.
5. If the number of cards removed is smaller than the message indicates, remove the missing cards from the stacker indicated by the error message and place them on the bottom of the stack of cards removed in step 3.
6. Place the removed cards under the cards (if any) in the indicated hopper and close MFCU cover.
7. Lift cards in the primary hopper and press the NPRO key

to turn off the error indicator on MFCU panel. If the error indicator does not turn off, raise cards in the secondary hopper and press the NPRO key. If the NPRO key does not work, check that the card path is clear, because a wrongly positioned card can inhibit the NPRO key.

8. Press MFCU start key to continue the job.

Feed Check, Hopper Check and Punch Check

1. Open MFCU top cover.
2. If the error message indicates a secondary feed check, remove the card from the primary (upper) wait station and place it under the cards (if any) in the primary hopper. If the error message indicates a primary feed check, remove the card from the secondary (lower) wait station and place it under the cards (if any) in the secondary hopper.
3. Remove all remaining cards from the card feed path starting at the area between the hopper and wait station and progressing through the punch and print station. Keep cards face down and in order. If there is a card in the punch station or corner station, replace it with a blank card or a pre-punched card as required.
4. Remove the card that has not been ejected from the hopper. The card is either completely or partly located in the hopper.
5. Check the number of cards removed with the card number displayed in the error message. If equal go to step 6.
6. If the number of cards removed is smaller than the message indicates, remove the number of missing cards from the stacker indicated in the error message and place them on the bottom of the stack of cards removed in step 3.
7. Place removed cards under the cards (if any) in the indicated hopper and close MFCU cover.
8. Lift the cards in the primary hopper and press the NPRO key to turn off the error indicator on MFCU panel. If the error indicator does not turn off, raise the cards in the secondary hopper and press the NPRO key. If the NPRO key does not work, check that the card path is clear, because a wrongly positioned card can inhibit the NPRO key.
9. Press MFCU start key to continue job.

Error on Recovery

To recover, when an error condition occurs during a restart procedure, re-establish the condition that existed when the restart procedure was started, and then repeat the restart procedure.

Conversion Binary to Hexadecimal to Decimal (Integers Only)

Binary	Hex	Decimal				
		16^4	16^3	16^2	16^1	16^0
0001	1	65,536	4,096	256	16	1
0010	2	131,072	8,192	512	32	2
0011	3	196,608	12,288	768	48	3
0100	4	262,144	16,384	1,024	64	4
0101	5	327,680	20,480	1,280	80	5
0110	6	393,216	24,576	1,536	96	6
0111	7	458,752	28,672	1,792	112	7
1000	8	524,288	32,768	2,048	128	8
1001	9	589,824	36,864	2,204	144	9
1010	A	655,360	40,960	2,560	160	10
1011	B	720,896	45,056	2,816	176	11
1100	C	786,432	49,152	3,072	192	12
1101	D	851,968	53,248	3,328	208	13
1110	E	917,504	57,344	3,584	224	14
1111	F	983,040	61,440	3,840	240	15

To convert a binary number (see the table above), proceed as follows:

1. Separate the binary number by spacing it into groups of four bits each, starting from the right. If necessary, add leading zeros for leftmost group. Thus:
   Binary 110110110=0001 1011 0110.
2. Using the first two columns of the table, convert each group of four binary bits into hexadecimal (hex). Thus:
   Binary 0001 1011 0110=Hex 1B6.
3. Working from the right, relate bits of the hex number to the associated decimal column. Thus:
   6 relates to 16^0 column, B relates to 16^1 column and 1 relates to 16^2 column.
   Using bits in the hex column as reference, find the associated decimal part and add decimal parts to get the decimal total. Thus:
   Hex 6=(16^0 column) decimal 6
   Hex B=(16^1 column) decimal 176
   Hex 1=(16^2 column) decimal 256
   Decimal 438=Hex 1B6=Binary 110110110

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Chapter 6. Glossary

This glossary contains technical terms associated with this publication. A wider and more general range of terms is contained in IBM Data Processing Glossary, GC20-1699.

IBM is grateful to the American National Standards Institute (ANSI) for permission to reprint its definitions from the American National Standard Vocabulary for Information Processing (Copyright c 1970 by American National Standards Institute, Incorporated), which was prepared by Subcommittee X3.5 on Terminology and Glossary of American National Standards Committee X3. These definitions are indicated by an asterisk.

address translation: The process of changing the address of an item of data or an instruction from its virtual address to its machine storage address. See also dynamic address translation.

basic control (BC) Mode: A mode in which the features of a System/360 computing system and some System/370 features, such as new machine instructions, are operational on a System/370 computing system or a 4300 processor. See also extended control (EC) mode.

control registers: A set of registers used for operating system control of relocation, priority interruption, program event recording, error recovery, and masking operations.

control storage: An area in a subprocessor where the microcode is stored.

cursor: A movable marker on a video display used to indicate the position of the next character to be entered on the screen.

*dump: To copy the contents of all or part of a storage, usually from an internal storage into an external storage.

dynamic address translation: (1) The change of a virtual storage address to a machine storage address during execution of an instruction. See also address translation. (2) A hardware feature that performs the translation.

enter: Refers in this manual to the placing of information into the system by specifying commands, data or addresses at the keyboard, and then pressing the ENTER key. See also "Key In".

extended control (EC) mode: A mode in which all the

features of a System/370 computing system or a 4300 processor in 370 mode, including dynamic address translation, are operational. See also basic control (BC) mode.

hexadecimal: A number system that uses the equivalent of a decimal number 16 as a base.

Initial Microcode Load: The procedure that causes the microcode to be loaded into control storage. Abbreviated to IML.

*initial program load: The procedure that causes the initial part of an operating system or other program to be loaded such that the program can then proceed under its own control. Abbreviated to IPL.

*initialize: To set counters, switches and addresses to zero or other starting values at the beginning of, or at the prescribed points in, a computer routine.

integrated adapter (or attachment): A device which allows I/O devices to be attached to the system without a standard input/output interface.

*interrupt: To stop a process in such a way that it can be resumed.

key in: Refers to the typing of characters by means of the alphameric keys at the keyboard. It does not include pressing the ENTER key. See also "Enter".

logical storage: A term used to denote either virtual storage if virtual storage control is in effect, or real storage if virtual storage control is not in effect.

machine storage: The storage where data and instructions actually reside when they are accessed by the processor and channel programs (called real storage in System/370).

main storage: All program addressable storage from which instructions may be executed and from which data can be loaded directly into registers.

microinstruction: A basic or elementary machine instruction. Each program, each channel routine, and so on, consists of sequences of microinstructions.

*modem: (MOdulator-DEModulator.) A device that modulates and demodulates signals transmitted over communication facilities.

multipoint network: A line or circuit that interconnects several stations in a data communications system.

native attachment: A part of some machines that allows I/O devices to be attached to the processor directly instead of via channel and control unit. (Also called integrated attachment and integrated adapter).

*online: Pertaining to equipment or devices under continual control of the processor.

*operating system: Software that controls the execution of computer programs and provides scheduling, debugging, input/output control, accounting, compilation, storage assignment, data management, and related services.

processor: A processor which fetches instructions from main storage, processes them, and returns the results to main storage. It also analyzes I/O instructions and handles input/output operations and I/O interruptions.

program status word: A doubleword in the processor storage used to control the order in which instructions are executed, and to hold and indicate the status of the computing system in relation to a particular program. Abbreviated to PSW.

real address: The address of a location in real storage.

real storage: The storage of a computing system where data and instructions in machine storage are made addressable to the processor and channel programs.

service processor: A subprocessor which loads microcode, initializes the system, monitors and logs errors, and handles the manual control operations of the system.

stand-alone program: An independent program that does not require an operating system.

teleprocessing: The processing of data that is received from or sent to remote locations by way of telecommunication lines.

tributary station: In a centralized multipoint data communications system, this is a station, other than the control station, that can communicate only with the control station when polled or selected by the control stations.

typamatic key: A key that repeats its function as long as it is held down.

virtual address: An address which refers to virtual storage and must, therefore, be translated into a machine storage address when it is used.

virtual storage: Addressable space that appears to the user as machine storage, from which instructions and data are mapped into machine storage locations. The size of virtual storage is limited by the addressing scheme of the computing system and by the amount of auxiliary storage available, rather than by the actual number of machine storage locations.

IBM 4331 Processor
Operating Procedures

GA33-1525-1

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Technical Newsletter

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Operator's Library
IBM 4331 Processor
Operating Procedures
and Problem
Determination Guide

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This Technical Newsletter replaces the IBM 3279-2C Color Display Station, Problem Determination Guide GA33-3051, which is located in the handrest of the 3279-2C keyboard.

Summary of Amendments

This Technical Newsletter provides information on procedures for the 3279-2C console, if it is connected as an operator console to a 4331 processor.

Note:
Please file this cover letter at the back of the manual to provide a record of changes.

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Appendix A

IBM 4331 Processor's Operating Procedures

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CLEANING THE SCREEN

Switch power off at the 3279 before cleaning the screen. Do not spray liquid onto the screen or allow liquid to run down into the display enclosure.

CAUTION

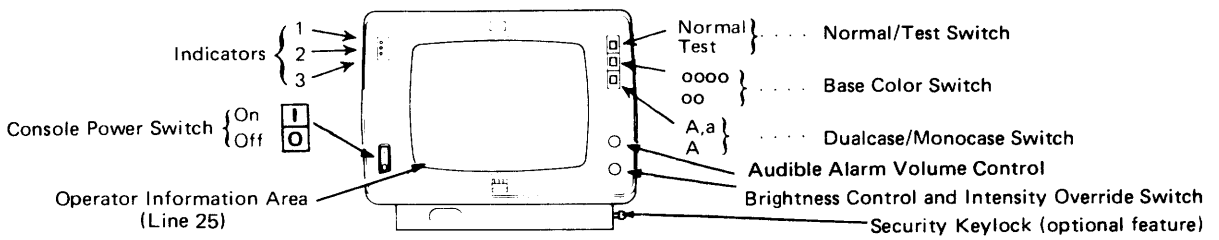
Acid solutions or abrasive products can damage the antiglare coating. Do not use them to clean the screen.

1. Moisten a soft, lint-free cloth with an antistatic cleaning fluid (IBM part 771754 or 2200118).
2. Rub the screen firmly with the moistened cloth.
3. Wipe the surface dry with a clean, soft cloth.

Note: The following cleaning agents may be used instead of antistatic cleaning fluid:

- Water only.
- Water and detergent, followed by a water-dampened cloth.
- Ammonia-based glass cleaner.

SECTION 1. CONTROLS AND INDICATORS



SECTION 2. MAKING THE 3279-2C READY.

1. Make sure that the 4331 Processor is powered on (power complete light on).
2. Power off the 3279-2C.
3. If a security keylock is installed, insert the key and turn it clockwise.
4. Set the Normal Test switch to Normal and the 0000/00 switch to 0000 (4-color).
5. Set the 3279-2C power switch to on.
6. Wait for one minute.

The 3279-2C is ready if:

- Indicators 1 and 2 are lit, and indicator 3 is not lit.
- A white cursor and a blue divider line are displayed.
- The Ready symbol (I$\underline{A}$) is displayed.

If the 3279-2C is not ready, refer to the Symptom Index (Section 6).

SECTION 3. 3279-2C STAND-ALONE TEST PROCEDURE

All tests must be performed in the correct sequence to achieve the expected result.

The instruction to record a problem relates to one that may need assistance from outside your organization. Record the problem by section and step number, then consult the appropriate person who may contact a service representative.

1. Set the Normal/Test switch to Test.
2. Set the A,a/A switch to A,a (dualcase display).
3. Set the 0000/00 switch to 0000 (4-color).
4. Set the Power On/Off switch to on. ----------> Indicators 1 and 3 light.
5. Wait for one minute. -----> Indicator 2 lights and the character pattern fills the screen.

6. Observe the characters displayed in the top two lines. The characters should be:

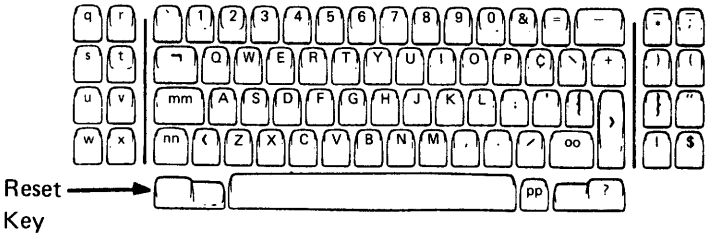
```
aeiouaeiouaeiounAEIOUAOYAEEIOUYCAEIOUAEIOUAEIOUNabcdefghijklmnopqrstuvwxyzæ øåç;*
ABCDEFGHIJKLMNOPQRSTUVWXYZÆØÅÇ;*0123456789><[])(){='"/\|¦?!$¢£¥Pt¤0123456789ß§#@%_
```

7. Observe the operator area at the bottom of the screen. The characters should be:

```
01234567><[])(){ ='"/\|¦?!$¢£¥Pt¤0123456789ß§#@%_&-.,:+ , aeiouaoyaee iouuç
```

8. Press and release each ---> key in turn to enter the characters shown in the keyboard diagram.

The characters displayed after pressing each key are the same as the characters shown in the diagram below.



Note: Do not press the RESET key while doing this check.

9. Press and release (1) the RESET key, and (2) the C key. ----------> The character pattern on step 6 replaces the characters entered in step 8.

10. Press and release (1) ------> the RESET key and (2) the B key

2̄ is displayed in the first position of the operator information area.

11. Press and release (1) the RESET key, (2) the M key, (3) the J key. (4) the K key, and (5) the L key. -------> The first three characters of the top line are JKL.

12. Press and release (1) the RESET key, and (2) the C key. Press and release (1) the RESET key, (2) the B key, (3) the alphabetic 0 key, and (4) the alphabetic key. ----> The character pattern (step 6) is restored.

    The characters are displayed in red.

13. Press and release (1) the RESET key, (2) the B key, (3) the alphabetic 0 key, and (4) the A key. ----------> The characters are displayed in blue (some red remains).

14. Set the Normal/Test switch to Normal. ------> The character pattern is removed from the screen. Indicator 3 goes out.

15. Go to: "3279-2C with Processor Test Procedure" (Section 4). If the results are not as expected, set the Power switch to off, wait 10 seconds, set the Power switch to on, and repeat the 3279-2C Stand-Alone Test Procedure. If the results are wrong again, record the failing step (and keys) and report the problem.

SECTION 4. 3279-2C WITH PROCESSOR TEST PROCEDURE

The 3279-2C must pass the Stand-Alone-Tests (Section 3) before proceeding with these tests.

1. Ensure that the 3279-2C is ready (see Section 2). If the Ready symbol appears, go to step 6, if not continue with step 2.

2. Set the Normal/Test switch to Test, then back to Normal.

3. If other 3279 connected to the same processor are not working correctly, see Chapter 4 (Problem Determination) to locate the problem.

4. If the Ready symbol is not displayed, record that step 1 failed and report the problem.

5. Set the 0000/00 switch to 0000 (4-color). Set the A,a/A switch to A,a (dualcase display). Turn the audible alarm control clockwise.

6. At the keyboard: press and release the CHG DPLY key --> MAN OP appears on line 25

7. Hold down the ALT key and press the COPY key ----> TEST appears on line 25

8. Press the keys /0 (numeric) and ENTER ----------> The following picture is displayed.

```
+----------------------+
|                      |
|TEST:    1;00         |  <--  All characters are displayed blue.
|?SEL PEN    SEL PEN   |  <--  ?SEL PEN is white, SEL PEN is red.
|  &SEL PEN    >SEL PEN|  <--  All characters are displayed blue.
|  DISPLAY INSERT CK _ |  <--  DISPLAY INSERT is blue, CK is
|                      |       green, and cursor is white.
+----------------------+
```

9. Move the cursor under C of the CK field

10. Press the insert (â) key ----------> Insert symbol (^) appears on line 25.

11. Press the keys JKL -------> jkCK appears on line 4 and inhibit symbol appears on line 25.

12. Press the RESET key ------> Insert symbol and inhibit symbol are erased.

13. Set the 0000/00 ----------> Red and blue fields become white and green.
    switch to 00

    Switch back 0000/00 switch to 0000

14. You have now completed the display/processor test procedure. To leave the test procedure, hold down the ALT key and press the COPY key ----------> MAN OP appears on line 25 and TEST is erased.

    If you have a problem with the 3279-2C and steps of sections 3 and/or 4 do not fail, record the symptom and report the problem. See also Chapter 4 (Problem Determination).

SECTION 5. COLOR CONVERGENCE PROCEDURE

This procedure describes how to optimize the settings of the primary colors (red, green blue) displayed to produce a pure compound color. For example, white contains all three primary colors. If convergence is wrong, you can see traces of each color at the edges of a white character.

If the color convergence procedure is already used by another 3279, the message CONVERGENCE ON PORT nn is displayed.

Note: Before doing color convergence, check the date on the battery that is in the access area at the back of the 3279-2C. (The first two numbers show the month, and the second two show the year.) If the battery is more than 3 years old, change it. See Section 7.

1. Ensure that the 3279-2C is ready (see Section 2). ----> The ready symbol is displayed in the operator information area.

2. Wait for at least 10 minutes to allow the 3279-2C to warm up.

3. Press the CHG DPLY key
   - if MAN OP appears on line 25 go to step 5,
   - if 'MODE SEL CANCELS CONV' message is displayed; another display is using the convergence routine. Go to step 4.

4. Press MOD SEL key, -------> Color convergence on other display is cancelled.
   press CHG DPLY key
   Go to step 3.

5. Hold down the ALT key and press the COPY key ----> TEST appears on line 25.

6. Press the keys /7 and ENTER --------> Pattern -|-|- is displayed.

7. If the convergence pattern shows traces of green and red, use the cursor positioning keys to move the green pattern toward the red until they coincide and a yellow pattern is displayed.

Note: If any step from 6 through 14 fails, look at the operator information area. If an inhibited symbol is displayed, press the RESET key and continue at the same step.

8. Press and release the R key. ----> The convergence pattern changes to pink.

9. If the convergence pattern shows traces of blue and red, use the cursor positioning keys to move the blue toward the red until they coincide and a pink pattern is displayed.

10. Press and release the R key. ----> The yellow pattern replaces the pink.

11. If necessary, realign the green as described in step 7.

12. Press and release the spacebar twice. ----> The result may be either: (1) one yellow pattern is displayed at a different position, or (2) thirteen convergence patterns are displayed.

13. If only one pattern is displayed, repeat steps 7 through 12, otherwise continue with step 14. ---> If any step fails, see note after step 7.

14. Observe the patterns; they should be white. If traces of any other colors can be seen, press and release the spacebar and repeat from step 7.

15. If the convergence patterns are correct, hold down the ALT key and press the COPY key. -------> The system returns to manual state (MAN OP is displayed and TEST is erased).

SECTION 6. SYMPTOM INDEX

Before taking any action read through the whole of this section to find the symptom that most closely matches your problem. After recording a problem, if the console is usable you may continue working. If not power off.

Symptom	First Action	Follow-Up Action
1. All three indicators are lit.	Check that (1) power is available to the 3279-2C, and (2) the 3279-2C power switch is set to on.	Make the 3279-2C ready as described in Section 2. If the same symptom occurs, record the problem.
2. Nothing is displayed, but indicators 1 and 2 are lit.	Turn the brightness control fully clockwise. If there is still no display, switch the Normal/Test switch to Test and then back to Normal.	Turn the brightness control fully counterclockwise to engage the intensity override switch. The screen should go bright all over. Record the problem and any additional symptoms observed. Return the brightness control to normal.
3. Only indicator 1 is lit.	Record the problem.	
4. The screen is bright all over.	Turn the brightness control clockwise.	If the symptom remains, record the problem and switch off.
5. The display is unreadable; the lines are not horizontal and may be moving or rolling.	Record the problem.	
6. The display is unreadable; characters are unsteady or distorted.	Record the problem.	
7. The displayed picture width, height, or squareness is wrong.	Record the problem.	Continue working if the console is usable.

Symptom	First Action	Follow-Up Action
8. Not enough brightness.	Turn the brightness control clockwise.	Record the problem.
9. Very faint (fuzzy) characters - and the brigthness control has had little or no effect.	Record the problem.	
10. Out of focus (fuzzy) characters - brightness is adjustable.	Record the problem.	
11. One color (green, blue, or red) is brighter or dimmer than the other two.	Record the problem.	Continue working if the console is usable.
12. The brightness cannot be adjusted.	Record the problem.	
13. Only green and/or white characters are displayed above the blue divider line.	Set the 0000/00 switch to 0000 (4-color).	Record the problem.
14. The divider line, cursor, or characters are displayed in the wrong colors.	Set the Normal/Test switch to Test, then to Normal.	Record the problem.
15. The display contains only a green cursor and green divider line.	(1) Set the Normal/Test switch to Test and then to Normal. (2) Check that the 3279-2C is connected to a working processor. (3) Check any other 3279 connected to the processor.	If other 3279 are working, go to the procedures in Sections 2 and 3 of this guide. If they are not working, go to Chapter 4, Problem Determination.

Symptom	First Action	Follow-Up Action
16. Some red, green, or blue can be seen in white characters.	See Section 5.	If the same symptom recurs, change the battery (see Section 7) and retry the Color Convergence Procedure (Section 5). If the problem persists, record the problem.
17. Indicator 3 is lit.	Set the Normal/Test switch to Normal.	If indicator 3 stays lit, record the problem.
18. The 3279-2C is ready, but the keyboard does not work, one or more keys fail.	Record the problem.	
19. Errors or missing characters in the display and no error code symbol is in the operator information area.	Go to the Stand-Alone Test Procedure (Section 3).	
20. A symbol or message (other than IA) appears in the operator information area.	Refer to Chapter 2, Communicating with the System.	Record the problem.
21. The inhibited symbol is displayed in the operator information area.	(i) Press and release the RESET key and retry the operation. (ii) Press and release the RESET key and the ERASE EOF key and retry the operation.	Refer to Chapter 2. Record the problem.
22. Any other symptom.	Record the problem.	

SECTION 7. CHANGING THE BATTERY

A battery in the access area at the back of the 3279-2C provides power to the color convergence store when the display is switched off. If the color convergence has to be adjusted, or if machine check indicator followed by 228 or 229 is displayed on line 25 each time you switch on the display console, change the battery.
Note: Each battery is marked with a date-code; the first two numbers show the month, the second two show the year; if a battery is more than 18 months old, do not use it.

Replacment batteries are available from IBM through your IBM marketing representative. Order only sufficient batteries for your immediate needs; batteries can be expected to provide 3 years of normal operation, and those more than 18 months old must not be used as replacements.

If the display console is switched off while the battery is being replaced, the full convergence procedure will be required.

To change a battery:

1. With the 3279-2C switched on, open the cover of the access area at the back of the 3279-2C.

2. Unplug the connector from the old battery and remove the battery.
   Note: Return the old battery to IBM for disposal.

3. Place the new battery in the holder and replace the connector.

4. Close the cover of the access area.

5. Check operation with the new battery:
   a. Observe the displayed characters and, if necessary, perform the Convergence Procedure (Section 5).
   b. Switch power off and wait for approximately five minutes.
   c. Switch power on; the color convergence should be satisfactory. If the convergence is wrong, unplug the new battery and plug it in again to make sure that the connection is good; then perform the Convergence Procedure (Section 5). (If the symptom persists, record the problem.)

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