

IBM **Field Engineering Education**
Student Guide

SYSTEM/360

Model 25 - 1400 Series Compatibility Feature



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PREFACE

This guide is primarily intended for use by students enrolled in System/360 Model 25 - 1400 Series Compatibility Feature Course 13217.

Second Edition

This is a major revision of, and makes R25-5433-0 obsolete. (10-10-69)

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GENERAL INFORMATION

LEGEND

addr	address
ALD	Automated Logic Diagram
AH/DISP	Alter/Display
AMWP	bits 12-15 of PSW 1
atn	attention
aux	auxiliary
BCD	Binary Coded Decimal
BSM	Basic Storage Module
CB	Circuit Breaker
CE	Channel End; Customer Engineer
chan	channel
char	character
chk	check
cmnd	command
comm	communications
CPU	Central Processing Unit
CS	Control Storage
DAC	Disk Attachment Control
DCF	Disk Control Field
DE	Device End
Diag	Diagnostic
DM	Diagnostic Monitor
Dply	display
DR	driver (logic block)
Dsply	display
EBCDIC	Extended Binary Coded Decimal Interchange Code
EC	Engineering change
EOB	End of Block
EOR	End of Record (8th pos. R/P shift Reg. , 2025)
EPO	Emergency power off
E-phase	execute phase
EXOR	Exclusive OR
exec	execute
ext	external
FEESCM	Field Engineering Education Supplementary Course Material
FEMDM	Field Engineering Maintenance Diagram Manual
FEMM	Field Engineering Maintenance Manual
FETOM	Field Engineering Theory of Operation Manual
GPR	General purpose register
hex	hexadecimal
HI	high
H/stop	Hard stop
Hz	Hertz (cycles per second)
IC	Instruction counter
ICC	Interface Control Check
I-cycle	Instruction Cycle
IF	Interface
info	information
insn	instruction

int	interrupt
intv	interval
intvn	intervention
I/O	input/output
IPL	initial program loading
IR	interrupt request
I-time	instruction time
KB	keyboard
LS	local storage
LUA	load unit address (switches)
Man	manual
MAS	Microprogram automation system
MC	machine check
MCS	Multiple Character Set
MDM	Maintenance Diagrams Manual
MS	Main Storage
MST	Monolithic Storage Technology
ms	millisecond
neg	negative
No-Op	no operation
ns	nanosecond
OE	exclusive OR (logic block)
O/I	overload indicator (console)
op	operation
opnd	operand
OS	Operating system
P	Parity bit
PC	parity check
PCC	Print Compare Counter
Pch	punch
PCI	Program Controlled Interrupt
PFR	punch feed read
PLB	print line buffer
PLBAR	Print line buffer address register
PM	Preventive Maintenance
pos	positive
prgm	program
prgm	program check
pri	priority
PR-KB	printer-keyboard
prot	protection
Prt	printer
PS	Power Supply (number)
PSS	Print Sub Scan
PSW	program status word
PTT	Paper Tape transmission Code
pty	parity
PWR	power
Rdr	Reader
reg	register
req	request
res	reset
rgen	regenerate

RST	reset
Rtn	return, routine
R-W	read-write
SAR	storage address register
SDR	storage data register
seq	sequence
sld	Solid Logic Dense
SLT	Solid Logic technology
SS	Single Shot
st	start
STP0	storage protect register
STP1	storage protect local storage
STP	storage protect
svc	supervisor call
sw	switch
sys	system
TB	terminal board
Temp	temperature
T/R	tilt/rotate
UCS	Universal Character Set
UDT	unit definition table
USEC	Micro second
V/S	voltage sense
wd	word
WT	Word Type
XOR	Exclusive OR

COURSE DESCRIPTION

This course includes System/360 Model 25 console operation and manual intervention as related to the 1400 Compatibility Feature. Also, it includes the 1400 Emulator program and the System/360 Model 25 circuit changes called the 1400 Compatibility Feature.

Prerequisites

2025 CPU
 and one of the following:
 14107 1440 CPU
 34048 1401 CPU
 43221 1401/40/60 Instruction Set

Post-requisites

None

Basic Skills

Objective: Upon completion, using available documentation, the CE must be able to:

1. Determine whether or not a 1400 compatibility control program is currently in control storage.
2. Load any 1400 object program from cards, tape, or disk.
3. Operate the console to perform the following 1400 functions:
 - a. All resets.
 - b. Set an address in any Storage Address Reg. (STAR)
 - c. Turn on or off any sense switch.
 - d. Enter or alter data anywhere in 1400 compatibility stor.
 - e. Enter or alter any tape unit assignment.
 - f. Display any status or data pertinent to compatibility.
 - g. Instruction step.
 - h. Address Stop.
4. Identify any coded halt, and take corrective action where necessary to resume compatibility operation.
5. Verify and/or change initialization data.
6. Use all error indications to analyze and pinpoint hardware failures not found by diagnostics.

MATERIAL REQUIRED

System/360 Model 25 1400 Series Compatibility Feature (this book)	R25-5433
System/360 Model 25 1401/1460 and 1440 Compatibility Features SRL	A24-3412
2025 Processing Unit FETOM (library copy)	Y24-3527
Model 25 Microprogram Listing 1401/1460 Emulator *E40 (library copy)	
1440/1460 Pocket Reference Manual	229-2063
2025 Processing Unit FEMDM	Y24-3529

STUDENT OUTLINE

REVIEW

This unit of study is intended to review the 1400 instruction length and format, addressing scheme, index register selection, and difference between 1401/1460 and 1440 I/O instructions. Previous 1400 men may have forgotten this information and men who have taken the 1400 instruction set course can use the review.

Objective: Upon completion of this topic, the student, using the maintenance documentation, should be able to:

1. List the names of the I cycles which occur on a 1400 system, and point out those which normally would mark the end of an instruction.
2. Take any given 1400 address and identify the full decimal value contained in it, and which index registers are used, if any.
3. Divide a list of I/O instructions into those applicable to 1401/1460 systems, those applicable to 1440 systems, and those applicable to both.

Activity

Read: FETOM
Chapter 4, Character Configuration

Review: 1440/1460 Pocket Reference Manual
Areas dealing with:
- Instruction format
- Addressing scheme
- Character coding

Self-Evaluation Questions

1. Write the names of the first 9 I cycles which occur on 1400 systems. _____

2. Write the names of those I cycles where the end of the instruction may normally be detected. _____
3. Given the 1400 address 6SN, answer the following:
 - a. What is the full decimal address? _____
 - b. What index register is called for? _____

4. Divide the following I/O instructions into their appropriate groups.

- a. $\underline{M}\%T0222R$
- b. $\underline{1}$
- c. $\underline{M}\%F6333R$
- d. $\underline{7}$
- e. $\underline{M}\%G2444R$
- f. $\underline{U}\%U1B$
- g. $\underline{3}$
- h. $\underline{F}3$
- i. $\underline{M}\%U3400W$
- j. $\underline{K}2$
- k. $\underline{M}\%G1600W$
- l. $\underline{M}\%Y1201S$

<u>1401/1460</u> <u>Only</u>	<u>1440</u> <u>Only</u>	<u>Both</u> <u>_____</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Refer to the table of contents for the location of the self-evaluation question answers.

INTRODUCTION

This topic is intended to provide a broad understanding of the philosophy of 1400 emulation as applied to the 2025. Items covered in this topic include terminology, emulated features, throughput (speed) capabilities, configuring need, and graphics in emulation.

Objective: Upon completion of this topic, the student, using the maintenance documentation, should be able to:

1. Determine those operations necessary to place the system into 1400 emulator mode, and identify the major areas of system circuitry which are affected when in emulator mode.
2. Answer basic inquiries about the following areas of 1400 system emulation:
 - a. Source of the microprogram which performs emulation.
 - b. Switching between /360 and 1400 mode.
 - c. Which 1400 systems are emulated, and how an individual 1400 system is specified.
 - d. Basic method by which 1400 op codes are decoded and executed.
 - e. Configuration for a specifically featured 1400 system.
 - f. Feature designations and price structure.
3. Identify the correct definition of the following terms:
 - a. Compatibility feature
 - b. Emulator program
 - c. Emulation
 - d. Object program
 - e. Simulation
 - f. Bias constant
 - g. Storage wrap
4. Given a list of all 1400 system features and I/O devices, identify those supported by the 2025/1400 emulation feature.
5. Determine why time dependent 1400 programs may not work properly under 2025/1400 emulator mode, and what time factor exists between program execution by a 1400 system or by a 2025 in 1400 mode.
6. Initialize an Emulator CSL deck, given the feature data pertaining to a specific 1400 system.
7. Identify the A and H graphic set as printed by the console printer, and be able to switch between them by altering a byte in aux storage.

Activity

Read: SRL
 Feature Description (Inclusions and Exclusions)
 Implementation
 Auxiliary Storage
 Initialization
 Core Storage

FETOM
Chapter 4
Compatibility Feature
Implementation
Initialization

- Review: 1440/1460 Pocket Reference Manual
- Lab Project 1, 1400 Configuration Card
- Lab Project 2, 1400 CSL
- Lab Project 3, Graphics

Self-Evaluation Questions

1. List the three areas of 2025 circuitry which are added to or modified by the 1400 compatibility feature. _____

2. Given a need to run a 1401 program, followed by a 1440 program, followed by a S/360 program, arrange the following list in the correct order (some of the items may not be needed).
 - a. ___ 1401 Object program load
 - b. ___ 1440 Object program load
 - c. ___ Mode switch from console
 - d. ___ S/360 Object program load
 - e. ___ System reset to turn off 1400 mode
 - f. ___ S/360 CSL deck load
 - g. ___ 1401-60 CSL deck load
 - h. ___ 1440 CSL deck load
 - i. ___ Compatibility initialization deck to load only aux storage

3. The initialization card is prepunched with initialization data by the same program which punches out the CSL deck. _____ (True/False)

4. Match the following:

- | | |
|---------------------------------|--|
| a. ___ Compatibility feature | 1. 1400 address 0000 |
| b. ___ Emulator program | 2. Program which uses compatibility feature |
| c. ___ Emulation | 3. Hardware |
| d. ___ Object program | 4. Programming only |
| e. ___ Simulation | 5. Going beyond storage address limits |
| f. ___ Bias constant | 6. Customer's program |
| g. ___ Storage wrap | 7. Combination compatibility feature and emulator program |

5. Separate the following list into features supported by 2025/1400 emulation, versus those which are not.

- a. 1402-1403
- b. Multiple 1403s
- c. Console inquiry
- d. 1404
- e. 1405 Disk
- f. 7340 Tape
- g. 729-7330 tape
- h. 7335 tape
- i. 1442-1443
- j. Advanced programming
- k. Serial I/O
- l. 1419
- m. Multiply-divide
- n. 1285 optical reader
- o. 16K storage
- p. 1311 disk
- q. 1050 terminal
- r. Paper tape read/punch

Supported: _____

Unsupported: _____

6. A 1400 object program which depends upon having exactly 10 ms of time in which to do internal processing will finish the processing _____ (too soon/too late), because the 2025 does the object program approximately _____ times as fast as the 1400 systems.

Refer to the table of contents for the location of the self-evaluation question answers.

CONSOLE USE

This unit is intended to provide a complete knowledge of operating procedures for 1400 Emulation. The material covered includes use of all console switches, buttons, and indicators, and input/output messages via the console printer during emulation.

Objective: Upon completion of this topic, the student, using the operating documentation, should be able to:

1. Identify those console switches which have the same function in 1400 mode as in /360 mode.
2. Identify those console switches which have a 1400 meaning while the system is in 1400 mode. List the 1400 function performed. Correctly use them while the system is in 1400 mode.
3. Given a list of all console indicators, identify the one indicator which is unique to 1400 emulation operations, and the one indicator which has a different meaning in 1400 mode than it does in /360 mode.
4. Operate the system to go from /360 mode to 1400 mode. Load 1400 object programs and operate them. Return the system to /360 mode.
5. Given a list of possible 1400 emulation messages, do the following:
 - a. Identify each part of each message type.
 - b. Differentiate between normal and error messages.
 - c. Identify remote restart messages.
 - d. Name the cause of any message.
6. Operate the system to do the following:
 - a. Initiate and terminate alter and display of any area of storage.
 - b. Set and reset all sense switches.
 - c. Change any tape drive assignment.
7. Stop a 1400 program at any desired address, and instruction step through any part of a 1400 program.

Activity

Read: SRL
Operating Considerations (CSL, IPL, Interrupt, Alt/Disp, etc)
I/O Operating Description
Programmed and Error Stops
General Stops

Review: Lab Project 4, 1400 Mode System Use
Lab Project 5, Object Program Manipulation

Self-Evaluation Questions

1. Arrange the following items under the headings provided:

- a. System Reset
- b. Control Address Set
- c. Start
- d. Interval Timer
- e. Set IC
- f. Check Reset
- g. Stop
- h. Control Storage Load
- i. Store
- j. Lamp Test
- k. Display
- l. PR-KB Alter/Display
- m. Interrupt
- n. Load

1400 Function

No 1400 Function

2. Name one indicator which is unique to 1400 emulation. _____
 Name one indicator which has a different meaning in 1400 mode than it does in /360 mode. _____

3. Match the following two lists.

Message

Meaning

- | | |
|----------------------------|-----------------------------------|
| a. ___ ap0123 | 1. Successful CSL |
| b. ___ c0 | 2. Remote restart |
| c. ___ 0000 | 3. Instruction step mode |
| d. ___ 0789 0462 0081 4f4f | 4. Modify 1400 storage locations |
| e. ___ 0200 8248 | 5. End of alter storage operation |
| f. ___ 0200 f999 0365 df00 | 6. Sense switch change |
| g. ___ 1417 | 7. Set IC |
| ___ 1551 | |
| ___ 1555 | 8. Error halt |
| ___ 1556 | |
| h. ___ 0002 1000 b815 2100 | |

Refer to the table of contents for the location of the self-evaluation question answers.

CODED HALTS

This unit describes how to identify coded halts and take appropriate action. These halts replace all of the indications normally present on a 1400 system.

Objective: Upon completion of this topic, the student, using the maintenance documentation, should be able to:

1. Identify which of the following categories a given coded halt falls into:
 - a. stop key
 - b. invalid op code or address
 - c. I/O error
 - d. I/O intervention required
 - e. alter/display or console interrupt
 - f. programmed halt
2. Given a coded halt which specifies a particular unit of the system:
 - a. Identify what unit is specified.
 - b. Take the required action to proceed with the job.

Activity

Read: SRL
I/O Operating Differences
Restart Procedures

Review: SRL
Programmed and Error Stops
General Stops (by sequence)

Self-Evaluation Questions

1. Match the following:

a. ___ IIII AAAA BBBB 0400	1. Normal Stop (Stop Key)
b. ___ IIII AAAA BBBB 2102	2. Printer Intervention
c. ___ IIII AAAA BBBB 0080	3. Storage Wrap Error
d. ___ IIII HHHH HHHH 0601	4. Invalid I/O Operation
e. ___ IIII AAAA BBBB 6F6F	5. Invalid Op Code
f. ___ IIII AAAA BBBB 05C0	6. 1400 Halt - Instruction
g. ___ IIII AAAA BBBB DF08	7. Missing Word Mark (I-OP)
h. ___ IIII AAAA BBBB F000	8. Alter/Display Stop

Refer to the table of contents for the location of the self-evaluation question answers.

AUXILIARY STORAGE DATA

This unit is intended to provide a knowledge of the data contained in aux storage. All areas are covered, but detailed attention is given to Module 0, where the most important functions occur.

Objective: Upon completion of this topic, the student, using the maintenance documentation, should be able to:

1. Locate any portion of aux storage in the storage maps of the FETOM or in the CSL listing, and identify the purpose of the named area.
2. Be able to display and interpret the meaning of any byte or bytes of Module 0, and if necessary, alter manually or via alter/display, any designated data.
3. Given a data translation problem, determine what storage module is involved, where the translation data is located within the module, and whether the fault is within the data there or elsewhere.
4. Locate input or output buffer areas for each I/O device, and in the event of incorrect data handling, locate the buffer area where the data becomes incorrect.

Activity

Review: SRL

Auxiliary Storage Map
Module 0 Byte Uses

Lab Project 6, Read Error Column Indicator

Lab Project 7, Tape and Disk Assignments

Self-Evaluation Questions

1. What data is located in aux storage location 0X88-0X89? _____
2. Where, exactly, did it come from? _____
3. What address would be alter/displayed to look at the sense-switch byte? _____
4. If you desired to change the Mod 25 disk drive associated with 1400 disk module 0, what aux storage position would have to be addressed? _____
5. What aux storage position would have to be addressed to change the Mod 25 tape unit associated with 1400 tape unit 3? _____
6. In the part of the microprogram listing which shows aux storage assignments, several modules are not shown. Why are they not shown, and what do they contain immediately after a successful CSL? _____

Refer to the table of contents for the location of the self-evaluation question answers.

LOCAL STORAGE USE

In this unit, the application of some local storage registers is covered. The parallel between 1400 system registers and certain local storage registers is drawn and used as a starting point in the following unit (General Compatibility Operation).

Objective: Upon completion of this topic, the student, using the maintenance documentation, should be able to:

1. Identify the local storage registers which are used as the 1400 I STAR, A STAR, B STAR, OP register, and A Reg (location of the D-modifier character).
2. With a 1400 (decimal) I, A, or B address given, predict what value will be found in the corresponding local storage register (hexadecimal).

Activity

Read: FETOM
Chapter 4, Local Storage (Zone Zero)

Self-Evaluation Questions

1. In what local storage zone are the registers used as I STAR, A STAR, B STAR located? _____
2. What local storage register is used as I STAR? B STAR? OP REG? A Register (for purposes of holding the D-Modifier character)? _____

3. Given a 4K 1400 storage size and a 48K Mod 25 storage size, what hexadecimal address will be generated for a 1400 (decimal) address of 0456? _____

Refer to the table of contents for the location of the self-evaluation question answers.

GENERAL COMPATIBILITY OPERATION

This topic covers selected portions of the 1400 microprogram listing. Included are ICYC (I cycles), INIZ (Bias Constant Adjustment), IBCH (Conditional Branch).

Objective: Upon completion of this topic, the student, using the maintenance documentation, should be able to:

1. Given any 1400 op code, trace through the ICYC portion of the 1400 compatibility listing, arriving at the correct routine to execute the operation.
2. Locate and correct a microroutine fault anywhere in the 1400 emulation microprogram.

Activity

Review: FETOM
OP Code Modification and Conversion
Local Storage Use

Read: FETOM
CPU Operations
I Cycles

1400 COMPATIBILITY CIRCUITS

This unit covers the circuitry involved in 1400 compatibility, and describes its operation.

Objective: Upon completion of this topic, the student, using the maintenance documentation, should be able to:

1. Identify the purpose of compatibility circuits as used to control the 2540.
2. Analyze and correct compatibility circuit failures in the 2540 circuitry.
3. Identify the purpose of compatibility circuits as used to control storage wrap detection.
4. Analyze and correct compatibility circuit failures in the storage wrap detection circuitry.
5. List the purposes of compatibility circuitry as used to control 2311 operations.
6. Analyze and correct compatibility circuit failures in the 2311 circuitry.

Activity

Read: FETOM
Address Error Detection
1402 Read Operations
File Circuitry

Self-Evaluation Questions

1. Which one of the following describes best the purpose of compatibility circuitry for the 2540?
 - a. Converts a 1 op code to a read CCW.
 - b. Prevents overlapping read and punch operations.
 - c. Translates stacker commands.
 - d. Provides a 6.5 ms delay following a 1 op code.
 - e. Makes a line called "reader busy" active.
2. Which of the following describes the function of the storage wrap portion of compatibility circuitry?
 - a. Monitors the M Reg addressing lines.
 - b. Recognizes a special character in storage.
 - c. Prevents errors during a storage wrap operation.
 - d. Modifies M Reg values to wrap from low to high end of 1400 storage.
 - e. Prevents the M Reg from ever having a value outside the defined 1400 storage limits.
3. Compatibility circuitry for 2311 is used only during a load/write operation.
_____ (True/False)

Refer to the table of contents for the location of the self-evaluation question answers.

I/O OPERATIONS - DETAILS

This unit explains how the Mod 25 meets the objectives of selected I/O operations. Reader, printer, and file are covered as native devices, while tape operations are used to cover channel.

Objective: Upon completion of this topic, the student, using the maintenance documentation, should be able to:

1. Given a 1400 file record address, identify which cylinder, track, and record number the Model 25 would use to locate the record.
2. List the necessary steps to convert a disk pack previously used on a 1400 system (1311) to allow use on a Mod 25 operating in 1400 emulation mode (2311).
3. Turn on compare disable when necessary to write new addresses on a disk pack, and bypass the read back check operation when desired.
4. List the system requirements necessary to list on the native 1403 a tape written on a 1400 system.

Activity

Read: FETOM
I/O Operations

SRL
I/O Operating Considerations
Printer
Reader/Punch
Magnetic Tape
Magnetic Disk

Self-Evaluation Questions

1. On what cylinder, track, and record would a sector write operation be performed with the following DCF?

*001308001

2. What steps must be taken to convert a disk pack from use on a 1400 system (1311) to use with the same records on a Mod 25 (2311) operating in 1400 emulator mode? (4 steps)

3. Why are the above 4 steps necessary?

4. What is the address and bit number of the bit which controls compare disable?
What state (on/off) must the bit be in to turn on compare disable? _____

5. What tape feature is necessary in order to read a tape written on a 1400 system?

Refer to the table of contents for the location of the self-evaluation question answers.

SAFETY PRECAUTIONS AND HOUSEKEEPING

Refer to your CE Safety Practices card (Form 229-1264) for general safety precautions. Additional instructions on safety and housekeeping procedures will be supplied by your instructor, as required by your training locations.

LAB PROJECT 1 - 1400 CONFIGURATION CARD

Objective: Upon completion of this project, the student, using the available documentation, should be able to:

1. Punch up a 1400 CSL deck initialization card, or discriminate between correct and incorrect data punched in a configuration card.

Time required to complete this project averages 1.5 hours.

Tools, Test Equipment, and Documentation

FETOM
Hex to EBCDIC Conversion Chart
Keypunch

Directions

1. Working on paper first, determine what data should be punched in the card.
2. Punch up the card (or cards, if more than one configuration is desired) and insert the card into its proper place in the CSL deck.

Study Questions

1. Where is the configuration card data placed in the Mod 25? _____

2. The purpose of the configuration data is to:
 - a. describe a 1400 system to the emulator program.
 - b. describe the Mod 25 system to the emulator program.
 - c. complete an unfinished portion of the emulator program.
 - d. set up compatibility hardware registers.
 - e. interface to the customer's object program.

Answers

1. Aux storage Module 0 bytes 0080 to 00BF
2. a and b

LAB PROJECT 2 - 1400 CSL

Objective: Upon completion of this project, the student, using the available documentation, should be able to:

1. Describe the steps necessary to enter the 1400 microprogram into control storage.
2. Verify that the 1400 microprogram is in control storage.
3. Verify configuration data as it resides in aux storage.

Time required to complete this project averages .5 hours.

Tools, Test Equipment, and Documentation

FETOM
1400 CSL Deck and Listing
1400 Compatibility
SRL Type Element for Console Printer

Directions

1. Insert generated configuration card into proper place in CSL deck.
2. Load deck and verify correct loading via initial console printer output message.
3. Display aux storage locations to assure configuration card data entered properly. Use the SRL as an operating guide to assure correct operation of the system while doing this project.

Study Questions

1. Where is the configuration card located within the CSL deck? _____

2. What output message is printed as a result of successful 1400 CSL operation?

Answers

1. Last card before the end card. (Second from the rear)
2. 0000

LAB PROJECT 3 - GRAPHICS

Objective: Upon completion of this project, the student, using the available documentation, should be able to:

1. List those special characters within the A and H graphic sets which differ from each other, and state which character belongs to which set.

Time required to complete this project averages .5 hour.

Tools, Test Equipment, and Documentation

FETOM

1400 SRL

1400 Compatibility SRL Type Element on the Console Printer

Directions

1. Using the SRL section on input messages for guidance, enter into an unused portion of program storage all special characters as shown on the front of the console printer keys.
2. Locate and change the control bit in aux storage so the alternate graphic set is used, then enter the same characters again in the same order. Note the differences on the console printer paper.

Study Question

1. What characters in the "A" graphic set have alternate characters in the "H" graphic set? _____

Answer

1. Lozenge - ✕ , Percent - %, Commercial at - @, Number Sign - #.

LAB PROJECT 4 - 1400 MODE SYSTEM USE

Objective: Upon completion of this project, the student, using the available documentation, should be able to:

1. Alternate the system between 1400 and 360 mode.
2. Load and use a 1400 object program to perform various functions.
3. Interpret and respond to 1400 mode output messages.

Time required to complete this project averages 1.0 hour.

Tools, Test Equipment, and Documentation

1400 CSL Deck
1400 Object Deck
1400 Compatibility SRL Type Element on the Console Printer
Blank Cards
Printer Paper
SRL

Directions

Load 1400 CSL deck, and verify correct loading. Load the supplied 1400 object deck and use it to:

1. Generate ripple-punched cards.
2. List the cards.
3. Duplicate the cards.
4. Put them on tape and/or disk.
5. List out from tape and/or disk.

Study Questions

1. When the system reset key is depressed, there are three distinct indications which identify that a 1400 core load is in core storage. Name them.

- a. _____
- b. _____
- c. _____

2. The alter/display function in 1400 mode operates differently than when in /360 mode. Name the differences (other than graphic differences).

a. _____

b. _____

Answers

1.
 - a. Display bytes 0 and 1 show all bits on.
 - b. Console printer types instruction address.
 - c. 1400 indicator lamp is on.
2.
 - a. No automatic space when altering or displaying.
 - b. Display continues indefinitely until stopped.

LAB PROJECT 5 - OBJECT PROGRAM MANIPULATION

Objective: Upon completion of this project, the student, using the available documentation, should be able to:

1. Effectively utilize address stop and instruction step to manipulate or debug a 1400 object program.

Time required to complete this project averages .5 hour.

Tools, Test Equipment, and Documentation

FETOM
1400 Compatibility SRL
1400 Pocket Reference Manual

Directions

1. Enter a simple program via the console printer, or load an assembled object program.
2. Select an instruction within the program and set up to do an address stop on the instruction.
3. Do the address stop in both process and instruction step mode.
4. Answer the associated questions.

Study Questions

1. What console operation can be used to determine the correct switch settings (for switches ABCD) to do an address stop? _____
2. Which function is used for address stop? (SAR delayed stop or MS address stop)

3. Is the instruction done when the address match stop occurs? _____

Answers

1. Set IC
2. SAR delayed stop
3. Yes

LAB PROJECT 6 - READ ERROR COLUMN INDICATION

Objective: Upon completion of this project, the student, using the available documentation, should be able to:

1. Determine, following a read error, what column(s) had the error.

Time required to complete this project averages .5 hour.

Tools, Test Equipment, and Documentation

FETOM

Listing of 1400 Compatibility Microprogram

Blank card deck

Directions

1. Punch one punch in any column of a card. Place this card in the middle of a deck of blank cards.
2. Disconnect a read brush in the same column as was punched in the card.
3. Run the deck through the reader via a simple read op loop.
4. Check the logout area (Module 1) when the error occurs.
5. Try this with I/O check stop both off and on, and with first then second read brush disconnected.

Study Questions

1. Where is the read error column indicator data stored? _____
2. Where is the punch error column indicator data stored? _____
3. What happens to a previous error indicator bit when another card is read?

Answers

1. Aux storage module 1 bytes F6 - FF
2. Aux storage module 5 bytes F6 - FF
3. It is reset.

LAB PROJECT 7 - TAPE AND DISK ASSIGNMENTS

Objective: Upon completion of this project, the student, using the maintenance documentation, should be able to:

1. Alter tape and disk drive assignments in aux storage to allow a given 1400 tape or disk drive to be assigned to any of the attached Mod 25 tape or disk drives.

Time required to complete this project averages .75 hour.

Tools, Test Equipment, and Documentation

FETOM
1400 Compatibility SRL
1400 Object Program
Scratch Tape Reel
Scratch Disk Pack

Directions

1. Use the 1400 object program to generate records on disk drive 0.
2. Copy the records from disk to tape if tape is available (otherwise, go directly to the printer from disk). Go from tape to printer.
3. Do not move the tape or disk pack to a different drive, but change the assignments in aux storage. This is necessary because the object program writes on one unit and reads from another. See the instructions typed out upon request by the object program.

SELF-EVALUATION QUESTION ANSWERS

REVIEW

1. I op and I1 through I8
2. I1, I2, I4, I5, I7, and I8
3. a. 8625
b. Index Reg 1 (loc 0087-0089)
4. 1401/1460 1440 Both

Only	Only	
b	e	a
d	k	c
g	l	f
		h
		i
		j

INTRODUCTION

1. Storage address low wrap detection, 2540 feed start (clutch control), and file share cycles (data handling)
2. a. 2
b. 4
c. not needed
d. 6
e. not needed
f. 5
g. 1
h. 3
i. not needed
3. False
4. a. 3
b. 2
c. 7
d. 6
e. 4
f. 1
g. 5
5. Supported: a, c, g, h, i, j, m, o, and p
Unsupported: b, d, e, f, k, l, n, q, r
6. too soon, 1.5 times

CONSOLE USE

- | | | |
|----|-------------------------------------|-------------------------|
| 1. | <u>1400 Function</u> | <u>No 1400 Function</u> |
| | a, c, e, g, l, m, n | b, d, f, h, i, j, k |
| 2. | 1400 mode indicator, wait indicator | |
| 3. | a. | 4 |
| | b. | 6 |
| | c. | 1 |
| | d. | 2 |
| | e. | 7 |
| | f. | 5 |
| | g. | 3 |
| | h. | 8 |

CODED HALTS

- | | | |
|----|----|---|
| 1. | a. | 5 |
| | b. | 7 |
| | c. | 1 |
| | d. | 3 |
| | e. | 2 |
| | f. | 4 |
| | g. | 8 |
| | h. | 6 |

AUXILIARY STORAGE DATA

1. Bias constant
2. columns 13-14 of initializer card
3. 0XA8
4. 0XA1
5. 0X83
6. Contents of data buffers (i.e. Row Image, Column Image) are not shown because data is variable. The contents of these buffers following CSL is the same as for a normal read operation.

LOCAL STORAGE USE

1. CPU zone (zone 0)
2. I0-I1, U0-U1, V0-V1, G1, D1
3. B228

GENERAL COMPATIBILITY OPERATION

None

1400 COMPATIBILITY CIRCUITS

1. d
2. b
3. False - used in read and write, load and move mode.

I/O OPERATIONS - DETAILS

1. Cylinder 7, track (head 5, record (sector) 9
2. Dump information from 1311 to tape or cards, do a /360 disk initialization on the pack (on a 2311), do a 1400 clear disk utility in emulator mode (on a 2311), re-write the dumped data on the pack (on a 2311).
3. All data is coded in EBCDIC and all records formatted in count-key-data format even though the system is in 1400 emulation mode.
4. 00A1 bit 6, on for compare disable on.
5. 7 track tape feature.



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