

IDENTIFICATION  
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MONITOR/BUILDER  
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MAINDEC-X8-DIQAB-D-D

FAMILY-OF-8 SYSTEMS EXERCISER

DEC / X 8 U S E R S G U I D E

REVISION D

THIS MANUAL INCLUDES THE COMPLETE OPERATING  
PROCEDURES FOR THE FAMILY-OF-8 SYSTEMS EXERCISER.

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PREFACE

THE DESCRIPTIONS IN THIS DOCUMENT PERTAIN ONLY TO REVISION D OF THE DEC/X8 MONITOR/BUILDER (MAINDEC-X8-DIQAB-D). FOR USERS WHO ARE FAMILIAR WITH REV A, REV B, OR REV C OF DX8MB, THE LIST OF OPERATIONAL DIFFERENCES BELOW BETWEEN REV A AND D SHOULD BE HELPFUL.

IN ADDITION, AN "\*" APPEARS AT THE LEFT MARGIN WHEREVER A SIGNIFICANT CHANGE HAS BEEN MADE IN THE DOCUMENT. "\*" ALSO APPEARS IN THE TABLE OF CONTENTS TO THE RIGHT OF THE NUMBER OF ANY PAGE/PARAGRAPH WHICH CONTAINS A MAJOR CHANGE.

OPERATIONAL CHANGES FROM REV A TO REV B

WARNING: REVISION A OF DEC/X8 MODULE "TC01DT" (MAINDEC-X8-DITCA-A) MUST BE PATCHED AS FOLLOWS TO OPERATE UNDER REVISION B OF THE DEC/X8 MONITOR/BUILDER.

LOCATION	OLD	NEW
0417	7240	7000
0420	3456	7000

1. THE ![DL\*] COMMAND HAS BEEN REPLACED WITH THE MORE GENERAL ![DNN\*] AND ![LNN\*] COMMANDS WHERE NN IS THE DEVICE CODE OF THE DEVICE TO WHICH TTO OUTPUT IS TO BE SWITCHED. ![LNN\*] MUST BE USED WHEN SWITCHING TO AN LP08 OR LE-8 LINE PRINTER. ![DNN\*] MUST BE USED FOR ALL OTHER "TTY COMPATIBLE" DEVICES.
2. THE ERROR REPORT HEADER NOW INCLUDES THE RELATIVE MODULE LOCATION AT WHICH THE ERROR REPORT WAS INITIATED. THE ERROR REPORT HEADER NOW APPEARS AS FOLLOWS WHERE "RPC:" IS THE NEWLY ADDED ITEM.  
  
TYPE ERR IN JFX MOD:MODNAM FLD:IN CNTR:NNNN RPC:NNNN CODE:NNNN
3. IF THE TTO IS FREE DURING THE "\*E" PHASE, ANY KEY STRUCK ON THE TTI WILL BE ECHOED ON THE TTO.
4. BUILDER HAS AN ADDITIONAL COMMAND IF THE SYSTEM HAS AT LEAST 8K OF MEMORY. THIS COMMAND LISTS EXISTING AND EMPTY JOB SLOTS TO ALLEVIATE THE "GUESSING" AS TO WHAT JOB SLOTS ARE AVAILABLE. THE SYNTAX IS:

X[ES\*]  
EMPTY SLOTS:  
NN NN NN NN NN NN NN ETC.

%

WHERE NN DESIGNATES ANY EMPTY JOB SLOT NUMBER.

5. ADDITIONAL EXTERNAL BUFFERS HAVE BEEN ADDED IN FIELDS 2 THROUGH 7 RANGING FROM 1400 THROUGH 2377, ALSO THE GENERAL DESIGNATOR FOR THE BUFFER STARTING AT 5600 HAS BEEN CHANGED FROM 56F4 TO 56F0. THE NEW BUFFER DESIGNATORS ARE:

02F0 FOR F=0 THROUGH 7  
14F0 FOR F=2 THROUGH 7  
56F0 FOR F=0 THROUGH 7

6. IF "+C" IS TYPED BY THE USER WHILE THE TTO IS BUSY, MONITOR WILL HONOR THE "+C" REQUEST AS SOON AS THE TTO IS FREE.
7. THE USER NOW HAS THE CAPABILITY OF SWITCHING THE CONSOLE KEYBOARD. THE COMMAND IS ![TNN+] WHERE "NN" IS THE DEVICE CODE OF THE NEW CONSOLE KEYBOARD (TTI). THIS COMMAND IS AVAILABLE IN 8K OR MORE.
8. PROCEDURES FOR BUILDING VIA THE PMK-02 CASSETTE HAVE BEEN ADDED.
9. THE MONITOR NOW DYNAMICALLY MODIFIES THE MANNER IN WHICH JOB SLOTS ARE ROTATED. HENCE, AT ANY GIVEN TIME A GIVEN JOB SLOT MAY BE MOVED FROM 0 TO 3 MEMORY FIELDS.
10. VARIOUS OTHER "TRANSPARENT" IMPROVEMENTS HAVE BEEN MADE WHICH MAKE EVEN MORE EFFICIENT USE OF PROCESSOR TIME.

OPERATIONAL CHANGES FORM REV B TO REV C  
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1. PARAGRAPH 1.6 ON PAGE 1-6 OF THE "DEC/X8 USERS GUIDE" WAS CHANGED TO READ AS FOLLOWS:

"PRELIMINARY TEST PROGRAMS  
-----

THE SYSTEM UNDER TEST SHOULD BE CAPABLE OF  
RUNNING ALL APPLICABLE PROCESSOR AND OPTION  
TESTS WITH SPECIAL EMPHASIS ON MEMORY DIAGNOSTICS."

2. THE MONITOR HAS BEEN CHANGED TO RANDOM JOB SLOT ROTATION. THE EFFECT, MANNER OF ROTATION, AND TYPEOUTS HAVE NOT CHANGED. "ROTRD" OF FIELD 1 IS NOW THE CONTROLLING FACTOR FOR SLOT ROTATION. "ROTRD" FIELD 0 IS USED IN RANDOM NUMBER GENERATION.

(II)

OPERATIONAL CHANGES FROM REV C TO REV D

- \*1. THE MONITOR DOCUMENT AND PROGRAM REFERENCES TO PS/8 WERE CHANGED TO OS/8.
- \*2. THE DOCUMENT AND PROGRAM WERE CHANGED TO CORRECT PREVIOUS PROBLEM WITH "POWER FAIL" (I.E. POWER FAIL "JMP," AT LOCATION 01624 WAS CHANGED TO A "HLT").
- \*3. THIS DOCUMENT WAS CHANGED TO IDENTIFY BUILD COMPATIBILITY BETWEEN "OS/8" AND COS 300 DIAGNOSTIC MEDIUM.
- \*4. THIS DOCUMENT WAS CHANGED TO IDENTIFY COMPATIBILITY BETWEEN THE "PDP-8/E" AND THE "PDP-8/A".

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## CHAPTER 1

### INTRODUCTION

-----

THE FAMILY-OF-8 SYSTEMS EXERCISER (DEC/X8) IS A POWERFUL AND ADAPTABLE MODULAR SOFTWARE SYSTEM DEDICATED TO THE PURPOSE OF TESTING FAMILY-OF-8 HARDWARE IN A SYSTEMS ENVIRONMENT. THE MODULAR STRUCTURE OF DEC/X8 ENABLES THE USER TO DESIGN AND BUILD A UNIQUE OPERATIONAL EXERCISER CONSISTENT WITH HIS NEEDS AND THE HARDWARE CONFIGURATION AT HAND.

THIS MANUAL INCLUDES THE COMPLETE OPERATING PROCEDURES FOR DEC/X8. INFORMATION PERTAINING TO PARTICULAR DEC/X8 SOFTWARE MODULES IS PRESENTED IN THE INDIVIDUAL MODULE DOCUMENTS WHICH ARE CLASSIFIED UNDER PRODUCT CODE "MAINDEC-X8-DXXXX".

CHAPTER 1 CONTAINS INTRODUCTORY INFORMATION INCLUDING HARDWARE, SUPPORTING SOFTWARE AND USER KNOWLEDGE REQUIREMENTS, AND AN OUTLINE OF THE CONVENTIONS USED IN THIS MANUAL.

CHAPTER 2 CONSISTS OF THAT INFORMATION NECESSARY TO UNDERSTAND AND EXECUTE THE PROCEDURES IN CHAPTERS 3, 4 AND 5.

CHAPTER 3 IS THE OPERATING PROCEDURE TO BE USED IN CUSTOMIZING THE MONITOR/BUILDER AND IN BUILDING A FULLY CONFIGURED EXERCISER.

CHAPTER 4 IS THE OPERATING PROCEDURE TO BE USED IN RUNNING A FULLY CONFIGURED EXERCISER.

ERROR INFORMATION AND PROCEDURES ARE GIVEN IN CHAPTER 5 AND SHOULD BE REFERENCED ANY TIME THAT AN ERROR OR UNEXPECTED EVENT OCCURS.

1.1 CONVENTIONS USED IN THE DEC/X8 USERS GUIDE  
-----

THE FOLLOWING CONVENTIONS ARE USED IN THIS MANUAL.

1. THE TERM "MEMORY" ALWAYS REFERS TO READ/WRITE MEMORY.
2. THE TERM "PDP-8/E" REFERS IN ALL CASES TO A PDP-8/E, PDP-8/M OR PDP-8/F PROCESSOR WITH A STANDARD PROGRAMMER'S CONSOLE AND AT LEAST 4K OF MEMORY.
3. THE TERM "PDP-8/E" REFERS IN ALL CASES TO A PDP-8/A PROCESSOR WITH A STANDARD PROGRAMMER'S CONSOLE AND AT LEAST 4K OF MEMORY, EXCEPT WHEN REFERENCING THE EAE OPTION (I.E. THE EAE OPTION IS NOT OPERATIONAL ON A PDP-8/A).
4. WHERE A MEMORY LOCATION IS GIVEN AS FIVE OCTAL NUMBERS OF THE FORM "FAAAA", "F" IS THE MEMORY FIELD, AND "AAAA" IS THE ABSOLUTE LOCATION IN THAT FIELD.
5. ANY PROGRAM HALT LOCATION GIVEN IN THIS MANUAL REFERS TO THE CONTENTS OF THE MA IN A PDP-8, 8/I, 8/L OR PDP-12. THE MA OF A PDP-8/E SHOULD DISPLAY THE INDICATED ADDRESS PLUS ONE UNLESS NOTED OTHERWISE.
6. TO ACCOMPLISH THE ACTION "LOAD ADDRESS" ON A PDP-12, SET THE INDICATED ADDRESS IN THE LEFT SWITCHES.
7. THE ACTION "DEPRESS START" IS ACCOMPLISHED ON A PDP-8/E BY DEPRESSING CLEAR, THEN CONT. ON A PDP-12, SELECT "8 MODE", DEPRESS I/O PRESET, THEN START LS WITH THE LEFT SWITCHES SET TO THE STARTING ADDRESS INDICATED.
8. ON A PDP-12, THE RIGHT SWITCHES ARE TO BE USED FOR ANY OF THE DEC/X8 SWITCH OPTIONS.
9. ALL REFERENCES TO "OS/8" APPLY ALSO TO "PS/8", "PS/12", "OS/12", AND THE "COS 300 DIAGNOSTIC MEDIUM".
10. THE FOLLOWING NOTATIONS AND/OR SYMBOLS ARE USED IN REFERENCE TO KEYBOARD/TELEPRINTER I/O.
  - [ ] BRACKETS ARE USED TO ENCLOSE USER KEYBOARD INPUT IN ANY EXAMPLES WHERE CLARIFICATION IS NEEDED TO DIFFERENTIATE BETWEEN PROGRAM OUTPUT AND USER INPUT.
  - ! DEC/X8 MONITOR WAITING FOR COMMAND INPUT.
  - x DEC/X8 BUILDER WAITING FOR COMMAND INPUT.
  - . OS/8 KEYBOARD MONITOR WAITING FOR COMMAND INPUT.
  - \* OS/8 COMMAND DECODER WAITING FOR COMMAND INPUT.

WHEN \* PRECEDES A LETTER IN A USER COMMAND, THE LETTER MUST BE TYPED WHILE THE CTRL KEY IS DEPRESSED (CONTROL CHARACTER), FOR INSTANCE [+B] IS TYPED BY DEPRESSING CTRL AND TYPING B, WHEN \* IS USED ALONE IN PROGRAM OUTPUT, THE PROGRAM IS INDICATING THAT IT IS READY TO READ A PAPER TAPE. RESPOND BY DEPRESSING RETURN.

INDICATES THAT THE USER SHOULD DEPRESS THE RETURN KEY.

# INDICATES THAT THE USER SHOULD DEPRESS THE LINE=FEED KEY.

\$ INDICATES THAT THE USER SHOULD DEPRESS THE ALTMODE OR ESCAPE KEY.

DEV REFERS TO THE STANDARD OS/8 DEVICE NAMES.

FILE.EX REFERS TO OS/8 FILE NAMES AS ALLOWED.

FILE.BN REFERS TO A OS/8 FILE IN ABSOLUTE BINARY FORMAT.

FILE.SV REFERS TO A OS/8 FILE IN SAVE (CORE IMAGE) FORMAT.

[R FILE\*] OS/8 USERS! RECALL THAT IF FILE.SV IS NOT ON DEVICE "SYS", THE [RUN DEV FILE\*] COMMAND MUST BE USED WITH THE SYSTEM DEVICE WRITE ENABLED.

## 1.2 DEC/X8 BASIC SYSTEM ORGANIZATION

-----

DEC/X8 CONSISTS OF THREE MAJOR SECTIONS. THE FIRST AND PRIMARY SECTION IS THE DEC/X8 MONITOR. MONITOR IS THE SOFTWARE MAINFRAME AND TRUE "WORK-HORSE" OF THE EXERCISER. IT CONTROLS INTERRUPT SERVICING, DEFERRED SERVICE QUEUING, AND USER-EXERCISER COMMUNICATIONS.

THE SECOND SECTION IS THE DEC/X8 BUILDER. BUILDER IS USED ONLY DURING THE EXERCISER BUILDING PHASE AND PROVIDES THE MEANS WITH WHICH THE USER "INSERTS" SOFTWARE MODULES INTO THE DEC/X8 MAINFRAME AND SAVES THE FULLY CONFIGURED EXERCISER IN SUITABLE FORM FOR FUTURE USE. IN 4K SYSTEMS, BUILDER IS NECESSARILY RESTRICTED TO PAPER TAPE OR PMK-02 CASSETTE INPUT/OUTPUT. HOWEVER, IN SYSTEMS WITH 8K OR MORE MEMORY AND AT LEAST ONE STANDARD MASS STORAGE DEVICE, BUILDER BECOMES VIRTUALLY DEVICE INDEPENDENT BY INTERFACING DIRECTLY WITH THE 8K PROGRAMMING SYSTEM, OS/8. BOTH MONITOR AND BUILDER RESIDE ON THE SAME BINARY TAPE (MAINDEC-X8-DIQAB-D-P8).

THE THIRD AND FINAL SECTION OF DEC/X8 CONSISTS OF ALL AVAILABLE DEC/X8 SOFTWARE MODULES. EACH OF THESE MODULES IS DESIGNED TO EXERCISE A SPECIFIC FUNCTION AND/OR DEVICE ASSOCIATED WITH FAMILY-OF-8 HARDWARE. EACH MODULE RESIDES ON ITS OWN BINARY TAPE, HAS ITS OWN DESCRIPTIVE DOCUMENT, AND IS INCLUDED IN PRODUCT CODE "MAINDEC-X8-DXXXX". THE LIST OF MODULES AVAILABLE FROM THE DEC SOFTWARE DISTRIBUTION CENTER MAY BE FOUND IN THE CURRENT EDITION OF THE "PDP-8 SOFTWARE PRICE LIST". IN ADDITION, ALL OBJECT PROGRAMS ASSOCIATED WITH DEC/X8 ARE AVAILABLE ON OS/8 FORMAT DECTAPE AND LINCTAPE AND MAY BE ORDERED FROM THE SOFTWARE DISTRIBUTION CENTER.

## 1.3 USER KNOWLEDGE REQUIREMENTS

-----

THE OPERATING PROCEDURES AND DISCUSSIONS PRESENTED IN THIS MANUAL ASSUME THAT THE USER IS FAMILIAR WITH AT LEAST THE OPERATIONAL ASPECTS OF THE SYSTEM UNDER TEST AS DESCRIBED IN "INTRODUCTION TO PROGRAMMING" AND THE "SMALL COMPUTER HANDBOOK". IN ADDITION IF THE OPTIONAL BUILDING PROCEDURES USING OS/8 ARE UTILIZED, THE USER MUST BE FAMILIAR WITH THE OS/8 CONVENTIONS GOVERNING SYSTEM BOOTSTRAPPING AND KEYBOARD COMMAND INPUT TO THE OS/8 KEYBOARD MONITOR AND COMMAND DECODER.

## HARDWARE REQUIREMENTS

---

### 1. PROCESSORS:

DEC/X8 IS OPERATIONAL ON THE FOLLOWING DEC PROCESSORS WITH THE RESTRICTIONS CITED.

PROCESSOR	RESTRICTIONS
PDP-8	ON A PDP-8 WITH EAE, THE CONTENTS OF THE STEP COUNTER ARE NOT SAVED UPON INTERRUPT. HENCE, IF AN EAE JOB WHICH REQUIRES A NON-VOLATILE STEP COUNTER IS RUNNING, NO OTHER JOB WHICH MODIFIES THE STEP COUNTER MAY BE RUNNING.
PDP-8/I	NONE.
PDP-8/L	NONE.
PDP-8/E	ON A 4K PDP-8/E WITH EAE TYPE KEB-E, THE CONDITION OF THE GT FLAG IS NOT RESTORED AFTER INTERRUPT. HENCE WHEN CUSTOMIZING A DEC/X8 EXERCISER FOR SUCH A HARDWARE CONFIGURATION THE ONLY ALLOWABLE DEC/X8 MODULE TO BE USED FOR EAE IS "EAEALL" WHICH MUST BE INITIALIZED TO RUN IN MODE A ONLY.
PDP-12	DEC/X8 DOES NOT HAVE THE CAPABILITY OF HANDLING LINC MODE INTERRUPTS. HENCE, ANY JOBS WHICH OPERATE WHOLLY OR PARTIALLY IN LINC MODE MUST OPERATE IN THAT MODE WITH THE INTERRUPT SYSTEM OFF.

NOTE: DEC/X8 IS NOT OPERATIONAL IN PDP-5 OR PDP-8/S SYSTEMS.

### 2. MEMORY:

A MINIMUM OF 4K MEMORY IS REQUIRED; HOWEVER, CERTAIN DEC/X8 CAPABILITIES ARE LOST AS NOTED IN APPLICABLE SECTIONS OF THIS MANUAL. DEC/X8 IS COMPLETELY OPERATIONAL IN 8K AND WILL UTILIZE UP TO AND INCLUDING 32K.

IT IS ASSUMED THAT IF THE SYSTEM HAS THE EXTENDED MEMORY CONTROL OPTION, THAT IT HAS AT LEAST 8K OF MEMORY. IT IS ALSO ASSUMED THAT THERE ARE NO MEMORY HOLES; E.G. FIELD 0, FIELD 1 AND FIELD 3, BUT NO FIELD 2.

3. REQUIRED I/O:

AN ASR-33 TELETYPE OR EQUIVALENT DEVICE(S) IS REQUIRED FOR KEYBOARD/TELEPRINTER COMMUNICATION AND PAPER TAPE I/O. IN SYSTEMS WITH A OS/8 CONFIGURATION, PAPER TAPE I/O IS NECESSARY ONLY TO LOAD THE MASS STORAGE MEDIA WITH THE DEC/X8 BINARY TAPES.

4. OPTIONAL OS/8 CONFIGURATION:

TO UTILIZE THE OPTIONAL BUILDING METHOD WHICH INTERFACES WITH THE BK PROGRAMMING SYSTEM, OS/8, AT LEAST ONE MASS STORAGE DEVICE FOR WHICH OS/8 SYSTEM AND DEVICE HANDLERS EXIST IS REQUIRED. IN ADDITION, THE SYSTEM MUST HAVE AT LEAST 8K OF MEMORY. FOR MORE INFORMATION, REFERENCE CURRENT OS/8 DOCUMENTATION.

1.5

SUPPORTING SOFTWARE REQUIREMENTS  
-----

DEC/X8 REQUIRES NO ADDITIONAL SOFTWARE WITH THE EXCEPTION OF THE STANDARD BINARY LOADER. HOWEVER, IF OS/8 IS USED IN THE BUILDING PROCESS, A OS/8 SYSTEM WHICH INCLUDES THE ABSOLUTE LOADER (ABSLDR,SV) AND PERIPHERAL INTERCHANGE PROGRAM (PIP,SV) IS REQUIRED.

NOTE: ABSOLUTE LOADER AND PIP ARE NEEDED ONLY TO LOAD THE DEC/X8 BINARY TAPES ONTO THE SELECTED STORAGE MEDIA.

1.6

PRELIMINARY TEST PROGRAMS  
-----

THE SYSTEM UNDER TEST SHOULD BE CAPABLE OF RUNNING ALL APPLICABLE PROCESSOR AND OPTION TESTS WITH SPECIAL EMPHASIS ON MEMORY DIAGNOSTICS.

## CHAPTER 2

### BASIC SYSTEM DESCRIPTION

-----

THIS CHAPTER PROVIDES THAT INFORMATION DEEMED NECESSARY TO INTELLIGENTLY USE THE OPERATING PROCEDURES IN CHAPTERS 3, 4 AND 5. INCLUDED IS A BRIEF DESCRIPTION OF EACH SECTION OF THE EXERCISER.

#### 2.1 BASIC SYSTEM CONCEPT

-----

DEC/X8 IS A MODULAR SOFTWARE SYSTEM, THIS IMPLIES THAT THE TOTAL SYSTEM MAY HAVE MANY UNIQUE SOFTWARE CONFIGURATIONS DEPENDENT UPON THE TYPE AND PLACEMENT OF THE VARIOUS SOFTWARE MODULES. A SOFTWARE SYSTEM STRUCTURED IN THIS MANNER CAN BE LIKENED TO A MODULAR HARDWARE SYSTEM IN WHICH PREDEFINED HARDWARE MODULES MAY BE INSERTED INTO A PREDEFINED HARDWARE MAINFRAME/INTERFACE (WITHIN CERTAIN CONSTRAINTS) TO PRODUCE A DESIRED EFFECT. TO CARRY THIS ANALOGY FURTHER WE CAN SAY THAT AS TOOLS OF SOME FORM ARE REQUIRED FOR HARDWARE MODULE INSERTION, SO MUST THERE BE TOOLS FOR THE INSERTION OF SOFTWARE MODULES, NAMELY "BUILDER". A LIMITED CAPABILITY TO "SWAP" MODULES IS ALSO AVAILABLE IN DEC/X8 THROUGH THE USE OF THE SLOT ROTATION FUNCTION. THERE IS, HOWEVER, NO CAPABILITY TO REMOVE SOFTWARE MODULES SHORT OF COMPLETE RECONFIGURATION.

#### 2.2 MEMORY ALLOCATION

-----

THE DEC/X8 MEMORY ALLOCATION MAP SHOWN BELOW IS A TRUE REPRESENTATION OF THE DEC/X8 MAINFRAME (INCLUDING MODULE SLOTS) AS IT APPEARS IN THE MEMORY OF A 32K SYSTEM. MEMORY FIELDS ARE SHOWN AS VERTICAL COLUMNS STARTING WITH FIELD 0 ON THE LEFT AND PROGRESSING TO FIELD 7 ON THE RIGHT. MEMORY PAGES ARE SHOWN AS HORIZONTAL ROWS EACH LABELLED WITH THE FIRST ADDRESS OF THAT PAGE, STARTING WITH PAGE 0 (0000) AT THE TOP AND PROGRESSING TO PAGE 37 (7600) AT THE BOTTOM. FUNCTIONAL BLOCKS ARE SHOWN AS GROUPS OF PAGES AND/OR FIELDS. TO GET THE TRUE PICTURE OF A SYSTEM WHICH HAS LESS THAN 32K OF MEMORY, DISREGARD ALL COLUMNS FOR FIELDS WHICH DO NOT EXIST.

THE DISCUSSIONS WHICH FOLLOW REFER TO THE MEMORY ALLOCATION MAP.

DEC/X8 MEMORY ALLOCATION MAP

---

MEM PAGE	FLD 0	FLD 1	FLD 2	FLD 3	FLD 4	FLD 5	FLD 6	FLD 7	FUNCTION
0000									PAGE ZERO
0200									EXTERNAL BUFFERS
0400	0200	0210	0220	0230	0240	0250	0260	0270	02F0
0600	(INIT)	(BUILD)							
1000									
1200									SKIP/SERVICE
1400									EXTERNAL BUFFERS
1600			1420	1430	1440	1450	1460	1470	14F0
2000	4K	8K							
2200	BASE MONITOR	BASE MONITOR							
2400									BASE MONITORS
2600									
3000									
3200									COMMONS
3400									
3600									JOB SLOTS
4000	J01	J11	J21	J31	J41	J51	J61	J71	JF1
4200									
4400									
4600									JOB SLOTS
5000	J02	J12	J22	J32	J42	J52	J62	J72	JF2
5200									
5400									
5600									EXTERNAL BUFFERS
6000	5600	5610	5620	5630	5640	5650	5660	5670	56F0
6200	(BUILD)	(BUILD)							
6400									
6600	J03	J13	J23	J33	J43	J53	J63	J73	JOB SLOTS
7000									JF3
7200	J04	J14	J24	J34	J44	J54	J64	J74	JOB SLOTS
7400									JF4
7600									SACRED

• BASE MONITOR EXTENSIONS



## 2.3 MONITOR

MONITOR IS A 4K SELF EXPANDING TO 32K EXECUTIVE AND WITH ITS VARIOUS EXTENSIONS COMPRISES THE DEC/X8 SOFTWARE MAINFRAME AND INTERFACE, THE DEGREE OF MONITOR EXPANSION IS DEPENDENT ON THE HIGHEST EXISTING MEMORY FIELD AND THE NUMBER AND PLACEMENT OF SOFTWARE MODULES.

MONITOR CONSISTS OF THE FOLLOWING SECTIONS.

### 2.3.1 4K BASE MONITOR (01400-03177)

THE 4K BASE MONITOR HAS THE CAPABILITY TO COMPLETELY CONTROL A 4K CUSTOM EXERCISER, ITS FUNCTIONS INCLUDE MODULE SERVICE QUEUING, BASIC INTERRUPT SERVICING, ERROR REPORTING, EXTERNAL BUFFER CONTROL AND KEYBOARD COMMAND INTERPRETATION. IN THE CASE OF AN 8K OR GREATER SYSTEM, LINKAGES ARE ESTABLISHED TO THE 8K BASE MONITOR TO EXPAND TO THOSE CAPABILITIES NEEDED IN 8K OR GREATER CUSTOM EXERCISERS.

### 2.3.2 8K BASE MONITOR (11400-13177)

THE 8K BASE MONITOR, WHICH IS ALWAYS LINKED TO THE 4K BASE MONITOR, HAS THOSE UNIQUE CAPABILITIES NECESSARY TO CONTROL 8K OR GREATER CUSTOM EXERCISERS. ITS FUNCTIONS INCLUDE MODULE SLOT ROTATION, STATUS REPORT GENERATION, TIMESHARE USER SERVICES AND KEYBOARD COMMAND INTERPRETATION OF 8K COMMANDS.

### 2.3.3 PAGE ZERO (F0000-F0177)

PAGE ZERO CONSISTS OF THOSE CONSTANTS, LINKAGES AND ROUTINES NEEDED BY MONITOR IN ALL MEMORY FIELDS, SOFTWARE MODULES ARE FREE TO USE SPECIFIED AREAS OF THIS PAGE AS NECESSARY. AT START TIME, PAGE ZERO IS COPIED THROUGHOUT ALL OF EXISTING MEMORY.

#### 2.3.4 SKIP/SERVICE CHAIN (F1200-F1377)

-----  
THE SKIP/SERVICE CHAIN CONTAINS ALL OF THE INFORMATION NEEDED BY MONITOR CONCERNING EACH OF THE SOFTWARE MODULES IN THE EXERCISER. IN REALITY, THIS CHAIN INCLUDES THE INTERRUPT SKIP CHAIN, THE DEFERRED SERVICE CHAIN (WHICH IS SIMILAR TO AN INTERRUPT SKIP CHAIN, BUT OPERATES ON SOFTWARE VICE HARDWARE FLAGS), LINKAGES TO THE MODULES THEMSELVES, AND THE CONTENTS OF VOLATILE REGISTERS AS SAVED UPON INTERRUPT.

AT INITIAL LOAD TIME, THIS CHAIN IS AN APPARENTLY MEANINGLESS SKELETON. DURING THE INITIAL STARTING SEQUENCE, IT IS EXPANDED THROUGHOUT MEMORY IN SKELETON FORM. THEN IN THE BUILDING PHASE IT IS CUSTOMIZED TO ACCOMMODATE PERTINENT INFORMATION FROM THE SOFTWARE MODULES WHICH ARE INSERTED.

EACH FIELD SEGMENT OF THE SKIP/SERVICE CHAIN CAN HOLD THE INFORMATION FOR FOUR MODULES. THE SPECIFIC AREA OF THE CHAIN WHICH CONTAINS THE INFORMATION FOR A SPECIFIC MODULE IS BASED ON THAT MODULE'S ASSIGNED PRIORITY LEVEL. PRIORITIES ARE EXPLAINED LATER IN THIS CHAPTER.

#### 2.3.5 COMMONS (F3200-F3577)

-----  
COMMONS CONSISTS OF THOSE ROUTINES NEEDED BY MONITOR TO SUPPORT KEYBOARD/TELEPRINTER I/O. THESE ROUTINES ARE EXPANDED THROUGH MEMORY AT START TIME TO ALLOW LIMITED ACCESS BY SOFTWARE MODULES.

#### 2.3.6 EXTERNAL BUFFERS (F0200-F1177; F1400-F2377; F5600-F6577)

-----  
THE EXTERNAL BUFFERS ARE AREAS OF MEMORY WHICH MONITOR ASSIGNS TO SOFTWARE MODULES UPON REQUEST. MODULES USUALLY USE THESE AREAS AS DATA BUFFERS, ESPECIALLY IF THE MODULE EXERCISES SOME SORT OF DATA BREAK MASS STORAGE DEVICE.

EACH MEMORY FIELD HAS TWO OR THREE EXTERNAL BUFFERS WHICH ARE DESIGNATED IN GENERAL FORM AS 02F0, 14F0 AND 56F0. BITS 0-5 OF THE DESIGNATOR INDICATE THE EVEN PAGE STARTING ADDRESS OF THE BUFFER AND BITS 6-8 DESIGNATE THE MEMORY FIELD. ALL EXTERNAL BUFFERS ARE 1000(8) WORDS LONG. THE UNIQUE DESIGNATION CODE FOR EACH BUFFER IS INDICATED ON THE MEMORY ALLOCATION MAP. BUFFERS 14F0 EXIST ONLY IN FIELDS 2 THROUGH 7.

THE SKELETON MONITOR/BUILDER UTILIZES BUFFERS 0200, 5600, 0210 AND 5610 FOR INITIALIZING AND BUILDING FUNCTIONS. ONCE AN EXERCISER IS CONFIGURED, AS MODULES ASSIGN AND USE THESE BUFFERS, THE ABOVE MONITOR FUNCTIONS ARE WIPED OUT.

2.3.7 SACRED AREA (F7600-F7777)  
-----

THE SACRED AREA IS RESERVED FOR THAT SOFTWARE WHICH IS EXTERNAL TO THE DEC/XB SYSTEM. IN A PAPER TAPE SYSTEM, PART OF THIS AREA CONTAINS THE BINARY LOADER. IN A OS/8 SYSTEM, THE FIELD 0 AND 1 PORTIONS CONTAIN VITAL SYSTEM LINKAGES AND ROUTINES, MONITOR NEVER INTENTIONALLY CHANGES ANY OF THE SACRED AREA! HOWEVER, IT SHOULD BE REMEMBERED THAT CERTAIN DATA BREAK DEVICES USE THIS AREA OF MEMORY FOR WORD COUNT AND CURRENT ADDRESS REGISTERS. IN THIS CASE, THE INTEGRITY OF THE SACRED AREA CANNOT BE GUARANTEED.

2.4 MODULE (JOB) SLOTS  
-----

FROM THIS POINT ON, SOFTWARE MODULES MAY SIMPLY BE REFERRED TO AS JOBS. THE SLOTS INTO WHICH JOBS ARE INSERTED ARE CALLED MODULE SLOTS, JOB SLOTS OR SIMPLY SLOTS.

AS SHOWN ON THE MEMORY ALLOCATION MAP, EACH MEMORY FIELD HAS FOUR JOB SLOTS. THE SLOTS IN FIELD F ARE DESIGNATED JF1, JF2, JF3 AND JF4. IN LATER PARTS OF THIS MANUAL A JOB SLOT MAY BE DESIGNATED BY "JFX" WHERE "F" IS THE MEMORY FIELD OF THE SLOT AND "X" IS 1, 2, 3 OR 4. JOB SLOT MEMORY ALLOCATION IS AS FOLLOWS:

SLOT -----	# OF PAGES -----	ADDRESS RANGE -----
JF1	4	F3600-F4577
JF2	4	F4600-F5577
JF3	2	F6600-F7177
JF4	2	F7200-F7577

EACH EXISTENT JOB SLOT MAY CONTAIN ONE AND ONLY ONE JOB. THE MAXIMUM SIZE JOB WHICH MAY BE INSERTED INTO A GIVEN SLOT IS STRICTLY A FUNCTION OF THE NUMBER OF MEMORY PAGES ALLOTTED THAT SLOT. THE DECISION CONCERNING WHAT JOB GETS INSERTED INTO WHAT SLOT IS MADE BY THE USER DURING THE BUILDING PHASE.

SOFTWARE MODULES (JOBS)  
-----

A DEC/XB SOFTWARE MODULE (JOB) IS A SUB PROGRAM DESIGNED TO EXERCISE SPECIFIC HARDWARE FUNCTIONS UNDER THE CONTROL OF THE DEC/XB SOFTWARE SYSTEM. THERE ARE TWO BASIC TYPES OF SOFTWARE MODULES, INTERRUPT DRIVEN AND BACKGROUND. INTERRUPT DRIVEN MODULES EXERCISE DEVICES WHICH CAUSE PROGRAM INTERRUPTS. THE CONTINUED RUNNING OF THIS TYPE OF MODULE IS DEPENDENT ON ITS NEXT DEVICE INTERRUPT. BACKGROUND MODULES ARE SELF SUSTAINING PROGRAMS AND DO NOT GENERATE OR REQUIRE PROGRAM INTERRUPTS.

SINCE AT THE TIME A MODULE IS PLANNED AND WRITTEN THERE IS NO WAY TO PREDICT THE ACTUAL MEMORY LOCATIONS WHICH THE MODULE WILL OCCUPY, THE MODULE MUST BE WRITTEN IN A PAGE RELOCATABLE FORMAT. ALL MODULES ARE WRITTEN AS THOUGH THEY WILL OCCUPY MEMORY STARTING AT 0200, WHILE IN REALITY THEY MUST OCCUPY MEMORY STARTING AT 3600, 4600, 6600 OR 7200 IN ORDER TO COINCIDE WITH ONE OF THE EXISTENT JOB SLOTS.

NORMALLY, PAGE RELOCATION IS COMPLETELY TRANSPARENT TO THE USER. HOWEVER, IF THE USER DECIDES TO LOOK AT THE CONTENTS OF MEMORY WITHIN A JOB, THE DIFFERENCES NOTED BELOW SHOULD BE EXPECTED BETWEEN REAL MEMORY CONTENTS AND THE CONTENTS AS SHOWN IN THE MODULE PROGRAM LISTING.

1. ALL ADDRESS POINTERS WHICH REFER TO ADDRESSES WITHIN THE MODULE ARE CHANGED ACCORDING TO THE FOLLOWING FORMULA:

$$(AAAA) = (RRRR) - 200 + (SSSS) \quad (\text{OCTAL})$$

WHERE (AAAA) IS THE REAL (ABSOLUTE) ADDRESS, (RRRR) IS THE RELATIVE ADDRESS AS SHOWN IN THE MODULE PROGRAM LISTING, AND (SSSS) IS THE FIRST ADDRESS IN THE JOB SLOT OCCUPIED BY THE MODULE.

2. ANY INSTRUCTION WHICH REFERENCES AN AUTO-INDEX REGISTER IS MODIFIED TO REFERENCE AN ASSIGNED AUTO-INDEX REGISTER BASED UPON THE JOB SLOT OCCUPIED AS FOLLOWS:

SLOT ----	AUTOINDEX REGISTER -----
JF1	F0014
JF2	F0015
JF3	F0016
JF4	F0017

EACH MODULE CONTAINS TWO SPECIAL SECTIONS IN ADDITION TO THE ACTUAL EXERCISER PROGRAM. THE MODULE INTERFACE TABLE PERMANENTLY RESIDES WITH THE MODULE AND IS PART OF THE INTERFACE WITH MONITOR. THIS SECTION ALWAYS IS THE FIRST PART OF A MODULE PROGRAM AND IS MODIFIED APPROPRIATELY BY MONITOR AND THE BUILDER. THE OTHER SPECIAL SECTION IS THE BUILDER (OR LOADER) CALLING SEQUENCE. THIS CALLING SEQUENCE IS USED ONLY WHILE A MODULE IS BEING LOADED AND PROVIDES CRITICAL INFORMATION TO BUILDER. THIS SECTION NEVER RESIDES IN MEMORY WITH THE MODULE.

2.6 JOB PRIORITIES

THE SEQUENCE IN WHICH JOBS ARE SERVICED, BOTH FOR INTERRUPTS AND HOUSEKEEPING, IS A FUNCTION OF EACH JOB'S PRIORITY. UNDER NORMAL OPERATING CONDITIONS, THE HIGHER PRIORITY JOBS ARE SERVICED FIRST.

JOB PRIORITIES ARE ASSIGNED BY THE USER AT BUILD TIME AND REMAIN FIXED THEREAFTER. THE DESIGNATION FOR JOB PRIORITY IS A TWO DIGIT OCTAL NUMBER STARTING AT THE HIGHEST PRIORITY, 00, TO THE LOWEST, 37. THE RANGE OF PRIORITIES IN A GIVEN SYSTEM IS DEPENDENT ON THE HIGHEST MEMORY FIELD AS FOLLOWS:

HIGHEST FIELD	PRIORITY RANGE
0	00-03
1	00-07
2	00-13
3	00-17
4	00-23
5	00-27
6	00-33
7	00-37

ROTATION OF JOB SLOTS  
 -----

THE 8K BASE MONITOR HAS THE ABILITY TO CHANGE THE MEMORY FIELDS OCCUPIED BY A HORIZONTAL ROW OF JOB SLOTS (E.G., ROW JF1) AND THE JOBS WHICH THEY CONTAIN. THIS FUNCTION IS CALLED "ROTATION".

PERHAPS THE BEST WAY TO UNDERSTAND WHAT HAPPENS WHEN SLOTS ARE ROTATED IS TO PICTURE THE RESULTS OF ROTATION AS FOLLOWS:  
 (A 12K SYSTEM IS SHOWN WITH ALL SLOTS ENABLED TO ROTATE ONE FIELD)

INITIALLY THE SLOTS ARE IN THE STANDARD CONFIGURATION:

FLD 0 -----	FLD 1 -----	FLD 2 -----
J01	J11	J21
J02	J12	J22
J03	J13	J23
J04	J14	J24

AFTER ONE ROTATION THE CONFIGURATION IS:

FLD 0 -----	FLD 1 -----	FLD 2 -----
J21	J01	J11
J22	J02	J12
J23	J03	J13
J24	J04	J14

AND AFTER ANOTHER:

FLD 0 -----	FLD 1 -----	FLD 2 -----
J11	J21	J01
J12	J22	J02
J13	J23	J03
J14	J24	J04

AND SO ON.

LET'S ASSUME THAT THE "RF0BDS" MODULE WAS LOADED INTO SLOT J02. INITIALLY, THIS JOB WOULD BE RUNNING IN FIELD 0, BUT AFTER ONE ROTATION, J02 WOULD OCCUPY AND BE RUNNING IN FIELD 1, AND AFTER ANOTHER ROTATION WOULD BE IN FIELD 2. WHENEVER A SLOT IS IN THE HIGHEST MEMORY FIELD, THE NEXT ROTATION MOVES IT TO FIELD 0. THEN THE PROCESS STARTS ONCE AGAIN.

## 2.8 MONITOR INITIALIZER

-----  
THE MONITOR INITIALIZER RESIDES IN BUFFER AREA 0200 AND SETS UP VARIOUS MONITOR LINKAGES AND INDICATORS BASED UPON USER SUPPLIED INFORMATION PERTAINING TO SYSTEM CHARACTERISTICS. THIS ROUTINE IS USED ONLY ONCE AND WILL BE WIPED OUT BY ANY JOB WHICH ASSIGNS AND USES BUFFER 0200.

## 2.9 BUILDER

-----  
BUILDER IS THE TOOL WITH WHICH THE USER INSERTS MODULES INTO JOB SLOTS. IT HAS THE ABILITY TO USE PAPER TAPE OR PMK-02 I/O ALONE, OR WILL INTERFACE DIRECTLY WITH OS/8 TO PROVIDE VIRTUAL DEVICE INDEPENDENCE DURING THE BUILDING PHASE.

WHEN A MODULE IS INSERTED INTO A JOB SLOT, BUILDER MAKES THE NECESSARY CHANGES IN THE MODULE PROGRAM CONCERNED WITH:

- 1) AUTOINDEX REGISTER REFERENCES;
- 2) CROSS PAGE POINTERS;
- 3) DEVICE CODE ASSIGNMENTS; AND
- 4) WORD COUNT AND CURRENT ADDRESS REGISTER ASSIGNMENTS.

IN ADDITION, BUILDER CONFIGURES THE SKIP/SERVICE CHAIN FOR THE CURRENT JOB AND ESTABLISHES THE NECESSARY CROSS FIELD LINKAGES TO CONNECT THE DIFFERENT FIELD SEGMENTS OF THAT CHAIN.

## 2.10 USER ACTION

-----  
ALL NECESSARY USER ACTION IS DESCRIBED IN CHAPTERS 3, 4 AND 5. TO BUILD A CUSTOM VERSION OF DEC/X8, GO TO CHAPTER 3, RUNNING PROCEDURES ARE GIVEN IN CHAPTER 4, AND CHAPTER 5 CONTAINS ALL ERROR INFORMATION AND PROCEDURES. MODULE DEPENDENT INFORMATION IS GIVEN IN THE VARIOUS MODULE DOCUMENTS.

CHAPTER 3  
DEC/X8 BUILDING PROCEDURE  
-----

THE PURPOSE OF THIS CHAPTER IS TO GIVE IN DETAIL THOSE STEPS WHICH MUST BE ACCOMPLISHED TO SUCCESSFULLY PLAN, BUILD AND SAVE A CUSTOM VERSION OF DEC/X8.

PROCEDURES FOR RUNNING A CUSTOM EXERCISER AND ERROR RECOVERY ARE GIVEN IN CHAPTERS 4 AND 5 RESPECTIVELY.

THE USER MUST BE FAMILIAR WITH ALL INFORMATION CONTAINED IN CHAPTERS 1 AND 2 BEFORE ATTEMPTING TO USE THE FOLLOWING PROCEDURE. IN ADDITION, IF OS/8 IS TO BE USED DURING THE BUILDING PHASE, THE USER SHOULD FAMILIARIZE HIMSELF WITH THE OS/8 CONVENTIONS GOVERNING SYSTEM BOOTSTRAPPING AND KEYBOARD INPUT TO THE OS/8 KEYBOARD MONITOR AND COMMAND DECODER.

THIS PROCEDURE MUST BE FOLLOWED IN A STEP BY STEP FASHION. OMIT ONLY THOSE STEPS WHICH DO NOT APPLY TO YOUR SITUATION.

ALL STEPS IN THIS PROCEDURE MAY BE ACCOMPLISHED IN A SYSTEM OTHER THAN THE TARGET SYSTEM PROVIDED THAT SYSTEM HAS AT LEAST THE AMOUNT OF MEMORY PRESENT IN THE TARGET SYSTEM.

3.1

PLANNING PHASE  
-----

THE PURPOSE OF THE FOLLOWING STEPS IS TO DESCRIBE THE PLANNING WHICH IS NECESSARY TO BUILD AN OPERATIONAL VERSION OF DEC/X8.

1. DETERMINE WHAT SOFTWARE MODULES APPLY TO YOUR CONFIGURATION USING THE "DEC/X8 SOFTWARE MODULE INDEX" (MAINDEC-X8-DIQAF- -D).
2. REFERENCING THE MODULE DOCUMENTATION OR THE "DEC/X8 SOFTWARE MODULE INDEX" (MAINDEC-X8-DIQAF- -D) MAKE NOTE OF THE FOLLOWING FOR EACH MODULE: 1) MEMORY PAGE REQUIREMENTS (2 OR 4); 2) WHETHER OR NOT IT IS AN INTERRUPT DRIVEN MODULE; AND 3) IF IT IS AN INTERRUPT DRIVEN MODULE, WHETHER OR NOT ITS INTERRUPT PRIORITY IS CRITICAL. (I.E., MUST IT BE ASSIGNED AT OR NEAR PRIORITY LEVEL 00).
3. BASED ON THE CONSTRAINT OF TWO-4 PAGE SLOTS AND TWO-2 PAGE SLOTS PER MEMORY FIELD, DETERMINE IF ALL THE APPLICABLE MODULES CAN BE INCLUDED IN ONE EXERCISER. IF NOT, IT MAY BE NECESSARY TO PLAN AT LEAST TWO CUSTOM VERSIONS OF DEC/X8. REFER TO THE "DEC/X8 SOFTWARE MODULE INDEX" FOR GUIDANCE CONCERNING OMISSIONS.
4. LIST ALL INTERRUPT DRIVEN MODULES IN INTERRUPT PRIORITY ORDER. PLACE CRITICAL MODULES AT THE HIGHEST PRIORITY LEVELS FOLLOWED BY MODULES FOR HIGH SPEED DATA BREAK DEVICES, THEN THE REMAINDER OF THE INTERRUPT DRIVEN MODULES.



5. FOLLOWING THE LAST ENTRY, LIST ALL NON-INTERRUPT (BACKGROUND) MODULES,

```

*****
*
* C A U T I O N ! ENSURE THAT *
* ALL INTERRUPT JOBS ARE GROUPED *
* AT THE HIGHEST PRIORITY LEVELS *
* AND THAT NO BACKGROUND JOBS *
* ARE AT A HIGHER PRIORITY LEVEL *
* THAN ANY INTERRUPT JOB. *
*
*****

```

6. NOW, STARTING AT THE TOP OF THE LIST, NUMBER EACH ENTRY SEQUENTIALLY IN OCTAL STARTING 00,01,02,..., ETC. THESE NUMBERS REPRESENT THE ASSIGNED PRIORITY LEVELS WHICH WILL BE USED LATER IN THE PROCEDURE.
7. CHECK THE LOWEST PRIORITY LEVEL ASSIGNED (GREATEST IN NUMERICAL VALUE) AND ENSURE THAT IT IS NO GREATER THAN THE LEVEL SHOWN IN THE TABLE BELOW AS BASED ON THE HIGHEST EXISTING MEMORY FIELD.

HIGHEST FIELD	MAXIMUM PRIORITY LEVEL
0	03
1	07
2	13
3	17
4	23
5	27
6	33
7	37

8. IF YOU HAVE EXCEEDED THE MAXIMUM LEVEL, PERHAPS TWO CUSTOM VERSIONS OF THE EXERCISER SHOULD BE PLANNED. REFER TO THE "DEC/X8 SOFTWARE MODULE INDEX" FOR GUIDANCE CONCERNING OMISSIONS.
9. IF YOUR GREATEST PRIORITY IS LESS THAN THE MAXIMUM INDICATED ABOVE, YOU MAY REPEAT NON-INTERRUPT (BACKGROUND) MODULES TO ACHIEVE THE MAXIMUM LEVEL. HOWEVER, CHECK THE DOCUMENT FOR ANY REPEATED MODULE IF THE SYSTEM CONTAINS A PDP-8 OR A 4K PDP-8/E AND THE REPEATED MODULE EXERCISES EAE. RECALL THE RESTRICTIONS:
  1. ON A PDP-8 WITH EAE, THE CONTENTS OF THE STEP COUNTER ARE NOT SAVED UPON INTERRUPT.
  2. ON A 4K PDP-8/E WITH EAE, THE CONDITION OF THE GT FLAG IS NOT SAVED UPON INTERRUPT. THE ONLY EAE JOB THAT SHOULD BE USED IN THIS CONFIGURATION IS "EAEALL" INITIALIZED FOR MODE A ALONE.
10. BESIDE EACH ENTRY IN YOUR LIST, NOTE WHETHER THE MODULE REQUIRES 2 OR 4 MEMORY PAGES.

11. NOW NOTE EACH ENTRY WITH THE JOB SLOT NUMBER YOU WISH TO ASSIGN THAT MODULE. YOU SHOULD ASSIGN JOB SLOTS SUCH THAT A MAXIMUM OF MEMORY FIELD AND PC SWITCHING TAKES PLACE AS YOU MOVE FROM ONE PRIORITY TO THE NEXT. REFERENCE THE MEMORY ALLOCATION MAP IN CHAPTER 2 AS NECESSARY. OF COURSE, A JOB SLOT MAY BE USED ONLY ONCE. RECALL THAT SLOTS JF1 AND JF2 ARE 4 PAGE SLOTS, AND THAT JF3 AND JF4 ARE 2 PAGE SLOTS.

THE FOLLOWING IS A TYPICAL ASSIGNMENT LIST FOR AN 8K PDP-8/E SYSTEM.

MODULE	PRIORITY	PAGE	JOB SLOT
TC01DT	00	4	J12
RF08DS	01	4	J01
RK08DS	02	4	J11
HSRHSP	03	2	J04
EAEALL	04	4	J02
MRI08A	05	2	J14
EAEOP	06	2	J03
OPRATE	07	2	J13

12. THIS COMPLETES THE PLANNING PHASE. IF OS/8 IS TO BE USED IN THE BUILDING PHASE, GO TO STEP 3.2, OTHERWISE GO TO STEP 3.3.2.

### 3.2 DEC/X8 - OS/8 SYSTEM CONFIGURATION

THE FOLLOWING STEPS ARE DESIGNED TO AID THE USER IN CONFIGURING A OS/8 SYSTEM FOR USE IN BUILDING A CUSTOM VERSION OF DEC/X8.

1. HAVE ON HAND, OR IF NECESSARY, CONFIGURE USING STANDARD OS/8 PROCEDURES, A OS/8 SYSTEM CONSISTING OF AT LEAST THE FOLLOWING OS/8 PROGRAMS (FILENAME).

ABSOLUTE LOADER (ABSLDR.SV)  
PERIPHERAL INTERCHANGE PROGRAM (PIP.SV)

2. USING STANDARD OS/8 PROCEDURES, BOOTSTRAP THE OS/8 SYSTEM.
3. AFTER A PERIOD (.) IS PRINTED, WRITE ENABLE ALL DEVICES TO BE USED.
4. PLACE THE DEC/X8 MONITOR/BUILDER BINARY TAPE (MAINDEC-X8-DIQAB-D-P8) IN THE SYSTEM READER AND TYPE THE FOLLOWING COMMANDS.

```
. [R ABSLDR+]          (CALL ABSOLUTE LOADER)
* [PTR: S] * [ ]      (ABSOLUTE LOADER LOADS
                      BINARY TAPE.)
. [SAVE DEV DX8MB+]   (MONITOR/BUILDER IS SAVED ON
                      DEVICE "DEV" AS FILE DX8MB.SV,
                      33 BLOCKS IN LENGTH.)
```

5. CALL THE PERIPHERAL INTERCHANGE PROGRAM AS FOLLOWS.

.[R PIP~]

\*

6. PLACE A SOFTWARE MODULE BINARY TAPE IN THE SYSTEM READER,  
THEN TYPE THE FOLLOWING COMMANDS WHERE "FILE" IS THE MODULE  
SHORT TITLE,

\*[DEV:FILE.BN<PTR:/B~]

+[-]

\*

THIS ACTION LOADS THE MODULE BINARY TAPE ON DEVICE "DEV" AS FILE  
"FILE.BN" WHICH MAY BE FROM ONE TO TEN BLOCKS IN LENGTH,  
REPEAT THIS STEP FOR EACH MODULE YOU PLAN TO USE.

7. CHECK THE DIRECTORY OF DEVICE "DEV" BY TYPING:

\*[DEV:/L~]

THIS COMMAND SHOULD RESULT IN AT LEAST THE FOLLOWING PRINT-  
OUT WHERE "N" IS A NUMBER FROM ONE TO TEN,

```
DXQMB ,SV 33  
FILE ,BN N (FOR EACH MODULE)  
XXX FREE BLOCKS
```

\*

8. RETURN TO THE OS/8 KEYBOARD MONITOR  
BY TYPING

\*[+C]

.

9. GO TO STEP 3.3.1.

MONITOR/BUILDER LOADING AND CUSTOMIZING  
-----

THE FOLLOWING STEPS CITE THE ACTION NECESSARY TO LOAD AND CUSTOMIZE THE DEC/X8 MONITOR/BUILDER.

1. IN A OS/8 SYSTEM, ALL OF STEP 3.2 MUST BE COMPLETE. THEN WITH THE OS/8 KEYBOARD MONITOR IN CONTROL (BOOTSTRAP OR RESTART AT 07605 IF NECESSARY), TYPE THE FOLLOWING TO LOAD DX8MB.9V.

.[R DX8MB-]

EVENTUALLY THE PROCESSOR WILL HALT AT 00200. GO TO STEP 3.

2. IN A PAPER TAPE (OR PMK-02) SYSTEM, LOAD THE DEC/X8 MONITOR/BUILDER BINARY TAPE (MAINDEC-X8-DIQAB-D-PB) USING THE STANDARD BINARY LOADER TECHNIQUE. THE INITIAL SETTING OF THE DATA FIELD IS OF NO CONSEQUENCE SINCE FIELD SPECIFICATION IS PRESENT ON THE BINARY TAPE.

NOTE: IF ANY FILLER CHARACTERS ARE NEEDED FOR THE CONSOLE TELEPRINTER AFTER A CARRIAGE RETURN-LINE FEED, DEPOSIT THE NUMBER OF FILLERS DESIRED IN LOCATION FILLER (03200).

3. LOAD ADDRESS 00200, THEN DEPRESS START.
4. THE PROGRAM WILL HALT AT 00200.
5. SET SR3=8 TO THE CONSOLE TELEPRINTER DEVICE CODE (STANDARD: 04).
6. DEPRESS CONT
7. THE PROGRAM WILL PRINT:

DEC/X8

REVISION D

MAINDEC-X8-DIQAB-D

REFER TO THE DEC/X8 USERS GUIDE "PREFACE" FOR A DESCRIPTION OF THE CHANGES FROM REV A TO REV D.

AND HALT AT 00211.

8. SET SR3=8 TO THE CONSOLE KEYBOARD DEVICE CODE (STANDARD: 03).
9. DEPRESS CONT.
10. DELETED

11. THE PROGRAM WILL NOW PRINT:

HSR?

IF THERE IS NO HIGH SPEED READER, TYPE N AND GO TO THE NEXT STEP. IF THERE IS, TYPE Y AFTER WHICH THE PROGRAM PRINTS:

DEV CODE:

TYPE THE 2 DIGIT DEVICE CODE FOR THE HIGH SPEED READER (STANDARD: 01).

12. NEXT THE PROGRAM WILL PRINT:

HSP?

IF THERE IS NO HIGH SPEED PUNCH, TYPE N AND GO TO THE NEXT STEP. IF THERE IS, TYPE Y AFTER WHICH THE PROGRAM PRINTS:

DEV CODE:

TYPE THE 2 DIGIT DEVICE CODE FOR THE HIGH SPEED PUNCH (STANDARD: 02).

13. THE PROGRAM WILL PRINT:

EXT MEM? (0-7)

TYPE THE NUMBER OF THE HIGHEST EXISTENT MEMORY FIELD (0-7).

NOTE: AT THIS POINT, ALL ACTIONS ARE IRREVERSIBLE. ANY MISTAKES MADE FROM THIS POINT ON CAN BE CORRECTED ONLY BY GOING BACK TO STEP 3.3.1 AND REPEATING ALL STEPS. UNDER NO CONDITIONS SHOULD A RESTART A LOCATION AT 00200 BE ATTEMPTED WITHOUT RELOADING MONITOR/BUILDER.

14. THE PROGRAM WILL NOW PRINT:

PDP-8?

IF THE PROCESSOR IS A TRADITIONAL PDP-8, TYPE Y AND GO TO THE NEXT STEP. IF NOT, TYPE N AFTER WHICH THE PROGRAM PRINTS:

PDP-8/E?

IF THE PROCESSOR IS A PDP-8/E, TYPE Y. OTHERWISE, TYPE N.

15. THE PROGRAM WILL NOW ASK IF THE FOLLOWING OPTIONS EXIST.  
TYPE Y IF THE OPTION DOES EXIST, N IF IT DOES NOT.

EAE? (EXTENDED ARITHMETIC ELEMENT)

PF? (POWER FAIL AND AUTO RESTART)

MP? (MEMORY PARITY)

TS? (TIME SHARE)

16. THE PROGRAM WILL NOW PRINT:

+C  
!

17. TYPE THE FOLLOWING COMMANDS.

[ [+B] OK? [Y]

THIS TRANSFERS CONTROL TO THE BUILDER.

18. THEN THE PROGRAM PRINTS:

INPUT VIA OS/8?

IF YOU ARE OPERATING WITH A OS/8 SYSTEM AND DESIRE TO BUILD  
USING OS/8 INPUT, TYPE Y AND GO TO THE NEXT STEP. OTHERWISE TYPE  
N AFTER WHICH THE PROGRAM PRINTS:

HSR?

IF YOU DESIRE TO BUILD USING THE HIGH SPEED READER ONLY,  
TYPE Y AND GO TO THE NEXT STEP. OTHERWISE, TYPE N AFTER  
WHICH THE PROGRAM PRINTS:

PMK-02?

IF YOU DESIRE TO BUILD USING THE PMK-02 FOR INPUT, TYPE Y  
AND GO TO THE NEXT STEP. OTHERWISE, TYPE N AFTER WHICH  
THE PROGRAM PRINTS:

CONSOLE READER ASSUMED.

19. NOW THE PROGRAM ASKS:

OUTPUT VIA OS/8 USING FILE BASED DEVICE?

IF YOU ARE OPERATING WITH A OS/8 SYSTEM AND DESIRE TO SAVE THE FULLY CUSTOMIZED EXERCISER AS A ".SV" FILE ON A FILE BASED DEVICE, TYPE Y AND GO TO THE NEXT STEP. OTHERWISE, TYPE N AFTER WHICH THE PROGRAM PRINTS:

HSP?

IF YOU DESIRE TO PUNCH THE BINARY TAPE FOR THE CUSTOMIZED EXERCISER ON THE HIGH SPEED PUNCH, TYPE Y AND GO TO THE NEXT STEP. OTHERWISE, TYPE N AFTER WHICH THE PROGRAM PRINTS:

PMK-02?

IF YOU DESIRE TO "PUNCH" THE BINARY TAPE ON THE PMK-02, TYPE Y AND GO TO THE NEXT STEP. OTHERWISE, TYPE N AFTER WHICH THE PROGRAM PRINTS:

CONSOLE PUNCH ASSUMED.

20. NEXT THE PROGRAM PRINTS:

X

TO SIGNIFY THAT IT IS READY TO ACCEPT BUILDER COMMANDS.

21. THE FOLLOWING IS AN EXAMPLE OF THE MAXIMUM TELEPRINTER  
OUTPUT FOR THE STEPS ABOVE.

DEC/X8

REVISION D

MAINDEC-X8-DIQAB-D

REFER TO THE DEC/X8 USERS GUIDE "PREFACE" FOR A  
DESCRIPTION OF THE CHANGES FROM REV A TO REV D.

HSR?[Y] DEV CODE![01]

HSP?[Y] DEV CODE![02]

EXT MEM?(0-7) [3]

PDP-8?[N] PDP-8/E?[Y]

EAE?[Y] PF?[N] MP?[N] TS?[Y]

↑C

! [+B] OK?[Y]

INPUT VIA OS/8?[N] HSR?[N] PMK-02?[N]

CONSOLE READER ASSUMED.

OUTPUT VIA OS/8 USING FILE BASED DEVICE?[N] HSP?[N] PMK-02?[N]

CONSOLE PUNCH ASSUMED.

%

22. GO TO STEP 3.4



BUILDING PHASE  
-----

THE PURPOSE OF THE FOLLOWING STEPS IS TO CITE THE USER ACTION NECESSARY TO INSERT SOFTWARE MODULES INTO THE DEC/X8 MAINFRAME AND TO SAVE THE RESULTANT CUSTOM VERSION OF DEC/X8 ON BINARY FORMAT PAPER TAPE (OR PMK-02), OR AS A ".SV" FILE ON A OS/8 FILE BASED DEVICE.

1. STEP 3.3 MUST BE COMPLETE.
2. ENSURE BUILDER IS IN CONTROL (% DISPLAYED). IF NECESSARY, LOAD ADDRESS 03000, THEN DEPRESS START. THE PROGRAM WILL HALT AT 03000 (PDP-8/E MA=3002). DEPRESS CONT AND TYPE THE FOLLOWING COMMANDS.

```

+C
! [+B] OK? [Y]
X (BUILDER IN CONTROL).

```

3. IF OS/8 IS TO BE USED, WRITE ENABLE THE SYSTEM'S DEVICE.
4. TYPE THE FOLLOWING COMMAND.

```
X[CB*] (COMMAND BUILDER TO BUILD.)
```

```
PRI100% (BUILDER WAITS FOR THE JOB SLOT ASSIGNMENT FOR PRIORITY LEVEL 00.)
```

5. USING THE LIST YOU MADE, SIMILAR TO THE LIST SHOWN IN 3.1, TYPE THE JOB SLOT DESIGNATION WHICH CORRESPONDS TO PRIORITY LEVEL 00 FOLLOWED BY CARRIAGE RETURN. FOR EXAMPLE, USING OUR SAMPLE LIST:

```
PRI100X[U12*]
```

6. BUILDER'S RESPONSE AND THE USER'S ACTION NOW DEPEND ON THE METHOD OF INPUT SPECIFIED IN STEP 3.3.18. IF INPUT IS VIA OS/8, GO TO STEP 7. IF INPUT IS VIA THE HIGH SPEED READER, GO TO STEP 8; IF VIA THE CONSOLE READER GO TO STEP 9.1; OR IF VIA THE PMK-02 GO TO STEP 9.2.

7. IF INPUT IS VIA OS/8, BUILDER CALLS THE OS/8 COMMAND DECODER WHICH PRINTS (\*), AFTER WHICH THE USER MUST SPECIFY THE APPROPRIATE MODULE INPUT FILE NAME AND ITS RESIDENT DEVICE. USING OUR SAMPLE LIST:

```
PRI100%[J12*]
*[DEV:TC01DT*] (AN EXTENSION OF .BN IS ASSUMED BY THE
PROGRAM AND NEED NOT BE SPECIFIED.)
```

NOTE: IF [+C] IS TYPED BY THE USER WHILE THE OS/8 COMMAND DECODER IS IN CONTROL, THE OS/8 KEYBOARD MONITOR WILL BE CALLED AND "C" WILL BE DISPLAYED. TO RECOVER TYPE [ST 03000\*] AND GO TO STEP 2 ABOVE. STEP 3 WILL START WITH THE CURRENT PRIORITY.

OF COURSE OS/8 USERS MAY WANT TO INPUT DIRECTLY FROM THE SYSTEM READER USING THE MODULE BINARY TAPE. IN THIS CASE, PLACE THE BINARY TAPE IN THE SYSTEM READER AND TYPE THE FOLLOWING:

```
PRI100%[J12*]
*[PTRI*]
+[*]
```

NOW GO TO STEP 10.

8. IF INPUT IS VIA THE HIGH SPEED READER, PLACE THE APPROPRIATE MODULE BINARY TAPE IN THE READER AND SIGNAL BUILDER TO READ BY TYPING CARRIAGE RETURN. THE SEQUENCE ON THE TELEPRINTER SHOULD BE:

```
PRI100%[J12*]
+[*]
```

NOW GO TO STEP 10.

- 9.1 IF THE PROGRAM HAS ASSUMED THE CONSOLE READER AS THE INPUT DEVICE, SWITCH THE READER TO FREE, INSERT THE APPROPRIATE MODULE BINARY TAPE IN THE READER AND TYPE CARRIAGE RETURN. THEN SWITCH THE READER TO START.

NOTE: AFTER THE TAPE HAS READ IN AND THE PROGRAM STARTS PRINTING, IMMEDIATELY SWITCH THE READER TO FREE. AT LEAST ONE COMMAND ERROR CAN BE EXPECTED AFTER EACH CONSOLE READER EVOLUTION. IF THE ERROR RESULTS IN

?  
X

TYPE X[B\*] WHICH WILL GO TO THE NEXT PRIORITY LEVEL.

THE TELEPRINTER SEQUENCE AT THIS POINT WILL BE:

```
PRI100%[J12*]
+[*]
```

NOW GO TO STEP 10.

9.2 IF INPUT IS VIA THE PMK-02, PROCEED AS FOLLOWS.

- A. AFTER "+" HAS BEEN PRINTED BY THE PROGRAM, THE PROGRAM WILL HALT AT LOCATION 05647.
- B. SWITCH OVER TO THE PMK-02 (INHIBIT RECORDING).
- C. POSITION TO LEADER CODE OF THE DESIRED MODULE, THEN DEPRESS "CONT".
- D. WHEN THE PROGRAM HAS READ THE MODULE BINARY AND NO ERRORS HAVE OCCURRED, THE PROGRAM WILL HALT AT LOCATION 09002 WITH THE AC=0000.
- E. SWITCH CONTROL TO THE CONSOLE TTY AND DEPRESS "CONT".
- F. NOW GO TO STEP 10.

10. ONCE THE MODULE BINARY FILE OR TAPE IS LOADED AND IF NO ERRORS HAVE OCCURRED, THE PROGRAM MAY ASK FOR DEVICE CODE, WORD COUNT AND CURRENT ADDRESS REGISTERS SPECIFICATIONS. THE PROGRAM OUTPUTS THE FOLLOWING IN SUCH A CASE, (THE ENTIRE SEQUENCE IS SHOWN FOR CLARIFICATION AS IT WOULD APPEAR IF OS/8 WERE BEING USED.)

PRI100%[J12\*]

\*[DEV:TC010T\*] (OS/8 INPUT SHOWN.)  
DC:0760 ?[\*] (STANDARD DEVICE CODE 76)  
0770 ?[\*] (STANDARD DEVICE CODE 77)  
WC:7754 ?[\*] (STANDARD WORD COUNT 7754)  
CA:7755 ?[\*] (STANDARD CURRENT ADDRESS 7755)  
PRI101% (READY FOR NEXT MODULE)

THE STANDARD ASSIGNMENT IS ALWAYS INDICATED. IF THE DEVICE IN THE TARGET SYSTEM USES THE STANDARD INDICATED, TYPE CARRIAGE RETURN AS SHOWN ABOVE. IF THE SYSTEM USES OTHER THAN THE STANDARD INDICATED, TYPE THE NEW VALUE IN THE SAME FORMAT AS THE STANDARD; I.E. 4 OCTAL NUMBERS FOLLOWED BY CARRIAGE RETURN AS FOLLOWS:

\*[DEV:TC010T\*]  
DC:0760 ?[0740\*]  
0770 ?[0750\*]  
WC:7754 ?[7752\*]  
CA:7755 ?[7753\*]

11. REPEAT STEPS 5 THROUGH 10 FOR EACH PRIORITY LEVEL. AFTER EACH MODULE IS LOADED, BUILDER WILL INCREMENT THE CURRENT PRIORITY BY 1. BUILDER MAY INDICATE A PRIORITY ONE GREATER THAN THE REAL MAXIMUM, BUT WILL NOT ACCEPT ANY MORE MODULES AT THAT POINT. IF A COMMAND ERROR OCCURS AND THE PRINTOUT:

?  
%

IS DISPLAYED, TYPE %[B\*] TO RETURN TO STEP 5 AT THE CURRENT PRIORITY. IF AN ERROR IS MADE IN ANY PORTION OF JOB SLOT OR MODULE SPECIFICATION GO ALL THE WAY BACK TO STEP 3.3 AND COMPLETELY RELOAD TO CORRECT THE MISTAKE.

12. THE FOLLOWING IS AN EXAMPLE OF THE TELEPRINTER OUTPUT FOR THE FIRST PORTION OF THE BUILD OF AN EXERCISER AS SHOWN IN THE SAMPLE LIST IN 3.1. THE INPUT IS VIA QS/8 WITH ALL MODULE FILES ON DEVICE DSK. (DEVICE DSK DOES NOT HAVE TO BE SPECIFIED BY "DEV" SINCE IT IS THE DEFAULT DEVICE.)

\*C  
I[+B] OK?[Y]

X[B\*]

PRI100X[J12\*]  
\*ETC01DT\*]  
DC:0760 ?[\*]  
0770 ?[\*]  
WC:7754 ?[\*]  
CAI7755 ?[\*]

PRI101X[J01\*]  
\*RF08DS\*]  
DC:0600 ?[\*]  
0610 ?[\*]  
0620 ?[\*]  
0640 ?[\*]  
WC:7750 ?[\*]  
CAI7751 ?[\*]

PRI102X[J11\*]  
\*RK8DS\*]  
DC:0730 ?[\*]  
0740 ?[\*]  
0750 ?[\*]

NOTE: NO WC: OR CAI SPECIFICATION IS REQUIRED SINCE THE RKB IS A SINGLE CYCLE BREAK DEVICE. (NOW BYPASSING THE OUTPUT FOR PRIORITIES 03 THROUGH 05 THE END OF THE BUILD LOOKS LIKE THIS)

PRI106X[J03\*]  
\*CEAEDP\*]

PRI107X[J13\*]  
\*COPRATE\*]

PRI110X[+C]

!

THE LAST PRIORITY INDICATED BY BUILDER IS ONE GREATER THAN THE GREATEST LEVEL. IT IS IMPOSSIBLE TO INSERT A MODULE AT THIS PRIORITY BECAUSE ALL EXISTENT SLOTS ARE OCCUPIED.

13. AFTER THE LAST MODULE IS INSERTED, TYPE:

PRINNXL+GJ

!

14. IF THE SYSTEM HAS 8K OF MEMORY OR MORE, ENSURE SR 2 AND 3 ARE SET TO 0 AND TYPE:

[CS+]

THIS GENERATES A DEC/XB STATUS REPORT IN LONG FORM AS DESCRIBED IN CHAPTER 4. CHECK THE CONTENTS OF THIS REPORT TO DETERMINE THAT YOU HAVE BUILT THE EXERCISER AS PLANNED.

15. USING THE INITIALIZE ([I]JFX+J) COMMAND (REFER TO CHAPTER 4), INITIALIZE ALL MODULE PARAMETERS WHICH YOU WANT TO LEAVE SET UP PERMANENTLY. REFERENCE THE MODULE DOCUMENTS FOR PARAMETER DEFINITION.

16. USING THE ODT ([O+O]) COMMAND (REFER TO CHAPTER 4), MAKE ANY OTHER DESIRED PERMANENT CHANGES INCLUDING MODULE PROGRAM PATCHES IF NECESSARY.

17. TRANSFER CONTROL BACK TO BUILDER BY TYPING:

[O+B] OK?LYJ

X

NOW WE ARE READY TO SAVE THE CUSTOM VERSION OF DEC/XB.

18. IF OUTPUT VIA OS/B WAS SELECTED IN STEP 3,3,19 GO TO STEP 19. IF OUTPUT VIA THE HIGH SPEED PUNCH WAS SELECTED, GO TO STEP 20; IF VIA THE PMK-02 GO TO STEP 21. OTHERWISE, PROCEED AS FOLLOWS.

TYPE THE FOLLOWING:

X[P+]

0

THEN TYPE CARRIAGE RETURN AND TURN ON THE CONSOLE PUNCH. LEADER FOLLOWED BY A BINARY TAPE OF FIELD 0 OF THE EXERCISER, THEN TRAILER ARE PUNCHED. WHEN TRAILER IS BEING PUNCHED, TURN OFF THE PUNCH TO PREVENT OTHER TELEPRINTER OUTPUT FROM BEING PUNCHED.

WHEN COMPLETE, THE PROGRAM PRINTS THE NUMBER OF THE NEXT SEQUENTIAL FIELD, OR IF ALL FIELDS HAVE BEEN PUNCHED, PRINTS X. TO PUNCH THE NEXT FIELD, TYPE CARRIAGE RETURN, THEN TURN ON THE PUNCH. DO THIS UNTIL THE CONTENTS OF ALL EXISTENT FIELDS HAVE BEEN PUNCHED. THE TAPE MAY BE SEPARATED IN THE AREA OF LEADER/TRAILER CODE.  
NOW GO TO STEP 22.

19. IF OUTPUT VIA OS/8 WAS SELECTED IN STEP 3,3,19,  
TYPE THE FOLLOWING COMMANDS, (ENSURE THAT ALL  
APPLICABLE DEVICES ARE WRITE ENABLED.)

X[P\*]

UPON ".", TYPE "SAVE (DEV) (FILE)" - - -

.[SAVE DEV DX8EA\*]

THE FULLY CONFIGURED EXERCISER IS NOW SAVED ON DEVICE  
"DEV" AS FILE DX8EA.SV. THIS FILE IS (16N)+1 DECIMAL  
BLOCKS IN LENGTH WHERE "N" IS THE HIGHEST MEMORY  
FIELD PLUS ONE. TO VERIFY THIS FACT, USE PIP AS FOLLOWS:

.[R PIP\*]

\*[DEV]DX8EA.SV/L\*]

DX8EA.SV XXX

WHERE "XXX" IS THE NUMBER OF BLOCKS AS FOLLOWS:

HIGHEST FIELD -----	BLOCKS -----
1	33
2	49
3	65
4	81
5	97
6	113
7	129

NOW GO TO STEP 22.

20. IF OUTPUT VIA THE HIGH SPEED PUNCH WAS SPECIFIED IN 3.3.19, TYPE THE FOLLOWING COMMANDS:

X[P=]  
0

TURN ON THE HIGH SPEED PUNCH AND TYPE CARRIAGE RETURN, LEADER, FOLLOWED BY A BINARY TAPE OF FIELD 0 OF THE EXERCISER, THEN TRAILER ARE PUNCHED.

WHEN COMPLETE, THE PROGRAM PRINTS THE NUMBER OF THE NEXT SEQUENTIAL FIELD, OR IF ALL FIELDS HAVE BEEN PUNCHED, PRINTS X, TO PUNCH THE NEXT FIELD TYPE CARRIAGE RETURN, DO THIS UNTIL THE CONTENTS OF ALL EXISTENT FIELDS HAVE BEEN PUNCHED, THE TAPE MAY BE SEPARATED IN THE AREA OF LEADER/TRAILER CODE, NOW GO TO STEP 22.

21. IF OUTPUT VIA THE PMK-02 WAS SPECIFIED IN 3.3.19, PROCEED AS FOLLOWS.

- A. TYPE THE FOLLOWING COMMAND:

X[P=]

- B. THE PROGRAM WILL HALT AT LOCATION 01071.

- C. SWITCH CONTROL TO THE PMK-02 AND POSITION TO A FREE AREA OF TAPE. ANY ACTIONS WITH THE PMK-02 FROM THIS POINT ON MUST BE WITH THE PMK-02 RECORD ENABLED.

- D. USING THE AUDIO CAPABILITY OF THE PMK-02, NOTE THE CUSTOMIZED EXERCISER VERSION INDICATING THE CURRENT MEMORY FIELD SEGMENT (THE FIRST SEGMENT IS FIELD 0, THEN FIELD 1, ETC., FOR ALL OF EXISTING MEMORY).

- E. DEPRESS "CONT", THE PROGRAM WILL NOW "PUNCH" LEADER, THEN THE BINARY FOR THE CURRENT MEMORY FIELD, THEN TRAILER, STOP THE PMK-02 WHILE TRAILER IS BEING PUNCHED.

- F. IF THERE ARE MORE SEGMENTS TO BE PUNCHED, THE PROGRAM WILL EVENTUALLY HALT AT LOCATION 01071. IN THIS EVENT GO BACK TO STEP D TO "PUNCH" THE NEXT SEGMENT.

- G. IF THERE ARE NO MORE SEGMENTS TO BE PUNCHED, THE PROGRAM WILL EVENTUALLY HALT AT LOCATION 03000 (PDP-8/E MA=3002). IN THIS EVENT, SWITCH CONTROL BACK TO THE CONSOLE.

22. THIS COMPLETES THE BUILDING PROCEDURE, PROCEED TO CHAPTER 4 TO LOAD AND RUN THE CUSTOMIZED EXERCISER.



## CHAPTER 4

### DEC/X8 RUNNING PROCEDURE

THE PURPOSE OF THIS CHAPTER IS TO GIVE IN DETAIL THOSE STEPS WHICH MUST BE ACCOMPLISHED TO LOAD AND RUN A CUSTOM VERSION OF DEC/X8. FIRST, DETAILED DESCRIPTIONS PERTAINING TO KEYBOARD COMMANDS, SWITCH REGISTER OPTIONS, MONITOR VARIABLES AND NORMAL REPORTS ARE GIVEN; THEN THE LOADING, STARTING AND RUNNING METHODS ARE DESCRIBED. FINALLY SUMMARIES OF THE KEYBOARD COMMANDS AND SWITCH REGISTER OPTIONS ARE PRESENTED FOR EASY REFERENCE.

INFORMATION AND PROCEDURES CONCERNING ERRORS ARE GIVEN IN CHAPTER 5.

THE USER MUST BE FAMILIAR WITH ALL INFORMATION PRESENTED IN CHAPTERS 1 AND 2 BEFORE PROCEEDING.

#### 4.1 KEYBOARD COMMANDS (DETAILED DESCRIPTION)

-----

THIS SECTION DESCRIBES IN DETAIL ALL AVAILABLE DEC/X8 KEYBOARD COMMANDS AND GIVES EXAMPLES WHERE NECESSARY OF THEIR NORMAL USAGE. ANY INPUT ERRORS ARE FLAGGED BY "?". DEPRESS THE "RUBOUT" OR "DEL" KEY TO CANCEL A COMMAND. THIS ACTION WILL RESULT IN A SYNTAX ERROR. REFER TO 4.1.10 IN CHAPTER 1 FOR KEYBOARD/TELEPRINTER CONVENTIONS.

##### 4.1.1 CALLING THE DEC/X8 KEYBOARD MONITOR

-----

[+C] "CONTROL C" IS HONORED IMMEDIATELY ONLY WHEN THE EXERCISER IS NOT BUSY QUEUING TO THE CONSOLE TELEPRINTER OR ROTATING JOBS. OTHERWISE, MONITOR WILL WAIT UNTIL A CONVENIENT TIME TO HONOR THE COMMAND. WHEN HONORED, [+C] TURNS OFF THE INTERRUPT (IF NOT ALREADY OFF), STOPS ALL JOB SERVICING, AND FINALLY RESULTS IN "!" BEING DISPLAYED.

##### 4.1.2 EXITING THE DEC/X8 KEYBOARD MONITOR

-----

TWO COMMANDS ARE AVAILABLE FOR EXITING THE KEYBOARD MONITOR, TURNING THE INTERRUPT SYSTEM ON, AND RESUMING JOB SERVICING.

1. ! [+E] "EXERCISE" RESULTS IN THE INTERRUPT BEING TURNED ON AND IN MONITOR RESUMING JOB SERVICES. ALSO ANY JOBS WHICH HAVE JUST BEEN PUT IN THE RUN STATE WILL BE STARTED, AND ANY JOBS WHICH HAVE THEIR "COMMAND TO KILL" FLAG SET WILL BE KILLED.
2. ! [+R] "EXERCISE AND FORCE ROTATION" RESULTS IN ALL ACTIONS SPECIFIED BY ! [+E], AND IN ADDITION FORCES ROTATION AND AN AUTOMATIC STATUS REPORT. IF THE SYSTEM HAS ONLY 4K, ! [+R] FUNCTIONS EXACTLY AS ! [+E]. ROTATION AND STATUS REPORTS ARE AVAILABLE ONLY IN 8K OR GREATER SYSTEMS.

#### 4.1.3 INITIALIZING JOBS

-----  
:[IJFX+] "INITIALIZE JOB JFX" IS USED TO INITIALIZE JOB PARAMETERS. THIS COMMAND WILL TRANSFER CONTROL TO THE JOB INITIALIZATION ROUTINE (MODULE ADDRESS "INIT") WHICH WILL ALWAYS PRINT THE JOB SHORT TITLE AND MAY ASK FOR PARAMETER INPUT. AT THE COMPLETION OF THE INITIALIZATION ROUTINE, THE JOB RETURNS CONTROL TO THE KEYBOARD MONITOR. THE JOB TO BE INITIALIZED MUST BE IN THE KILLED STATE, OTHERWISE A SYNTAX ERROR IS INDICATED. FOR EXAMPLE, THE FOLLOWING IS THE TELEPRINTER OUTPUT FOR THE RF08 DISK MODULE "RF08DS" AS IT WOULD APPEAR IN SLOT J01.  
NOTE: DEPRESSING THE "RUBOUT" OR "DEL" KEY WILL USUALLY CAUSE A RETURN TO THE FIRST PARAMETER.

```
:[IJ01+]
RF08DS                (SHORT TITLE)
A  [0]                (PARAMETERS)
B  [2]
C  [0]
D  [0]
E  [0]
F  [0]
!
```

BEFORE INITIALIZING A JOB, REFER TO THE APPLICABLE MODULE DOCUMENT FOR PARAMETER DEFINITIONS.

#### 4.1.4 RUNNING JOBS

-----  
TWO COMMANDS ARE AVAILABLE FOR RUNNING JOBS.

1. :[RJFX+] "RUN JOB JFX" RESULTS IN JOB JFX BEING SWITCHED TO THE RUN STATE. THE JOB WILL NOT BE STARTED UNTIL :[E+] IS COMMANDED WHICH WILL CAUSE AN EFFECTIVE BRANCH TO MODULE ADDRESS "RUN". THE JOB MUST BE IN THE KILLED STATE, OTHERWISE A SYNTAX ERROR IS INDICATED. TO RUN JOBS J01, J02 AND J04, TYPE THE FOLLOWING.

```
:[RJ01+]
:[RJ02+]
:[RJ04+]
:[E+]
```

2. :[AR+] "RUN ALL JOBS" IS AVAILABLE IN SYSTEMS WITH 8K OR MORE MEMORY AND CAUSES ALL EXISTENT JOBS NOT ALREADY RUNNING TO BE SWITCHED TO THE RUN STATE. TO RUN ALL JOBS, TYPE:

```
:[AR+]
:[E+]
```

#### 4.1.5 KILLING JOBS

TWO COMMANDS ARE AVAILABLE FOR KILLING JOBS.

1. !KJFX+J "KILL JOB JFX" SETS THE "COMMAND TO KILL" FLAG IN JOB JFX. THE JOB WILL NOT BE KILLED UNTIL !E+ is COMMANDED AND THE JOB HAS THE CHANCE TO REACH A POINT OF EXIT. TO KILL JOBS J01, J02, AND J04, TYPE THE FOLLOWING,

```
!KJ01+J  
!KJ02+J  
!KJ04+J  
!E+
```

2. !AK+J "KILL ALL JOBS" IS AVAILABLE ONLY IN SYSTEMS WITH AT LEAST 8K OF MEMORY AND SETS THE "COMMAND TO KILL" FLAG IN ALL EXISTENT JOBS. TO KILL ALL JOBS, TYPE!

```
!AK+J  
!E+
```

#### 4.1.6 ON-LINE MEMORY MODIFICATION

!OJ IS THE BASIC COMMAND USED FOR EXAMINING OR MODIFYING MEMORY. THERE ARE TWO MODES OF ADDRESS SPECIFICATION FOR THIS COMMAND, ABSOLUTE AND RELATIVE. THE ABSOLUTE MODE SHOULD BE USED WHENEVER THE ABSOLUTE ADDRESS IS KNOWN (MONITOR ADDRESSES). THE RELATIVE MODE SHOULD BE USED IN SPECIFYING MODULE (OR JOB) ADDRESSES.

THE ABSOLUTE FORM IS AS FOLLOWS WHERE "FAAAA" IS AN ABSOLUTE ADDRESS.

```
!OFAAAA] CCCC  
"CCCC" IS THE CONTENTS OF LOCATION FAAAA.
```

THE RELATIVE FORM REQUIRES THE FOLLOWING:

```
!OJFX+J  
[RRRR]  
FAAAA CCCC
```

WHERE "JFX" IS THE JOB NUMBER AND "RRRR" IS THE RELATIVE ADDRESS AS IT APPEARS IN THE MODULE LISTING. MONITOR THEN COMPUTES AND DISPLAYS THE ABSOLUTE ADDRESS "FAAAA" AND ITS CONTENTS "CCCC".

AFTER "FAAAA" HAS BE TYPED BY THE USER IN THE ABSOLUTE MODE OR "FAAAA" HAS BEEN PRINTED BY MONITOR IN RELATIVE MODE, AND "CCCC" HAS BEEN DISPLAYED, THE USER HAS THE FOLLOWING OPTIONS:

1. RETURN TO MONITOR

FAAAA CCCC[-] (CARRIAGE RETURN)  
!

2. DEPOSIT "DDDD" IN LOCATION "FAAAA"

FAAAA CCCC [DDDD+] (DUMP VERIFY)  
FAAAA DDDD

3. OPEN THE NEXT SEQUENTIAL LOCATION AND EXAMINE

FAAAA CCCC[#] (LINE FEED)  
FAAAA(+1) CCCC

NOTE: AFTER MONITOR HAS PRINTED THE CONTENTS OF A LOCATION (CCCC), THE USER MAY PROCEED AS CITED IN 1 THROUGH 3 ABOVE.

4.1.7 GENERATE OFF-LINE STATUS REPORT  
-----

!CS+J GENERATES AN OFF LINE STATUS REPORT; THAT IS, IT IS PRINTED WITH THE INTERRUPT SYSTEM OFF. NO JOBS ARE SERVICED DURING THIS EVOLUTION. WHEN THE REPORT HAS BEEN COMPLETELY DISPLAYED, CONTROL RETURNS TO THE KEYBOARD MONITOR, THE SYSTEM MUST HAVE AT LEAST 8K OF MEMORY. (SR 2 AND 3 HAVE FURTHER CONTROL.)

4.1.8 SWITCHING CONSOLE TTY INPUT/OUTPUT  
-----

TTY INPUT/OUTPUT IS NORMALLY ON THE CONSOLE DEVICE. HOWEVER, IF THE SYSTEM HAS AT LEAST 8K OF MEMORY AND ANOTHER "TTY COMPATIBLE" DEVICE, TTY INPUT/OUTPUT MAY BE SWITCHED BETWEEN THE CONSOLE AND THAT DEVICE BY THE USE OF THE FOLLOWING COMMANDS.

WARNING: IF THERE IS A JOB WHICH EXERCISES THE DEVICE TO BE SELECTED BY ONE OF THE FOLLOWING COMMANDS, THAT JOB MUST BE IN THE KILLED STATE PRIOR TO THE USE OF THAT COMMAND.

1. !ETNN+J ALL KEYBOARD INPUT IS SWITCHED TO THE TTY KEYBOARD WITH DEVICE CODE "NN".
2. !ELNN+J ALL TELEPRINTER OUTPUT IS SWITCHED TO THE LP08 OR LE-8 LINE PRINTER WITH DEVICE CODE "NN". THIS COMMAND MUST BE USED UNIQUELY FOR THE LP08 AND LE-8 LINE PRINTERS.
3. !DNN+J ALL TELEPRINTER OUTPUT IS SWITCHED TO THE TTY COMPATIBLE DEVICE OTHER THAN AN LP08 OR LE-8 LINE PRINTER WITH DEVICE CODE "NN". THIS COMMAND MUST BE USED UNIQUELY FOR ALL DEVICES OTHER THAN AN LP08 OR LE-8 LINE PRINTER.

NOTE: THE NUMBER OF FILLER CHARACTERS AFTER CR-LF MAY BE CHANGED BY DEPOSITING THE NUMBER OF FILLERS IN LOCATION FILLER (03200) PRIOR TO THE USE OF !DNN+J OR !ELNN+J.

#### 4.1.9 SWITCHING CONTROL TO BUILDER AND BUILDER COMMANDS

! [+B] OK? [Y] SWITCHES CONTROL FROM MONITOR TO BUILDER. THIS COMMAND MUST BE USED WITH CAUTION SINCE BUILDER RESIDES IN EXTERNAL BUFFER AREAS. THE ONLY TIME THIS COMMAND SHOULD BE USED IS DURING THE BUILDING PHASE, OR IMMEDIATELY AFTER LOADING THE CONFIGURED EXERCISER BUT PRIOR TO RUNNING ANY JOBS.

ONCE BUILDER IS IN CONTROL, "X" IS PRINTED. THERE ARE FOUR COMMANDS AVAILABLE:

1. %E+C] RETURN TO DEC/X8 KEYBOARD MONITOR.
2. %E+B] PUT BUILDER IN THE BUILD MODE, THIS COMMAND CAN BE USED TO FILL ANY UNUSED JOB SLOTS; HOWEVER, CHAPTER 3 SHOULD BE REFERENCED.
3. %E+S] PRINT EMPTY JOB SLOTS (REQUIRES 8K OF MEMORY). THE OUTPUT IS:  
EMPTY SLOTS:  
NN NN NN NN ETC,  
WHERE "NN" INDICATES AN OPEN OR EMPTY JOB SLOT.
4. %E+P] SAVE THE EXERCISER, REFER TO THE BUILDING PROCEDURE IN CHAPTER 3.

PERHAPS THE MOST COMMON REASON FOR SWITCHING TO BUILDER ONCE AN EXERCISER HAS BEEN COMPLETELY CONFIGURED AND SAVED IS TO CHANGE THE JOB PARAMETERS AND SAVE THE RESULT. THIS IS ACCOMPLISHED AS FOLLOWS:

```
LOAD THE FULLY CONFIGURED EXERCISER.  
START AT 03000  
+C  
! [I]JFX+] (INITIALIZE JOBS.)  
(ETC)  
! [+B] OK? [Y] (SWITCH TO BUILDER)  
%E+P] (SAVE THE EXERCISER)
```

THE ABOVE PROCEDURE SHOULD ONLY BE USED BY USERS WHO ARE FAMILIAR WITH THE BUILDING PROCEDURE.

#### 4.1.10 SWITCHING CONTROL TO OS/8

THE FOLLOWING COMMANDS SHOULD BE USED IF AND ONLY IF OPERATING UNDER A OS/8 SYSTEM AND ONLY BY EXPERIENCED USERS.

1. !EX] OK? [Y] THIS COMMAND EXECUTES A JUMP TO LOCATION 07605 WHICH CALLS THE OS/8 KEYBOARD MONITOR BUT DOES NOT SAVE THE EXERCISER IMAGE. DO NOT ATTEMPT TO RESTART THE EXERCISER--- IT MUST BE RELOADED USING THE ,LR DX8EA+] TYPE COMMAND.
2. !EW] OK? [Y] THIS COMMAND EXECUTES A JUMP TO 07600 WHICH CALLS THE OS/8 KEYBOARD MONITOR AND SAVES THAT PORTION OF THE EXERCISER WIPED OUT ON THE SYSTEMS DEVICE (MUST BE WRITE ENABLED), PROVIDING NO OTHER PROGRAMS ARE CALLED WHILE IN OS/8, THE EXERCISER MAY BE RESTARTED BY THE START COMMAND ,LST 03000+], OTHERWISE, THE EXERCISER MUST BE RELOADED USING THE ,LR DX8EA+] TYPE COMMAND.

## 4.2 SWITCH REGISTER (SR) OPTIONS (DETAILED DESCRIPTION)

-----

THE VARIOUS SWITCH REGISTER OPTIONS ARE CONTROLLED BY THE USER VIA THE PROCESSOR SWITCH REGISTER, ON A PDP-12, THE RIGHT SWITCHES MUST BE USED.

### 4.2.1 SR0: SERVICE QUEUING MODE

-----

1. SR0=0: SETTING SR0=0 SETS THE PRIORITY QUEUE MODE. IN THIS MODE, IF MORE THAN ONE INTERRUPT DRIVEN JOB REQUIRE SERVICE AT THE SAME TIME, MONITOR SERVICES THE JOB WITH THE HIGHEST PRIORITY FIRST. BACKGROUND JOB SERVICING IS SWITCHED AFTER ANY OTHER JOB CAUSES AN INTERRUPT. THIS MODE OF OPERATION SHOULD BE THE MOST DIFFICULT FOR SYSTEM HARDWARE TO EXECUTE.
2. SR0=1: THIS SETS RING QUEUE MODE. IN THIS MODE, SERVICING IS GRANTED TO JOBS IN A SEQUENTIAL MANNER. A GIVEN JOB'S PRIORITY HAS LITTLE OR NO EFFECT ON THIS SERVICING SCHEME. RING MODE CAUSES INTERACTION TO DEGRADE CONSIDERABLY AND SHOULD BE COMPARATIVELY LESS DIFFICULT FOR THE SYSTEM HARDWARE TO HANDLE THAN PRIORITY MODE.

### 4.2.2 SR1: TIME SHARE MODE OPERATION

-----

1. SR1=0: ALL JOBS RUN IN EXECUTIVE MODE; I.E., THE TIME SHARE OPTION IS NEVER UTILIZED.
2. SR1=1: IF THE SYSTEM HAS AT LEAST 8K OF MEMORY AND A TIME SHARE OPTION, ALL JOBS WILL RUN PARTIALLY OR ENTIRELY IN USER MODE WITH THE EXECUTION OF ALL TRAPPED INSTRUCTIONS BEING CONTROLLED BY MONITOR'S TIME SHARE USER SERVICE ROUTINE. THIS OPTION MAY NOTICEABLY SLOW UP THE EXERCISER.

### 4.2.3 SR2: NORMAL REPORTS CONTROL #1

-----

1. SR2=0: IF THE SYSTEM HAS AT LEAST 8K OF MEMORY, THE FOLLOWING NORMAL TELEPRINTER REPORTS ARE ENABLED:  
1) ROTATE COMPLETION REPORT; AND  
2) DEC/X8 STATUS REPORT.
2. SR2=1: DISABLES ALL PERIODIC NORMAL REPORTS AND DISREGARDS [CS+] REQUESTS.

4.2.4 SR3: NORMAL REPORTS CONTROL #2  
-----

1. SR3=0: WHENEVER A STATUS REPORT IS GENERATED, IT WILL BE IN LONG FORM.
2. SR3=1: STATUS REPORTS WILL BE GENERATED IN SHORT FORM.

4.2.5 SR4: ROTATION CONTROL  
-----

1. SR4=0: IF THE SYSTEM HAS AT LEAST 8K OF MEMORY, PERIODIC SLOT ROTATION IS ENABLED.
2. SR4=1: ROTATION IS DISABLED.

4.2.6 SR5: MQ PEEK CONTROL  
-----

1. SR5=0: HARDWARE ALLOWING, THE CONTENTS OF THE MQ ARE PRESERVED AND RESTORED FOR EACH JOB.
2. SR5=1: CAUTION MUST BE EXERCISED IN THE USE OF THIS OPTION, DO NOT SET SR5 TO A 1 IF ANY JOB WHICH UTILIZES THE MQ IS IN THE RUN STATE. SR5 WHEN SET TO A 1 FORCES THE CONTENTS OF THE ADDRESS SPECIFIED IN LOCATION MQADDR(00174) IN THE FIELD SPECIFIED BY THE CDF INSTRUCTION IN LOCATION MQFELD(00173) TO BE PLACED IN THE MQ WHENEVER MONITOR CHANGES JOB SERVICES. THE PREVIOUS CONTENTS OF THE MQ ARE LOST.

4.2.7 SR6: ERROR RETURN CONTROL  
-----

1. SR6=0: ALL FATAL ERRORS RESULT IN A HALT, NON-FATAL ERRORS EXIT TO THE JOB IN ERROR WHICH THEN CONTINUES.
2. SR6=1: ALL FATAL ERRORS RESULT IN A HALT, ALL NON-FATAL ERRORS TURN OFF THE INTERRUPT SYSTEM AND RETURN TO THE KEYBOARD MONITOR (↑C STATE). TO CONTINUE, USE THE ![+E] COMMAND.

4.2.8 SR7-8: ERROR REPORT CONTROL  
-----

1. SR7-8=00: REPORT ALL ERRORS INCLUDING ALL BAD DATA FOR DATA ERRORS WITH TALLY.
2. SR7-8=01: REPORT ALL ERRORS, BUT ONLY THE FIRST FOUR SETS OF FAILING DATA WITH TALLY.
3. SR7-8=10: REPORT ALL ERRORS, BUT NO DATA FOR DATA ERRORS. THE TALLY IS STILL REPORTED.
4. SR7-8=11: NO ERRORS ARE REPORTED.



4.2.9 SR9: JOB ACTION UPON ERROR  
-----

1. SR9=0: THE JOB IN ERROR CONTINUES TO RUN.
2. SR9=1: THE KILL FLAG FOR THE JOB IN ERROR IS AUTOMATICALLY SET.

4.2.10 SR10: EXTERNAL BUFFER ASSIGNMENT CONTROL  
-----

1. SR10=0: EXTERNAL BUFFERS ARE ASSIGNED AND RELEASED AT WILL BY APPLICABLE JOBS.
2. SR10=1: PRESENT EXTERNAL BUFFER ASSIGNMENTS ARE FROZEN.

4.2.11 SR11: DEVICE ADDRESSING CONTROL  
-----

1. SR11=0: RANDOM DEVICE UNIT SELECTION AND ADDRESSING ARE ENABLED.
2. SR11=1: CURRENT UNITS AND ADDRESSING ARE FROZEN WHERE POSSIBLE.

#### 4.3 MONITOR VARIABLES (DETAILED DESCRIPTION)

THERE ARE THREE SETS OF MONITOR VARIABLES WHICH THE USER MAY CHANGE. ALL CHANGES SHOULD BE MADE USING THE ![\*O] COMMAND.

##### 4.3.1 MQ PEEK VARIABLES

TWO VARIABLES EXIST FOR THE MQ PEEK FUNCTION (SR5=1):  
1. LOCATION MQFELD (00173); AND  
2. LOCATION MQADDR (00174).  
INITIALLY, MQFELD CONTAINS A CDF 00 INSTRUCTION (6201) AND MQADDR CONTAINS THE POINTER TO SRVAL1 (1564). IN THIS STATE, WHEN SR5=1 THE PRIORITY OF THE CURRENT JOB BEING SERVICED IS DISPLAYED IN THE MQ; I.E. THE CONTENTS OF LOCATION 01564.

TO CHANGE THESE VARIABLES SO THE CONTENTS OF LOCATION FAAAA ARE DISPLAYED, TYPE THE FOLLOWING COMMANDS:

```
![*000173] 6201 [62F1*]  
00173 62F1[*]  
00174 1564 [AAAA*]  
00174 AAAA[*]  
!
```

##### 4.3.2 PERIODIC TIME VARIABLES FOR ROTATION AND STATUS REPORT

A DOUBLE PRECISION COUNTER IS USED TO COUNT OFF THE PERIODIC TIME FOR ROTATION AND AUTOMATIC STATUS REPORTS. THE ACTUAL TIME OF THE PERIOD IS A FUNCTION OF THE COUNTER PRESET VALUE, AND THE NUMBER AND TYPES OF JOBS WHICH ARE RUNNING. THE COUNTER PRESET IS INITIALLY SET TO 77770000 (DOUBLE PRECISION, 2'S COMPLEMENT). LOCATION ENDPR1 (00175) CONTAINS THE LEAST SIGNIFICANT HALF OF THE PRESET WHILE ENDPR2 (00176) CONTAINS THE MOST SIGNIFICANT. TO CHANGE THE VALUE OF THE PRESET TO DDDDEEEE TYPE THE FOLLOWING COMMANDS:

```
![*000175] 0000 [EEEE*]  
00175 EEEE[*]  
00176 7777 [DDDD*]  
00176 DDDD[*]  
!
```

THEN, WHEN READY TO START EXERCISING, USE THE ![\*R] COMMAND. THIS WILL CAUSE COUNTER OVERFLOW, ROTATION, A STATUS REPORT AND FINALLY COUNTER PRESET.

### 4.3.3 ROTATE SLOT SELECTION

-----  
ROTATE SLOT SELECTION IS MODIFIED BY THE MONITOR EACH TIME A ROTATION  
TAKES PLACE, AND BY SOME SOFTWARE MODULES AT PERIODIC INTERVALS.  
THE USER NO LONGER HAS ANY CONTROL OVER THE SLOTS SELECTED.  
IN GENERAL, A SLOT WILL BE ROTATED THE NUMBER OF TIMES THAT A BIT  
SET FOR THAT SLOT APPEARS (UP TO 3) IN LOCATION "ROTWRD" (10177).

SLOT	BITS ASSIGNED
----	-----
JF1	0,4,8
JF2	1,5,9
JF3	2,6,10
JF4	3,7,11

4.4 NORMAL TELEPRINTER REPORTS

THERE ARE THREE TYPES OF NORMAL REPORTS GENERATED BY MONITOR IN ANY SYSTEM WHICH HAS AT LEAST 8K OF MEMORY. NO NORMAL REPORTS ARE GENERATED IN 4K SYSTEMS.

4.4.1 LONG FORM STATUS REPORT

THE PURPOSE OF THIS REPORT IS TO GIVE THE USER A PICTURE OF WHAT JOBS ARE IN MEMORY AND THEIR STATUS. THIS REPORT IS GENERATED IF SR2-3=00 AND [S-] IS COMMANDED OR AN EXERCISER TIME PERIOD HAS EXPIRED. THE HEADINGS AND THEIR DEFINITIONS ARE:

1. JOB: JOB NUMBER
2. MODULE: MODULE OR JOB SHORT TITLE
3. MAINDEC: MAINDEC NUMBER (PRODUCT CODE). THE PREFIX "MAINDEC=X8" IS IMPLIED.
4. FLD: THE MEMORY FIELD IN WHICH THE JOB IS CURRENTLY LOCATED.
5. PRI: THE JOB'S ASSIGNED PRIORITY LEVEL.
6. STATE: "R" INDICATES THE JOB IS IN THE RUN STATE; "K" INDICATES THE KILLED STATE.
7. CNTR: THE CONTENTS OF THE JOB'S PASS COUNTER.

BELOW IS A LONG FORM STATUS REPORT FOR AN EXERCISER AS DESCRIBED IN CHAPTER 3.

DEC/X8

JOB	MODULE	MAINDEC	FLD	PRI	STATE	CNTR
01	RF08DS	DIRFA-A	0	01	R	2345
02	EAEALL	DIKEA-B	0	04	K	0000
03	EAEDP	DHKEA-A	0	06	K	0000
04	HSRHSP	DIPCA-A	0	03	R	0342
11	RK8DS	DIRKA-A	1	02	R	1460
12	TC01DT	DITCA-B	1	00	R	0127
13	OPRATE	DIKAC-B	1	07	R	0007
14	MRI08A	DIKAA-A	1	09	R	0006

#### 4.4.2 SHORT FORM STATUS REPORT

-----  
THE PURPOSE OF THIS REPORT IS TO GIVE THE USER CRITICAL INFORMATION PERTAINING TO JOBS IN THE RUN STATE ONLY. NO INFORMATION IS GIVEN FOR JOBS IN THE KILLED STATE. THIS REPORT IS GENERATED IF SR2=3=01 AND [LS=] IS COMMANDED OR AN EXERCISER TIME PERIOD HAS EXPIRED. THE HEADINGS AND THEIR DEFINITIONS ARE:

1. JOB: JOB NUMBER
2. FLD: THE MEMORY FIELD IN WHICH THE JOB IS CURRENTLY LOCATED.
3. CNTR: THE CONTENTS OF THE JOB'S PASS COUNTER.

BELOW IS A SHORT FORM STATUS REPORT OF THE SAME CONDITIONS SHOWN IN THE LONG FORM IN 4.4.1.

DEC/X8

JOB	FLD	CNTR
01	0	2345
04	0	0542
11	1	1460
12	1	0127
13	1	0007
14	1	0006

#### 4.4.3 ROTATE COMPLETION REPORT

-----  
THIS REPORT IS DISPLAYED AT THE SUCCESSFUL COMPLETION OF JOB SLOT ROTATION PROVIDING SR2=0. THE FORM IS

ROTATE XXXX

WHERE "XXXX" IS THE CONTENTS OF LOCATION ROTWRD (10177).

## 4.5

LOADING THE CUSTOMIZED EXERCISER  
-----

1. IF THE CUSTOM VERSION OF DEC/X8 IS IN THE FORM OF A OS/8 ".SV" FILE (DX8EA.SV), TYPE THE FOLLOWING COMMANDS WITH THE OS/8 KEYBOARD MONITOR IN CONTROL (BOOTSTRAP OR START AT 07605 IF NECESSARY).

.LR DX8EA\*]

EVENTUALLY THE PROCESSOR WILL HALT AT LOCATION 03000 (PDP-8/E MA=3002). THEN PROTECT THE VOLATILE OS/8 DEVICES AND GO TO 4.6.

2. IF THE CUSTOMIZED EXERCISER RESIDES ON ONE OR MORE BINARY TAPES, LOAD EACH TAPE USING THE STANDARD BINARY LOADER TECHNIQUE. THE INITIAL SETTING OF THE DATA FIELD IS OF NO CONSEQUENCE SINCE FIELD SPECIFICATION IS PRESENT ON EACH TAPE. THEN GO TO 4.6.
3. IF THE CUSTOMIZED EXERCISER RESIDES ON A PMK-02 TAPE, LOAD EACH MEMORY FIELD SEGMENT USING THE STANDARD BINARY LOADER TECHNIQUE. THE INITIAL SETTING OF THE DATA FIELD IS OF NO CONSEQUENCE SINCE FIELD SPECIFICATION IS PRESENT ON EACH RECORDED SEGMENT.

## 4.6

STARTING THE CUSTOMIZED EXERCISER  
-----

1. LOAD ADDRESS 03000.
2. DEPRESS START.
3. THE PROGRAM WILL HALT AT 03000 (PDP-8/E MA=3002).
4. DEPRESS CONT
5. THE PROGRAM WILL PRINT!
  - ↑C
  - !
6. GO TO 4.7

## 4.7

RUNNING THE CUSTOMIZED EXERCISER  
-----

1. SET UP ALL DEVICES/OPTIONS TO BE EXERCISED AS EXPLAINED IN THE MODULE DOCUMENTATION. IT MAY BE NECESSARY TO RESTART THE EXERCISER AS DESCRIBED IN 4.6 IN ORDER TO GENERATE SYSTEM INITIALIZE.
2. INITIALIZE ALL JOBS USING THE !IJFX+J COMMAND REFERENCING THE MODULE DOCUMENTS.
3. SET THE SWITCH REGISTER TO 1240.
4. RUN SINGLE JOBS OR SMALL GROUPS OF JOBS AT WILL TO DISCOVER ANY CATASTROPHIC FAILURES.

NOTE: IT IS A REQUIREMENT THAT THE NUMBER OF JOBS RUNNING THAT REQUIRE EXTERNAL BUFFERS MUST NOT EXCEED THE NUMBER OF BUFFERS AVAILABLE; OTHERWISE THE EXERCISER WILL PROBABLY HANG.

5. KILL ALL JOBS.
6. SET THE SWITCH REGISTER TO 0000.
7. RUN ALL JOBS SIMULTANEOUSLY FOR THE TIMES INDICATED BELOW. REFER TO THE "DEC/X8 SOFTWARE MODULE INDEX" (MAINDEC-X8-DIGAF= -D) FOR EXCEPTIONS IN THE RUNTIME FOR PARTICULAR DEVICES.

MINIMUM RUNTIME -----	TEST EFFECTIVENESS -----
30 MINUTES	MOST SOLID FAILURES DISCOVERED.
2 HOURS	MOST SOLID AND INTERMITTENT FAILURES DISCOVERED.
8 HOURS	SYSTEM ACCEPTANCE

NOTE: DURING PROLONGED RUNTIME, SET SWITCH REGISTER OPTIONS TO USER ADVANTAGE. SR0 SHOULD ALWAYS REMAIN IN THE 0 STATE TO ENSURE MAXIMUM INTERACTION. IT MAY ALSO BE NECESSARY TO ADJUST MONITOR VARIABLES DEPENDENT UPON THE NUMBER AND TYPES OF JOBS RUNNING. IN 8K OR GREATER SYSTEMS, THE ROTATION TIME PERIOD SHOULD BE ADJUSTED SUCH THAT ROTATION OCCURS AT NO LESS THAN 15 MINUTE INTERVALS. RAPID ROTATION FREQUENCY DECREASES INTERACTION APPRECIABLY.

## 4.8

HALTING THE EXERCISER  
-----

1. KILL ALL JOBS
2. RETURN TO +C STATE
3. DEPRESS HALT.
4. TO RESTART, FOLLOW THE STEPS IN 4.6.

SUMMARY OF KEYBOARD COMMANDS

REFER TO 4.1 FOR DETAILED DESCRIPTIONS.

<u>COMMAND</u>	<u>MINIMUM MEMORY</u>	<u>FUNCTION</u>
[+C]	4K	CALL DEC/X8 KEYBOARD MONITOR
[+E]	4K	EXERCISE
[+R]	8K	EXERCISE AND ROTATE
[IJFX+]	4K	INITIALIZE JOB JFX
[RJFX+]	4K	RUN JOB JFX
[AR+]	8K	RUN ALL JOBS
[KJFX+]	4K	KILL JOB JFX
[AK+]	8K	KILL ALL JOBS
[+OFAAAA]	4K	ABSOLUTE MODE MEMORY MODIFICATION
[+QJFX+] [RRRR]	4K	RELATIVE MODE MEMORY MODIFICATION
[S+]	8K	STATUS REPORT
[LNN+]	8K	CONSOLE OUTPUT ON LP08/LE8 WITH DEVICE CODE NN.
[DNN+]	8K	CONSOLE OUTPUT ON ITY WITH DEVICE CODE NN (OTHER THAN LP08/LE8).
[TNN+]	8K	CONSOLE KEYBOARD INPUT ON KEYBOARD WITH DEVICE CODE NN.
[+B]	4K	SWITCH CONTROL TO BUILDER
[B+]	4K	BUILD
[P+]	4K	PUNCH OR SAVE
[ES+]	8K	PRINT EMPTY SLOTS
[X]	8K	GO TO OS/8 KEYBOARD MONITOR AND DO NOT SAVE SWAPPED AREA.
[W]	8K	GO TO OS/8 KEYBOARD MONITOR



4.10 SUMMARY OF SWITCH REGISTER OPTIONS

REFER TO 4.2 FOR DETAILED DESCRIPTIONS.

SR BIT	STATE	FUNCTION
0	0	PRIORITY QUEUE
	1	RING QUEUE
1	0	JOBS RUN IN EXEC MODE
	1	JOBS RUN IN USER MODE
2	0	ENABLE NORMAL REPORTS
	1	DISABLE
3	0	LONG STATUS REPORT
	1	SHORT STATUS REPORT
4	0	ENABLE SLOT ROTATION
	1	DISABLE
5	0	MQ PRESERVED
	1	MQ PEEK (PRESET TO DISPLAY PRIORITY OF JOB CURRENTLY BEING SERVICED)
6	0	ERRORS TAKE NORMAL EXIT.
	1	ERRORS RETURN TO KEYBOARD MONITOR
7-8	00	PRINT ALL ERROR DATA
	01	PRINT FIRST 4 DATA SETS
	10	PRINT NO DATA
	11	PRINT NO ERRORS
9	0	JOB CONTINUES AFTER ERROR
	1	JOB IS KILLED AFTER ERROR
10	0	ENABLE RANDOM EXTERNAL BUFFER ASSIGNMENT
	1	FREEZE CURRENT ASSIGNMENTS
11	0	ENABLE RANDOM DEVICE UNIT SELECTION AND ADDRESSING.
	1	FREEZE CURRENT UNIT SELECTIONS AND ADDRESSING.

## CHAPTER 5

### ERROR INFORMATION AND PROCEDURES

-----

THIS CHAPTER PROVIDES BASIC INFORMATION CONCERNING ERRORS OF ALL TYPES WHICH MAY OCCUR DURING THE BUILDING AND RUNNING OF DEC/X8. RECOMMENDED RECOVERY PROCEDURES AND PERTINENT INFORMATION ARE THEN GIVEN FOR EACH TYPE OF ERROR. FINALLY, HELPFUL HINTS ARE PROVIDED FOR SYSTEM TROUBLESHOOTING.

#### 5.1 CLASSES OF ERRORS

-----

THERE ARE FOUR MAJOR CLASSES OF ERRORS: MONITOR ERRORS, BUILDER ERRORS, OS/8 ERRORS AND JOB ERRORS.

MONITOR ERRORS MAY OCCUR DURING THE BUILDING AND RUNNING PHASES. WITH ONE EXCEPTION, ALL MONITOR ERRORS RESULT IN A PROGRAM HALT WITHOUT AN ERROR PRINTOUT. THE EXCEPTION IS A POWER FAIL ERROR AS DETECTED BY THE POWER FAIL OPTION. IN THIS CASE, WHEN POWER IS RESTORED MONITOR PRINTS "PF" FOLLOWED BY A SYSTEM STATUS REPORT (IF SR2=0 AND 0K). THE EXERCISER THEN ENTERS MONITOR MODE AND AWAITS USER COMMANDS.

BUILDER ERRORS OCCUR ONLY DURING THE BUILDING PHASE AND RESULT IN A PROGRAM HALT. THERE ARE NO PRINTOUTS FOR THIS ERROR CLASS.

OS/8 ERRORS ARE INDICATED BY AN ERROR PRINTOUT AND RETURN TO EITHER THE OS/8 KEYBOARD MONITOR OR TO THE DEC/X8 BUILDER. THIS CLASS OF ERROR SHOULD OCCUR ONLY DURING OS/8 EVOLUTIONS WHILE BUILDING DEC/X8.

JOB ERRORS ARE USUALLY REPORTED BY ERROR PRINTOUTS. A PROGRAM HALT WITHOUT A REPORT WILL OCCUR IF THE ERROR CONDITION IS CONSIDERED FATAL.

5.2 ERROR PRINTOUTS (REPORTS)  
-----

THERE ARE THREE SOURCES OF ERROR REPORTS: JOB ERRORS, POWER FAIL,  
AND BUILDER- QS/8 I/O ERRORS.

5.2.1 JOB ERROR REPORTS  
-----

NOTE: DURING BACKGROUND JOB ERROR REPORTING ONLY  
ALL SERVICING CEASES FOR OTHER BACKGROUND JOBS.

A JOB ERROR REPORT ALWAYS HAS THE FOLLOWING HEADER:

TYPE ERR IN JFX MODITITLE FLDIF CNTR:NNNN RPC:NNNN CODE:NNNN

WITH THE FOLLOWING DEFINITIONS:

TYPE: "STAT" FOR A STATUS ERROR OR "DATA" FOR A DATA ERROR.

JFX: JOB NUMBER

MOD: MODULE SHORT TITLE

FLD: THE MEMORY FIELD IN WHICH THE JOB CURRENTLY RESIDES

CNTR: THE CONTENTS OF THE JOB'S PASS COUNTER

RPC: THE RELATIVE MODULE PC AT WHICH THE ERROR REPORT WAS INITIATED

CODE: THIS JOB'S ERROR ID CODE (REFER TO MODULE DOCUMENT FOR  
DEFINITIONS)

IN ADDITION, VARIOUS STATUS WORDS PERTAINING TO THE JOB IN ERROR  
MAY BE INDICATED IN EITHER "STAT" OR "DATA" REPORTS. THESE STATUS  
WORDS APPEAR BELOW THE HEADER AS FOLLOWS:

SA:NNNN SB:NNNN SC:NNNN SD:NNNN

THERE MAY BE FROM 0 TO 26(10) STATUS WORDS INDICATED DEPENDING ON  
THE MODULE. THE SYMBOLS "SX" WHERE "X" APPEARS IN ALPHABETICAL  
ORDER ARE DEFINED IN THE APPLICABLE MODULE DOCUMENT.

"DATA" ERRORS ALSO INCLUDE A SET OF DATA WORDS FOR EACH SET OF  
FAILING DATA. THE DATA SETS ARE REPORTED AFTER THE "SX" WORDS  
AND ARE PREFIXED BY "DX". AFTER THE FINAL "DX" REPORT, A TALLY  
OF THE NUMBER OF FAILING DATA SETS IS REPORTED.

HERE IS AN EXAMPLE OF A TC01/TC08 DECTAPE WRITE LOCK STATUS ERROR:

STAT ERR IN J01 MOD:TC01DT FLD:0 CNTR:0024 RPC:0423 CODE:0004  
SA:4400 SB:0200 SQ:7001 SD:7001 SE:0200 SF:0200 SG:0000  
SH:2612 SI:0140

BELOW IS AN EXAMPLE OF A DF32 DISK DATA ERROR. SWITCH REGISTER  
BIT 8 WAS SET TO A 1 SO ONLY THE FIRST FOUR FAILING DATA SETS WERE  
REPORTED.

DATA ERR IN J02 MOD:DF32DS FLD:0 CNTR:0141 RPC:0517 CODE:0002  
SA:0310 SB:5610 SQ:7435 SD:0000 SE:5577 SF:6142 SG:0310  
SH:2114 SI:0310 SJ:2457

DA:5600 DB:1274 DC:0000  
DA:5601 DB:3773 DC:0000  
DA:5602 DB:1167 DC:0000  
DA:5603 DB:3557 DC:0000  
TALLY:0343

ALL RECOVERY FOR NON-FATAL JOB ERRORS IS CONTROLLED VIA SR BITS 6-9

### 5.2.2 POWER FAIL ERROR REPORT

-----  
WHEN THE POWER FAIL OPTION DETECTS POWER LOW, THE EXERCISER IS INTERRUPTED (UNLESS IN MONITOR MODE), A RESTART JUMP IS STORED IN LOCATION 00000 AND THE PROGRAM EXECUTES "JMP .". UPON AUTO RESTART, "PF" AND THEN A SYSTEM STATUS REPORT (IF BK AND SR2=0) ARE PRINTED. THE EXERCISER THEN ENTERS MONITOR MODE AND AWAIT'S USER COMMANDS, ABSOLUTELY NO JOBS ARE STARTED OR SERVICED.

### 5.2.3 BUILDER-OS/8 I/O ERROR REPORTS

-----  
IF BUILDER INTERFACES WITH OS/8 AND AN I/O ERROR IS DETECTED, THE FOLLOWING ERROR REPORT MAY OCCUR:

OS/8 ERROR 1AAAA

FOR A DEFINITION OF THIS TYPE OF ERROR, REFER TO THE BUILDER-OS/8 ERROR TABLE ON PAGE 4 IN THE PARTIAL MONITOR/BUILDER PROGRAM LISTING ATTACHED.

OF COURSE, STANDARD OS/8 ERROR MESSAGES MAY BE DISPLAYED BY THE OS/8 SYSTEM, IN THIS CASE REFER TO CURRENT OS/8 DOCUMENTATION FOR INFORMATION.

### 5.3 ERROR HALT RECOVERY PROCEDURES

-----  
WHEN AN ERROR HALT OCCURS, REFER TO THE TABLE BELOW TO FIND THE PROCEDURE TO FOLLOW.

ADDRESS RANGE	MEMORY FIELD	EXERCISER PHASE	REFERENCE PROCEDURE
0000-0177	F	RUN	5.3.1
0200-1177	0	BUILD	5.3.1
1200-1377	F	RUN	5.3.1
1400-3177	0	ANY	5.3.1
1400-3177	1	ANY	5.3.1
3200-3577	F	ANY	5.3.1
3600-4577	F	RUN	5.3.2
4600-5577	F	RUN	5.3.2
5600-6577	0	BUILD	5.3.1
5600-6577	1	BUILD	5.3.1
6600-7177	F	RUN	5.3.2
7200-7577	F	RUN	5.3.2
7600-7777	0	BUILD	OS/8 DOCUMENTATION
7600-7777	1	BUILD	OS/8 DOCUMENTATION

ALL OTHER AREAS ARE UNDEFINED CRASHES.

### 5.3.1 MONITOR OR BUILDER ERROR HALT

-----

TO FIND THE ERROR CAUSE OR DEFINITION AND RECOVERY PROCEDURE, REFER TO THE "TABLE OF ERROR HALTS" ON PAGE 3 OF THE PARTIAL MONITOR/BUILDER LISTING ATTACHED.

### 5.3.2 JOB JFX ERROR HALT

-----

SAVE ALL PERTINENT REGISTER CONTENTS, HALT LOCATION, ETC. NOW "EXAMINE" THE FIRST LOCATION IN THAT JOB SLOT. THIS LOCATION ALWAYS SHOULD CONTAIN THE JOB NUMBER IN BITS 6-11. THEN COMPUTE THE RELATIVE ADDRESS OF THE HALT AS FOLLOWS:

$$(RRRR) = (AAAA) + 200 = (SSSS)$$

WHERE (RRRR) IS THE RELATIVE ADDRESS, (AAAA) THE ABSOLUTE ADDRESS OF THE HALT AND (SSSS) THE FIRST ADDRESS OF THAT JOB SLOT, NOW USING THE RELATIVE ADDRESS REFERENCE THE APPLICABLE MODULE LISTING TO DETERMINE THE CAUSE OF THE ERROR. FOR RECOVERY, RESTART THE EXERCISER AT 03000.

### 5.4 PROGRAM HANG RECOVERY

-----

A PROGRAM HANG MAY OCCUR UNDER ONE OF THE FOLLOWING CONDITIONS:

1. A CONFLICTING SET OF PARAMETERS IS SPECIFIED TO A JOB. FOR INSTANCE, IF RKB DISK DRIVES 0 AND 1 WERE SELECTED FOR EXERCISING BUT THE USER ELECTS TO USE ONLY DRIVE 2 USING ANOTHER PARAMETER. A HANG WILL OCCUR. MOST MODULES DO NOT CHECK FOR PARAMETER CONFLICTS DURING INITIALIZATION. TO RECOVER, SELECT NON-CONFLICTING PARAMETERS.
2. THE NUMBER OF JOBS RUNNING WHICH REQUIRE THE USE OF EXTERNAL BUFFERS EXCEEDS THE NUMBER OF BUFFERS AVAILABLE. TO RECOVER, KILL ENOUGH OF THESE JOBS TO CORRECT THE SITUATION. IT MAY BE NECESSARY TO [C], STOP THE EXERCISER AND THEN RESTART AT 03000.
3. THE HIGHEST PRIORITY JOB THAT USES EXTERNAL BUFFERS HAS BEEN COMMANDED BY THE USER TO USE ONE PARTICULAR BUFFER ONLY, BUT THAT BUFFER IS ALREADY ASSIGNED TO ANOTHER JOB. TO RECOVER, [C], STOP THE EXERCISER, RESTART AT 03000 AND THEN START THE JOB REQUIRING THE FIXED BUFFER. NOW THE OTHER JOBS MAY BE STARTED.

## 5.5 SYSTEM TROUBLESHOOTING (HELPFUL HINTS)

-----

THIS SECTION IS INTENDED TO GIVE THE USER SOME INSIGHT IN HOW TO USE DEC/X8 TO DIAGNOSE SYSTEM PROBLEMS. THIS LIST OF "HELPFUL HINTS" IS BY NO MEANS EXHAUSTIVE. THE INGENIOUS USER WILL DISCOVER MANY MORE METHODS OF HIS OWN.

### 5.5.1 INTERACTIVE PROBLEMS

-----

NOTE: UNDER A HEAVY WORK LOAD, THE DEC/X8 SOFTWARE MAY NOT BE QUITE FAST ENOUGH TO SERVICE DEVICES THAT HAVE CRITICAL TIMING REQUIREMENTS. FOR INSTANCE, TC01/TC08 DECTAPE TIMING ERRORS MAY OCCUR DUE TO SOFTWARE SHORTCOMINGS WHEN MANY INTERRUPT JOBS ARE RUNNING. ALSO DATA REQUEST LATE OR DATA RATE ERRORS MAY OCCUR IF THE PROCESSOR CANNOT ANSWER A BREAK REQUEST IN THE REQUIRED TIME PERIOD. THIS TYPE OF CONDITION MAY BE BROUGHT ABOUT BY RUNNING EAE, OR IF A PARTICULAR MEMORY IS SLOW.

WHEN AN INTERACTIVE PROBLEM IS SUSPECTED TRY ANY OF THE FOLLOWING METHODS:

1. SET SR0=1 (RING MODE QUEUING) TO DEGRADE INTERACTION.
2. RUN SMALL COMBINATIONS OF JOBS TO SEE WHAT COMBINATIONS CAUSE THE PROBLEM. IF A PARTICULAR DEVICE IS IN ERROR, RUN THAT JOB ALONE.
3. CHANGE JOB PARAMETERS TO WHAT SEEMS TO BE THE MOST LIKELY FAILING CONDITION. IF THE ERROR CAN BE MADE TO OCCUR FREQUENTLY, SCOPING WILL YIELD BETTER RESULTS.

### 5.5.2 SYSTEMS SOFTWARE FAILS - DEC/X8 RUNS

-----

SINCE SYSTEMS SOFTWARE MAY USE DIFFERENT INSTRUCTION OR FUNCTION SEQUENCES THAN OCCUR IN DEC/X8, THERE IS A POSSIBILITY THAT DEC/X8 WILL NOT DETECT CERTAIN ERRORS. HOWEVER, IT MIGHT HELP IF THE EXERCISER WERE CONFIGURED SIMILAR TO THE SYSTEMS SOFTWARE IN RESPECT TO FUNCTIONAL LOADS AND MEMORY PLACEMENT. IN ADDITION, IF THE SYSTEM FAILS WHILE RUNNING TIME SHARE SOFTWARE, SR1 CAN BE SET TO A 1 TO UTILIZE THE TIME SHARE HARDWARE.

### 5.5.3 SCOPE LOOPS

-----

ALTHOUGH THERE ARE NO AUTOMATIC SCOPE LOOP FEATURES IN DEC/X8, A TRUE SCOPE LOOP CAN BE APPROACHED THROUGH THE USAGE OF SR 7,8,10 AND 11, AND BY SELECTING CONSTANT JOB PARAMETERS INSTEAD OF ENABLING RANDOM SELECTION.

5.5.4 MEMORY PEEKING VIA THE MQ  
-----

IF THE SYSTEM UNDER TEST HAS EAE OR IS A PDP-8/E SYSTEM, THE MQ  
PEEK FUNCTION CAN BE QUITE HANDY (SR 5=1). AS AN EXERCISE IN THE  
USE OF THE MQ PEEK ABILITY IN A SYSTEM WHICH HAS DECTAPE (TC01/TC08)  
CONSIDER THE FOLLOWING:

DISPLAY THE CURRENT BLOCK NUMBER AS IT BREAKS INTO MEMORY:

```
! [IJFX+]          (INITIALIZE)
TC01DT
A [0]
B [0]
C [1] [0003]
D [1] [2676]
E [0]
F [1] [5610]          (BUFFER 5610 CONSTANT)
```

```
! [+000173] 6201 [6211+]
      00173 6211[+]
      00174 1564 [5600+]
      00174 5600[+]
```

```
! [AR+]          (WITH SR5=1)
! [+E]
```

NOTE: "TC01DT" USES THE FIRST LOCATION IN THE ASSIGNED EXTERNAL  
BUFFER FOR THE CURRENT BLOCK ON TAPE.

THE LIST IS ENDLESS!



/DEC/X8 MONITOR/BUILDER DX8MB REVISION D (13-NOV-74)  
/FAMILY - OF - 8 SYSTEMS EXERCISER (DEC/X8)  
/COPYRIGHT 1972, 1973, 1974, DIGITAL EQUIPMENT CORPORATION, MAYNARD, MASS.  
/FOR THE PDP-8, 8/I, 8/L, 8/E, 8/M, 8/P, PDP-12 (8 MODE INTERRUPTS ONLY),  
/AND ANY FUTURE D, E, C, PROCESSOR WHICH IS BASICALLY PDP-8 FAMILY COMPATIBLE AND AT  
/LEAST AS POWERFUL AS THE TRADITIONAL PDP-8.

/DES-PRG: JOHN VROBEL  
/ DIAGNOSTIC PROGRAMMING GROUP  
/ DIGITAL EQUIPMENT CORPORATION  
/ MAYNARD, MASS. 01754  
/ TK92SAL+

/IFDEF TSILX <XLIST> USED FOR CONDITIONAL XLISTING.

/\*\*\*\*\*

/TABLE OF ERROR HALTS

/-----

/THE FOLLOWING TABLE LISTS ALL ERROR HALTS IN THE DEC/X8 MONITOR/BUILDER.  
/IT IS BROKEN DOWN INTO 3 MAJOR SECTIONS: "HALTS IN FIELD 0",  
/"HALTS IN FIELD 1" AND "HALTS IN ANY FIELD".  
/THE LOCATION OF THE HALT IS INDICATED BY THE OCTAL NUMBER IMMEDIATELY  
/TO THE LEFT OF THE "HLTXXX" TAG.  
/ACCOMPANYING EACH HALT IS A DESCRIPTION OF THE  
/FAILURE AND THE RECOVERY PROCEDURE. ALL HALTS WHICH ARE COMMENTED "/\*"  
/ARE DEPOSIT ERRORS; THESE ERROR HALTS SHOULD HAVE BEEN MODIFIED BY THE PROGRAM  
/TO OTHER INSTRUCTIONS. THE RECOVERY FOR THIS TYPE OF ERROR IS TO RELOAD  
/OR REBUILD THE EXERCISER.

/AFTER ERROR HALTS OTHER THAN THE TYPE MENTIONED ABOVE.  
/A RESTART AT 03000 IS USUALLY SAFE. IF THE EXERCISER WILL NOT PASS THE  
/BUILDING PHASE OR RUN AT ALL AFTER BUILDING, THE BEST METHOD OF  
/DISCOVERING THE PROBLEM IS TO RUN ALL THE BASIC PROCESSOR TESTS  
/AND DEVICE TESTS.

/ERROR HALTS IN FIELD 0

/-----

0220	0001	HLT030	/*
0221	0635	HLT032	/*
0222	0645	HLT033	/TRANSFER FAILURE WHILE LOADING SKELETON SKIP/SERVICE CHAIN /THROUGHOUT MEMORY AS PART OF THE INITIAL LOAD/START SEQUENCE. /DEPRESS CONTINUE TO TRY IT AGAIN. IF FAILURES STILL OCCUR, RUN /ALL OF THE EXTENDED MEMORY DIAGNOSTICS. DATA IS BEING TRANSFERRED FROM /FIELD 0 TO THE FIELD INDICATED /IN THE CDF INSTRUCTION AT LOC /HLT032/ IN FIELD 0, THE FAILING ADDRESS IS IN LOCATION /0000 IN FIELD 0.
0223	0635		
0224	1071	HLT080	/IF BUILDER OUTPUT IS VIA THE #MK-02, PRESS CONT WHEN /READY TO "PUNCH" THE CURRENT FIELD BINARY.
0225	1424	HLT034	/*
0226	1462	HLT035	/*
0227	1522	HLT036	/*
0230	1523	HLT037	/*
0231	1542	HLT038	/*
0232	1624	HLT040	/POWER FAIL OPTION SENSED POWER LOW. "HALT" = WAITING FOR POWER TO GO /DOWN, AND IN TIME RESTART. THIS "HALT" SHOULD NEVER BE NOTICEABLE /BY THE USER UNLESS THE POWER FAIL OPTION OR POWER SUPPLY IS FAULTY.
0233	1666	HLT044	/*
0234	1720	HLT045	/*
0235	1745	HLT041	/MEMORY PARITY FAILURE. FATAL ERROR - RELOAD.
0236	1754	HLT042	/UNACKNOWLEDGED INTERRUPT. THIS ERROR MAY OCCUR UNDER SEVERAL /CONDITIONS: A) A DEVICE BEING EXERCISED INTERRUPTED WHEN /ITS EXERCISER MODULE DID NOT EXPECT AN INTERRUPT; B) NON-EXISTENT /DISK #0 ON DF32/DF32-D SYSTEM WHICH IS ALWAYS FATAL; C) INTERRUPT /FROM UNKNOWN SOURCE.

```

/TO RECOVER, RESTART THE EXERCISER AND COMMAND "E" WITH NO JOBS
/RUNNING, THEN ONE BY ONE ADD JOBS CHECKING FOR THE REPEAT OF
/THE ERROR CONDITION.
0237 2878 HLT046 /*
0240 2876 HLT047 /*
0241 2113 HLT048 /*
0242 2135 HLT049 /*
0243 2167 HLT050 /*
0244 2175 HLT051 /*
0245 2261 HLT052 /*
0246 2313 HLT053 /*
0247 2373 HLT054 /*
0250 2445 HLT055 /*
0251 2710 HLT056 /*
0252 3154 HLT057 /*
0253 3423 HLT058 /*
0254 3535 HLT059 /*
0255 3575 HLT060 /*
0256 5647 HLT079 /*
/IF BUILDER INPUT IS VIA THE PMK-02, PRESS CONT WHEN
/READY TO START TO READ THE MODULE BINARY FROM THE PMK-02,
/BINARY TAPE OR FILE FORMAT ERROR, ILLEGAL FIELD PUNCHES
/AT THE BEGINNING OF TAPE, CHECK TAPE AND/OR READ-IN DEVICE.
/RESTART AT LOC 03000.
0260 5670 HLT061 /*
/AN END OF TAPE CODE (LEVEL 8 ALONE) WAS DETECTED PRIOR TO
/THE MODULE CALL, TO TRY AGAIN, START DEC/X8 AT 03000 AND TRY
/TO INSERT THE MODULE AGAIN. THE PROBLEM MAY BE THE READ-IN DEVICE,
/THE TAPE OR BINARY FILE, OR IF THE MODULE IS NOT ONE OF DEC'S,
/THE MODULE CALLING SEQUENCE MAY BE MISSING FROM THE PROGRAM,
/THE MODULE CURRENTLY BEING INSERTED IS TOO LARGE TO FIT
/IN THE DESIGNATED JOB SLOT, START FROM 03000 AND ASSIGN A 4 PAGE
/JOB SLOT.
0262 5727 HLT063 /*
/THE MODULE TAPE OR FILE CONTAINS MORE THAN
/ONE FIELD STATEMENT OR PUNCHED FRAME. RESTART AT 03000.
0263 5734 HLT064 /*
/THE MODULE CALL IS LONGER THAN 1 PAGE OF MEMORY, CHECK THE LISTING
/FOR THAT MODULE.
0264 5747 HLT065 /*
0265 5752 HLT066 /*
0266 6001 HLT067 /*
/MODULE TAPE OR FILE CHECKSUM FAILURE. TO BE SAFE, REBUILD THE
/EXERCISER FROM SCRATCH. (AC=DIFFERENCE [NON-ZERO] BETWEEN CALCULATED AND REAL CHECKSUMS.)
/IF BINARY FILE JUST LOADED GOOD FROM PMK-02! AC=0000. PRESS
/CONT WHEN READY TO CONTINUE DIALOGUE ON TTY.
0270 6041 HLT068 /*
0271 6150 HLT069 /*
0272 6412 HLT070 /*
0273 6550 HLT071 /*

```

/ERROR HALTS IN FIELD 1

```

-----
0274 1475 HLT001 /*
0275 1505 HLT002 /*
/TRANSFER FAILURE WHILE LOADING PAGE ZERO AND COMMONS
/THROUGHOUT MEMORY. DEPRESS CONTINUE TO TRY IT AGAIN. IF A
/FAILURE STILL OCCURS, RUN ALL OF THE EXTENDED MEMORY DIAGNOSTICS.

```

```

/DATA IS BEING TRANSFERRED FROM FIELD 0 TO THE FIELD INDICATED
/IN THE CDF INSTRUCTION AT LOC
0276 1475 HLT001/ IN FIELD 1. THE FAILING ADDRESS IS IN LOC
0277 1507 HLT001/ IN FIELD 1.
0300 1703 HLT003 /*
0301 2145 HLT072 /*
0302 2147 HLT073 /*
0303 2265 HLT004 /*
0304 2320 HLT005 /*
0305 2412 HLT006 /*
0306 2430 HLT007 /*
0307 2503 HLT010 /*
/ROTATION FAILURE. SUMCHECK ERROR. FATAL = RELOAD.
/THE ROTATION WAS MOVING DATA TO THE FIELD INDICATED
/IN THE CDF INST AT LOCATION
0310 2476 HLT009/ IN FIELD 1 FROM EITHER THE NEXT LOWER FIELD, OR FROM THE
/HIGHEST EXISTENT FIELD IF THE CDF INST IS 0201.
0311 2610 HLT011 /*
/USER MODE BIT IN SAVE FIELD NOT SET, BUT HAD A USER INTERRUPT,
/RESTART AT 03000.
0312 2620 HLT012 /*
0313 2634 HLT013 /*
/ILLEGAL INSTRUCTION BY HARDWARE DEFINITION TRAPPED IN USER
/MODE, THE INST IS IN LOC
0314 2714 HLT014 /*
/USRCL/ IN FIELD 1, RESTART AT 03000
0315 2646 HLT014 /*
/OPR INST TRAPPED IN USER MODE BUT WAS NEITHER HLT NOR OPR TYPE.
/INST IS IN LOC
0316 2714 HLT015 /*
/USRCL/ IN FIELD 1. RESTART AT 03000
0317 2697 HLT015 /*
/HLT OR OPR TYPE OPR INST TRAPPED IN USER MODE AND SKIPPED WHEN
/EXECUTED. SUCH GOINGS ON ARE BEYOND THE SCOPE OF THIS EXERCISER.
/INST IS IN LOC
0320 2714 HLT016 /*
/USRCL/ IN FIELD 1.
0321 3030 HLT016 /*
/ILLEGAL INST BY SOFTWARE DEFINITION TRAPPED IN USER MODE,
/THE INSTRUCTIONS IN THIS CATEGORY ARE: RTF=6005, CAP=6007,
/6200, 6205, 6206, 6207, CNT=6204, RIB=6234, RMP=6244, SINT=6254, CUF=6264
/AND SUF=6274. THE INST IS IN LOC
/USRCL/ IN FIELD 1. MODULE MUST BE CORRECTED,
0322 2714 HLT017 /*
0323 3042 HLT020 /*
0324 3110 HLT074 /*
0325 3544 HLT021 /*
0326 6000 HLT022 /*
0327 6005 HLT023 /*
0330 6007 HLT024 /*
0331 6011 HLT025 /*
0332 6013 HLT026 /*
0333 6015 HLT027 /*
0334 6017 HLT028 /*
0335 6021 HLT029 /*
0336 6023 HLT029 /*

```

/ERROR HALTS WHICH MAY OCCUR IN ANY FIELD

```

-----
0337 0001 HLT030 /*
/PROGRAM "PROBABLY" INTERRUPTED TO THE FIELD IN THE IF INSTEAD OF FIELD 0,
/RESTART AT 03000.

```

0340 1224 /---> /IN THE RANGE STARTING AT  
SKPA+3  
0341 1345 /---> /THROUGH  
SKPD1  
/---> /ALL HALTS ARE DEPOSIT ERRORS AND/OR WILD DEVICE SKIP ERRORS.  
/THIS RANGE INCLUDES THE SKIP/SERVICE CHAIN. RELOAD THE  
/EXERCISER AT LEAST. REBUILDING MAY BE NECESSARY.

/B U I L D E R - P S / 8 E R R O R T A B L E  
/-----

/THE FOLLOWING TABLE LISTS ALL BUILDER - OS/8 ERROR CODES AS REPORTED  
/BY THE ERROR PRINTOUT "OS/8 ERROR 1AAAA". THE ERROR CODE (AAAA) IS  
/INDICATED BY THE OCTAL NUMBER IMMEDIATELY TO THE LEFT OF THE "PSBHTX"  
/TAG. ALL ERRORS LISTED BELOW INDICATE A OS/8 HARDWARE FAILURE. TO RECOVER, REPEAT THE  
/FUNCTION WHICH CAUSED THE ERROR.

0342	6845	PSBHT1	/AN ERROR OCCURRED WHILE ATTEMPTING TO "FETCH" A OS/8 DEVICE /HANDLER FROM THE SYSTEMS DEVICE.
0343	6867	PSBHT2	/AN ERROR OCCURED DURING THE USE OF THE DEVICE HANDLER /SPECIFIED IN THE (+CODEVIFILE=3) COMMAND.
0344	6158	PSBHT3	/AN ERROR OCCURED WHILE WRITING THE EXERCISER CORE CONTROL BLOCK /ON THE SYSTEM SCRATCH AREA DURING A "XP" OPERATION. ENSURE THAT THE SYSTEM DEVICE IS /WRITE ENABLED AND TRY IT AGAIN.

/START OF FIELD 1 ROUTINES

/ALL THE ROUTINES WHICH FOLLOW ARE EXECUTED IF AND ONLY IF  
/THE SYSTEM UNDER TEST HAS AT LEAST 8K OF CORE,

/ROUTINES INCLUDED ARE:

- /A. 8K RESTART (P1INIT)
- /B. STATUS REPORT GENERATOR
- /C. ROTATOR
- /D. TIME SHARE DECODER AND HANDLER.
- /E. OS/8 LOADER LINKAGES

/\*\*\*\*\*  
/THIS CODE IS IN FIELD 1.

```

1473 6201      CDF      00
1474 1707      TAD I    BOBIT      /GET WORD
1475 7402      HLT001. HLT/CDF N
1476 3707      DCA I    BOBIT      /STASH IT.
1477 1707      TAD I    BOBIT      /GET IT BACK,
1500 6201      CDF      00
1501 7041      CIA
1502 1707      TAD I    BOBIT      /COMPARE
1503 7650      SNA CLA
1504 5310      JMP      ,+4
1505 7402      HLT002. HLT
1506 5274      JMP      HLT001-1
1507 0000      BOBIT, 0      /MOVE FAILURE
                                   /TRY AGAIN UPON CONTINUE
                                   /CURRENT LOCATION
    
```

/\*\*\*\*\*

/THIS CODE IS IN FIELD 1

```

2476 7402      HLT009.
2477 4321      ROTA7.  HLT/CDF N
2500 7841      JMS      ROTAS      /SUMCHECK
2501 1411      CIA
2502 7440      TAD I    AUT011      /NEGATE
2503 7402      SRA
                                   /SAME?
                                   /ROTATION FAILURE - SYSTEM IS
                                   /DOWN. RELOAD TO BE SURE,
    
```

/\*\*\*\*\*

/FIELD 0 CODE  
/  
/PAGE ZERO  
/  
0000 \*0

/\*\*\*\*\*  
/THIS CODE IS IN FIELD 0.

/VARIABLES (USER MAY CHANGE)

0173	0201	MQFELD, CDF	00	/MQ ACCESS FIELD (MUST BE A CDF INST)
0174	1564	MQADDR, SRVAL1		/MQ ACCESS ADDRESS
0175	0000	ENQPR1, 0		/PASS COUNTER PRESETS (LEAST SIGNIFICANT)
0176	7777	ENQPR2, =1		/ (MOST SIGNIFICANT)
				/(CHGIC.1)
0177	0017	ROTWRD, 0017		/FIELD 1 ROTATE SLOT SELECT (SETUP FOR
				/RANDOM SLOT ROTATION)
				/THE INDICATED JOB SLOT WILL BE ROTATED
				/THE NUMBER OF TIMES A BIT SET FOR THAT SLOT
				/APPEARS (UP TO 3).
				/SLOT BITS
				/JX1 0,4,8
				/JX2 1,5,9
				/JX3 2,6,10
				/JX4 3,7,11

/\*\*\*\*\*

/THIS CODE IS IN FIELD 0.

0634	1400	TAD I	0	/GET WORD
0635	7402	HLT032, HLT/CDF N		
0636	3400	OCA I	0	/STASH
0637	1400	TAD I	0	/GET IT BACK
0640	0201	CDF	00	
0641	7041	CIA		/COMPARE
0642	1400	TAD I	0	
0643	7630	SNA CLA		
0644	0247	JMP	,+3	
	0645	HLT033,		
0645	7402	ILRELF, HLT		/MOVE FAILURE
0646	0234	JMP	HLT032=1	/TRY AGAIN UPON CONTINUE

/\*\*\*\*\*

3200 0000 /THIS IS IN FIELD 0 AND IS LOADED INTO ALL OTHER FIELDS.  
FILLER, 0 /NUMBER OF NULL FILLER CHARACTERS AFTER CR-LF.

/\*\*\*\*\*