

SOFTWARE COVER SHEET

APPLICATION				REVISION	
TOP ASSY	PROD LINE	APPROVED	DATE	DESCRIPTION	REV
	PDS	<i>[Signature]</i>	2/1/78	INITIAL RELEASE - 777	A
		<i>[Signature]</i>	1-19-79	DCM # IMP - 3094	A'
		<i>[Signature]</i>	2-9-79	DCM # IMP - 3119	B
		<i>B. Eldredg.</i>	4/14/80	DCM # 3497	C

CLASSIFICATION

FIRMWARE

SOFTWARE

PROGRAM FORMAT TEST PROCEDURE

ORIGINATOR	DATE	TITLE
<i>B. A. V. [Signature]</i>	2/31/78	COPS SOFTWARE PACKAGE
<i>[Signature]</i>	9/7/78	
<i>[Signature]</i>	9/7/78	
<i>[Signature]</i>	9/7/78	

PROG NO 440305834 REV C

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1. OVERVIEW:

THIS IS A DETAILED DESCRIPTION OF PDS SOFTWARE, INCLUDING A DESCRIPTION OF THE FUNCTION OF EACH PROGRAM.

SEE THE INDIVIDUAL 43030XXXX DOCUMENTATION FOR FURTHER DETAILS OF THE PROGRAMS.

NAME	DESCRIPTION AND ERRORS
FM	FILE MANAGER PROGRAM FOR LISTING DISK DIRECTORIES, COPYING FILES, ETC.
EDIT	TEXT EDITOR FOR EDITING TEXT FILES
ASM	COP CROSS ASSEMBLER
DSKIT	DISK INITIALIZATION AND TEST PROGRAM
CLIPMON	COP MONITOR PROGRAM FOR LOADING AND ALTERING SHARED MEMORY, MAKING PROMS, SINGLE STEPPING, BREAKPOINTING, AND TRACING COP CHIPS, ETC.
LIST	LISTS FILES ON CONSOLE OR PRINTER
XREF	GENERATES CROSS REFERENCE LISTING OF COP LABELS FROM SOURCE FILE.
MASKTR	GENERATES A DISK FOR TRANSFER OF CUSTOMER DEVELOPED PROGRAMS TO NSC FOR MASK GENERATION.
MDIAG	MEMORY DIAGNOSTIC FOR PDS SYSTEM.

THERE ARE SIX (6) INCLUDE FILES WHICH ARE INCLUDED IN ALL PROGRAMS FOR THE PDS SYSTEM. THEY ARE:

- 1) .INCLD LST
- 2) .INCLD MACLIB
- 3) .INCLD GENERAL
- 4) .INCLD SYSRAM
- 5) .INCLD HWADDR
- 6) .INCLD ENTRY

THE INCLUDES DEFINE ALL THE GENERALLY USED DEFINITIONS, ALL THE LIST DIRECTIVES, THE HARDWARE ADDRESSES, THE ENTRY POINTS OF ALL UTILITY PROGRAMS, THE RESERVED MEMORY LOCATIONS AND THE GENERALLY USED MACROS.

ALL PDS PROGRAMS ARE SET UP IN THE FORMAT



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SHOWN BELOW. THE MACROS DEFINED IN MACLIB AND ENTRY
USE INFORMATION FROM THE FORMAT TO ASSIGN THE PROPER
REV LEVEL, PROGRAM NAME, DESCRIPTION, CHANGES SINCE
LAST REVISION, AND ENTRY POINTS TO THE PROGRAMS.

OTHER MACROS ASSIGN BASE PAGE VARIABLES
START OF BASE PAGE, END OF BASE PAGE, BEGINNING
OF PROGRAM, END OF PROGRAM, ASSIGNMENT OF SYSRAM
LOCATIONS.

```
.LIST      OFFFF
.INCLD    LST
.INCLD    MACLIB
.NAME     NEWNAME, SOFT, POXXXX, 'TODAYS DATE', A
; (NONE)
; EDIT LINE 4, AND DELETE THIS LINE

; DESCRIPTION OF PROGRAM:
; ADD YOUR OWN DESCRIPTION
;
. INCLD   GENERAL
. PAGE   'ADDITIONAL CONSTANT DEFINITIONS'
; DEFINE YOUR OWN CONSTANTS
;
. INCLD   SYSRAM
. INCLD   HWADDR
. INCLD   ENTRY

ENTRY POINTS TO UTILITY ROUTINES

START OF BASE PAGE
;
; BASE PAGE VARIABLES GO HERE
;
END OF BASE PAGE

START OF PROGRAM

; FIRST LINE OF PROGRAM, MUST BE ENTRY LINE. THE NAME IN LINE
; 4 IS AUTOMATICALLY MADE A LABEL HERE, LOCATION 100
; THE REST OF YOUR PROGRAM GOES HERE

END OF PROGRAM

.END     NEWNAME

; EDIT THE .END LINE, USE YOUR PROGRAM NAME

2. CONVENTIONS AND STANDARDS:
```



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THE FOLLOWING VARIABLES CONTROL THE LISTING OF INCLUDE FILES, ETC. THESE LIST PARAMETERS ARE USED AS INCLUDES IN ALL PDS PROGRAMS. (.INCLD LST)

NACLIB	=	001	MACLIB LIST
GENERAL	=	001	; GENERAL LIST
SYSRAM	=	001	; SYSRAM LIST
HWADDR	=	001	; HWADDR LIST
ENTRY	=	001	; ENTRY LIST
COPCOM	=	001	; COPCOM LIST
PROM	=	021	; PROM LIST
PUTCMD	=	021	; PUTCMD LIST
FRMEP	=	001	; FIRMWARE ENTRY POINT LIST
FRMEJ	=	001	; FIRMWARE ENTRY JUMP LIST
XBTD	=	021	; BREAKPOINT/TRACE LIST
ELAPTI	=	021	; ELAPSED TIME LIST
XFPIN	=	021	; COPMON FP, I/O LIST
MODCOP	=	021	; MODIFY LIST
UNASM	=	021	; UNASM LIST
XLIST	=	001	; OTHER LIST

.MSTAT 0 ; NO MICRO EXPANSION

.PAGE 'ASSIGNMENT OF CONSTANTS'
 THE FOLLOWING .INCLUDE FILE DEFINES MOST OF THE GENERALLY USED EQUATES IN ALL PDS PROGRAMS THE FILE IS INCLUDED IN ALL PDS PROGRAMS. (.INCLD GENERAL)

GENERAL REGISTERS

AC0	=	0
AC1	=	1
AC2	=	2
AC3	=	3
R0	=	AC0
R1	=	AC1
R2	=	AC2
R3	=	AC3

CONDITIONAL CODES FOR THE BOC INSTRUCTION

INT	=	0	; INTERRUPT LINE EQUAL TO ONE
ZRO	=	1	; AC0 EQUAL TO ZERO
POS	=	2	; AC0 IS POSITIVE OR ZERO



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```

BIT0 = 3 ; BIT 0 OF ACO IS ONE
BIT1 = 4 ; BIT 1 OF ACO IS ONE
NZRO = 5 ; ACO NOT EQUAL TO ZERO
CPINT = 6 ; CONTROL PANEL INTERRUPT
STFL = 8 ; STACK FULL LINE EQUAL ONE
INEN = 9 ; INTERRUPT ENABLE EQUAL ONE
CRY = 10 ; CARRY EQUAL TO ONE
OVFL = 10 ; OVERFLOW EQUAL TO ONE
LEZ = 11 ; ACO LESS OR EQUAL TO ZERO
SERBIT = 12 ; CONSOLE INPUT FOR BAUDET
SELT = 13 ; SEL FLAG SET
NRDY = 14 ; DISK DATA NOT READY

```

CONTROL FLAGS

```

INTEN = 1 ; INTERRUPT ENABLE
SEL = 2 ; SELECT FLAG FOR SHIFTS

```

STATUS FLAGS

```

CY = X'2000 ; CARRY BIT
OV = X'4000 ; OVERFLOW BIT
L = X'8000 ; LINK BIT FOR SHIFTS

```

ASCII CHARACTER DEFINITIONS

```

CR = X'D ; CARRIAGE RETURN
LF = X'A ; LINE FEED
CNTLA = X'1 ; CONTROL/A
SHFTO = X'5F ; SHIFT/O (BACK ARROW ON TTY)
NULL = X'0
ESCAPE = X'1B
RURDOUT = X'7F
B = X'20 ; BLANK OR SPACE
; FOR SOURCE FILES)

```

PROMPT CHARACTERS USED BY EACH MAIN PROGRAM IN CDS

```

ZASM = 'A>' ; ASM
ZCOPMON = 'C>' ; COPMON
ZDSKIT = 'D>' ; DSKIT
ZEDIT = 'E>' ; EDIT
ZFM = 'F>' ; FM
ZPATCH = 'H>' ; PATCH
ZCDSASM = 'I>' ; CDSASM
ZLINK = 'K>' ; LINK
ZLIST = 'L>' ; LIST
ZNDJAG = 'M>' ; MEMORY DIAGNOSTICS

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```

ZPROMPT =      'P>'      ; PROMPT
ZXREF   =      'R>'      ; XREF
ZMASKTR =      'T>'      ; MASK TRANSFER
ZEXEC   =      'X>'      ; EXEC

```

ALL DISK FILE OPERATIONS MAKE USE OF A 'FILE STATUS TABLE' (FST) WHICH DEFINES THE VOLUME NAME, FILE NAME, FILE MODIFIER, ETC. OF A FILE. FOLLOWING IS A DEFINITION OF THE CONTENTS OF THE FST:

```

FSV1    =      0      ; VOLUME NAME, SUPPLIED BY
FSV2    =      1      ; ROUTINE 'PGFR'
FSV3    =      2
FSV4    =      3
FSN1    =      4      ; FILE NAME, SUPPLIED BY
FSN2    =      5      ; ROUTINE 'PGFR'
FSN3    =      6
FSN4    =      7
FSM1    =      8      ; FILE MODIFIER, SUPPLIED BY
FSM2    =      9      ; ROUTINE 'PGFR', DEFAULT
          ; SUPPLIED BY USER BEFORE
          ; CALLING PGFR
FSIT    =      9      ; INTERNAL TYPE (BITS 0-7)
          ; SUPPLIED BY USER. IF = 0,
          ; ROUTINE 'DISER' RETURNS
          ; ACTUAL INTERNAL TYPE IF
          ; FILE IS FOUND
FSPL    =      10     ; PROTECT LEVEL (BITS 12-15)
          ; SUPPLIED BY USER WHEN
          ; FILE IS CREATED.
          ; OTHERWISE IT IS NOT USED.
FSCT    =      11     ; CHANNEL TABLE ADDRESS
          ; SUPPLIED BY 'OPEN'
          ; ROUTINES
FSBA    =      12     ; BUFFER ADDRESS, SUPPLIED
          ; BY USER (256 WORDS)
FSST    =      13     ; DISK I/O STATUS, RETURNED
          ; WHEN ERROR OCCURS, SEE
          ; DISKIO STATUS RETURN CODES
          ; BELOW FOR DETAILS ON LEFT
          ; BYTE. SEE FIOSYS ERROR
          ; CODES BELOW FOR DETAILS
          ; ON RIGHT BYTE.
FSVN    =      14     ; FILE VERSION NUMBER,
          ; SUPPLIED BY 'DISER',
          ; INCREMENTED BY 'OPENW' OR
          ; 'OPENM'

```

FILE STATUS TABLE SIZE



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FSSIZE = 15 ; WORDS/FILE STATUS TABLE

WHEN A FILE IS OPENED BY ANY OF THE ROUTINES 'OPENR', 'OPENW' OR 'OPENM', AN INTERNAL TABLE IS ASSIGNED TO THE FST. THIS INTERNAL TABLE, CALLED A 'CHANNEL TABLE' (CT), IS USED FOR ALL DISK READ AND WRITE OPERATIONS. A MAXIMUM OF 5 CHANNEL TABLES ARE ALLOWED AT ONE TIME. WHEN A FILE IS CLOSED BY THE 'CLOSE' ROUTINE, ITS CHANNEL TABLE(S) IS RELEASED, MAKING IT AVAILABLE FOR THE NEXT 'OPEN' OPERATION. FOLLOWING ANY DISK READ OR WRITE OPERATION, THE DISK I/O STATUS IS INDICATED IN BOTH THE FST AND THE CHANNEL TABLE. FOLLOWING IS A DEFINITION OF THE CONTENTS OF THE CT:

CTCY	=	0	; CHANNEL TABLE ADDRESS
CTV1	=	1	; VOLUME NAME
CTV2	=	2	
CTV3	=	3	
CTV4	=	4	
CTN1	=	5	; FILE NAME
CTN2	=	6	
CTN3	=	7	
CTN4	=	8	
CTN1	=	9	; FILE MODIFIER
CTN2	=	10	
CTFC	=	10	; FLAGS (BITS 0-7), SEE ; CHANNEL TABLE FLAGS BELOW ; (INDICATE OPEN FOR READ, ; WRITE, OR MODIFY)
CTBS	=	11	; BEGINNING SECTOR
CTLS	=	12	; LAST SECTOR OPERATED ON
CTBP	=	13	; BUFFER POINTER
CTOP	=	14	; DISK I/O COMMAND
CTNS	=	15	; NEXT SECTOR
CTBA	=	16	; BUFFER ADDRESS
CTST	=	17	; DISK I/O STATUS

CHANNEL TABLE SIZE

CTSIZE = 18 ; WORDS/CHANNEL TABLE

CHANNEL TABLE FLAGS

RD	=	1	; READ STATUS FLAG
WR	=	2	; WRITE STATUS FLAG
MD	=	4	; MODIFY STATUS FLAG

MAXIMUM NUMBER OF CHANNEL TABLES



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MAXCHN = 5

EACH DISKETTE HAS A TABLE, LOCATED IN SECTOR 0, CALLED THE 'NEXT SECTOR TABLE', OR 'NST'. THE FIRST 154 WORDS OF THIS TABLE ARE LINKS TO THE NEXT LOGICAL EXTENT OF THE DISKETTE. AN EXTENT IS A GROUP OF 4 CONSECUTIVE SECTORS WHOSE SECTOR ADDRESS IS THE SAME EXCEPT FOR THE LAST TWO BITS. THERE ARE 154 EXTENTS ON EACH DISKETTE. THESE EXTENTS ARE NOT USED IN CONSECUTIVE ORDER, BUT RATHER ARE ASSIGNED TO INDIVIDUAL FILES AS THEY ARE NEEDED. THE NST DEFINES THE ORDER THAT EXTENTS ARE TO BE ACCESSED IN WHEN ACCESSING A FILE. THE NST ALSO CONTAINS THE DIRECTORY ADDRESS AND DISKETTE VOLUME NAME AND HEADER STRING. FOLLOWING ARE DEFINITIONS OF THESE TERMS:

NSTDF	=	154	;	155TH WORD OF NST IS FIRST
			;	DIRECTORY SECTOR NUMBER
NSTVOL	=	155	;	START OF DISK VOLUME NAME
NSTV1	=	0	;	VOLUME NAME OFFSETS
NSTV2	=	1		
NSTV3	=	2		
NSTV4	=	3		
NSTHDR	=	159	;	START OF DISK HEADER STRING

DISK HEADER STRING LENGTH

HDRLEN	=	40	;	HEADER IS 40 CHARS MAXIMUM
--------	---	----	---	----------------------------

NST SIZE

NSTSIZ	=	179	;	WORDS USED BY NST
--------	---	-----	---	-------------------

EACH DISKETTE HAS A DIRECTORY CONTAINING INFORMATION ABOUT BAD AND AVAILABLE SECTORS, AND FILE DATA FOR EACH FILE ON THE DISKETTE. FOLLOWING IS A DESCRIPTION OF THE DIRECTORY FORMAT:

DRV1	=	1	;	2ND WORD OF DIRECTORY IS
DRV2	=	2	;	START OF DISK VOLUME NAME
DRV3	=	3		
DRV4	=	4		
BSF	=	6	;	FIRST BAD SECTOR
BSL	=	7	;	LAST BAD SECTOR
BSCNT	=	8	;	BAD SECTOR COUNT
NAS	=	16	;	NEXT AVAILABLE SECTOR
LAS	=	17	;	LAST AVAILABLE SECTOR
ASCNT	=	18	;	AVAILABLE SECTOR COUNT



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```

DRF      =      26      ; DIRECTORY STARTING SECTOR
DRL      =      27      ; DIRECTORY ENDING SECTOR
DRCNT    =      28      ; DIRECTORY SIZE (SECTORS)
DRFE     =      30      ; FIRST FILE ENTRY IN
                        ; DIRECTORY STARTS AT THE
                        ; 31ST WORD AND HAS A FORMAT
                        ; AS SHOWN BELOW.

```

EACH FILE HAS AN ENTRY IN THE DISKETTE DIRECTORY. THE ENTRY IS CREATED WHEN THE FILE IS 'CLOSED' FOR THE FIRST TIME. THE FORMAT OF EACH ENTRY IS AS FOLLOWS:

```

DRN1     =      0      ; FILE NAME
DRN2     =      1
DRN3     =      2
DRN4     =      3
DRM1     =      4      ; FILE MODIFIER
DRM2     =      5
DRIT     =      5      ; INTERNAL TYPE (BITS 0-7)
DRBS     =      6      ; STARTING SECTOR NUMBER
DRES     =      7      ; ENDING SECTOR NUMBER
DRDF     =      8      ; DELETE FLAG CODE (BIT 15)
DRPL     =      8      ; PROTECT LEVEL (BITS 11-14)
DRTS     =      8      ; TOTAL # SECTORS USED (BITS
                        ; 0-9)
DRVN     =      9      ; FILE VERSION NUMBER

```

THE END OF THE DIRECTORY IS INDICATED BY A VALUE FOR DRN1 OF X'FFFF. THE NEXT SECTOR TABLE MARKS THE END OF THE BAD SECTOR LIST, THE END OF THE FREE SECTOR LIST, AND THE END OF EACH FILE WITH A SECTOR NUMBER OF X'FFFF.

DIRECTORY ENTRY SIZE

```

DESIZ    =      10      ; WORDS/DIRECTORY ENTRY
DEPS     =      25      ; DIRECTORY ENTRIES PER SECTOR

```

SPECIAL DISK FILE DEFINITIONS

```

FS       =      X'1C    ; FILE SEPARATOR (EOF MARK)

```

INTERNAL TYPE CODES FOR FILES

```

ITUNIV   =      0      ; UNIVERSAL
ITLM     =      1      ; LOAD MODULE
ITMP     =      2      ; MAIN PROGRAM
ITOV     =      3      ; OVERLAY

```



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```

JTBL      =      4      ; BLOCK
JTSYM     =      5      ; SYMBOLIC
JTSYT     =      6      ; SYSTEM
J1DATA    =      7      ; DATA

```

FLOPPY DISK SPECIFICATIONS

```

TRACKS    =      77     ; 77 TRACKS/DISKETTE
SECTORS   =      8     ; 8 SECTORS/TRACK
EXTENT    =      4     ; 4 SECTORS/EXTENT
SECTSZ    =     256    ; 256 WORDS/SECTOR

SHIFT     =      2     ; EXTENT = 2**SHIFT

SYNC      =     X'AAAA  ; DISK SYNC WORD

DSKADR    =     X'7D06  ; DISK HARDWARE ADDRESS
DRESET    =     X'7D02  ; ADDRESS FOR MASTER RESET

DSKSTAT   =      0     ; STATUS OFFSET FROM DISK ADR
DSKDATA   =     -1     ; DATA OFFSET FROM DISK ADR

```

DISK I/O PARAMETER LIST DEFINITIONS

```

OPCODE    =      0     ; READ/WRITE COMMAND (BELOW)
PSECT     =      1     ; PHYSICAL SECTOR
BUFADR    =      2     ; BUFFER ADDRESS
STATUS    =      3     ; DISK STATUS RETURN

```

DISK I/O PARAMETER LIST SIZE

```

PLSIZE    =      4     ; WORDS/PARAMETER LIST

```

DISK I/O COMMANDS

```

WCODE     =      1     ; OPCODE FOR DISK WRITE
RCODE     =      2     ; OPCODE FOR DISK READ

```

MAXIMUM ALLOWED NUMBER OF BAD SECTORS WHEN INITIALIZING A DISKETTE

```

BSMAX     =      150

```

DISK INTERFACE STATUS SIGNAL DEFINITIONS

```

D1ROPN    =     X'B    ; DRIVE DOOR WAS OPENED

```



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ROUTINES 'DISK1' AND 'DISK2' IN DISKIO RETURN A STATUS CODE WORD IN THE PARAMETER LIST ('STATUS'), WHICH DESCRIBES THE RESULTS OF THE DISK I/O OPERATION. THIS STATUS WORD HAS THE FOLLOWING FORMAT:

UPPER BYTE = TOTAL NUMBER OF ERRORS ENCOUNTERED
 LOWER BYTE = DISKIO STATUS RETURN CODE

DISKIO STATUS RETURN CODE BIT DEFINITIONS:

NOERR	=	1	;	NO ERRORS
DNRDY	=	2	;	DRIVE NOT READY
ADDRER	=	4	;	ADDRESSING ERROR
MISYNC	=	8	;	MISSING SYNC/WRITE PROTECT
WRERR	=	16	;	WRITE ERROR (NO CRC VERIFY)
RDERR	=	32	;	READ ERROR (NO CRC VERIFY)
CNDR	=	64	;	ILLEGAL DISK COMMAND

FLOSYS ERROR CODE DEFINITIONS

ER01	=	X'01	;	WRONG DISKETTE VOLUME
ER02	=	X'02	;	DISK FULL, DIRECTORY FULL
ER03	=	X'03	;	UNABLE READ NST
ER04	=	X'04	;	UNABLE TO ACCESS DIRECTORY
ER05	=	X'05	;	UNABLE TO WRITE DIRECTORY
ER06	=	X'06	;	DIR DOES NOT MATCH NST
ER07	=	X'07	;	DRIVE NOT ACTIVE
ER08	=	X'08	;	ATTEMPT TO READ PAST THE END OF THE DIRECTORY
ER09	=	X'09	;	INVALID CHANNEL TABLE
ER10	=	X'10	;	FILE NOT OPEN FOR READ
ER11	=	X'11	;	DISK READ ERROR ON FILE
ER12	=	X'12	;	ATTEMPT TO READ PAST EOF
ER13	=	X'13	;	FILE ALREADY OPEN
ER14	=	X'14	;	FILE NOT FOUND
ER15	=	X'15	;	NO CHANNEL TABLE AVAILABLE
ER16	=	X'16	;	FILE NOT OPEN FOR WRITE
ER17	=	X'17	;	ATTEMPT TO READ/WRITE PAST THE END OF THE DISK
ER18	=	X'18	;	DISK WRITE ERROR ON FILE
ER19	=	X'19	;	FILE NOT OPEN FOR MODIFY
ER20	=	X'20	;	NO PERMISSION TO DEL FILE
ER21	=	X'21	;	NO PERMISSION TO MOD FILE
ER22	=	X'22	;	UNABLE TO UPDATE NST
ER23	=	X'23	;	UNABLE TO FIND END OF DIR
ER24	=	X'24	;	SYNTAX ERROR IN FILE NAME
ER25	=	X'25	;	TOO MANY VOLUMES
ER26	=	X'26	;	ILLEGAL DEVICE



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NUMERRS = X'26 ; NUMBER OF ERROR CODES

DEFAULT PARAMETERS FOR COP DEVELOPMENT SYSTEM:

DEFAULT TAB STOPS

DTAB1 = 9
DTAB2 = 17
DTAB3 = 33

CARRIAGE WIDTHS

DWIDTH = 72 ; INITIAL WIDTH
NMWIDTH = 10 ; MINIMUM WIDTH
MXWIDTH = 80 ; MAXIMUM WIDTH

SERIAL I/O PARAMETER AND CONTROL WORDS

PMODE = OFA ; 150/9600 PARITY MODE WORD
NPMODE = OEE ; 150/9600 NO PARITY MODE
PTMODE = OFE ; 110 PARITY MODE WORD
NPTMOD = OEE ; 110 NO PARITY MODE WORD
UCMND1 = 037 ; UART CMND WORD
RS32 = RSBAUD/32 ; RS232 TYPE/32
TY32 = TYBAUD/32 ; CUR LOOP TYPE/32
CRDL30 = 200 ; 150/300 BAUD CR/LF DEFAULT
LFDL30 = 40 ; DELAYS IN MILLISECONDS,
; START UP ONLY

INITIAL CONSOLE SET UP PARAMETERS

DCNBD = 9600 ; BAUD RATE
DCNTYP = RS32 ; TYPE
DCNMOD = NPMODE ; MODE

INITIAL PRINTER SETUP PARAMETERS

DPRBD = 1200 ; BAUD
DPRYP = RS32 ; TYPE
DPRMOD = NPMODE ; MODE

PERIPHERAL DEVICE MNEMONICS

MNENPT = 'PT' ; PAPER TAPE



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MNEMCN = 'CN' ; CONSOLE
MNEMPR = 'PR' ; PRINTER

PERIPHERAL DEVICE CODES

PTDEV = X'2 ; PAPER TAPE
CNDEV = X'4 ; CONSOLE
PRTDEV = X'8000 ; PRINTER

DEFAULT COP CHIP NUMBER

DCHIP = X'420

INITIAL VALUES FOR TARGET CARD FLAGS

DICTAC = 0 ; TCTAC
DCNTR = 0 ; DCNTR
DBPFLG = 0 ; BPFLG
DFLAGS = 2 ; FLAGS
DBPDEX = 0 ; BPDEX

MAXIMUM NUMBER OF BREAKPOINTS ALLOWED IN COPMON

NBRCON = 10

THE FOLLOWING INCLUDE FILE CONTAINS MOST OF
THE MACROS USED BY THE PDS PROGRAMS. (. INCLD MACLIB)

.PAGE 'MACRO DEFINITIONS'

```
;  
; MACRO FOR GENERATING COMMENTS AND ASSIGNING PROGRAM NAME  
;  
.MACRO .NAME, MNAME, MWARE, PARTNUM, MDATE, MREV  
.MICRO PGMNM, 1, 8, *MNAME*  
.MICRO PGMREV, 1, 1, *MREV*  
.LIST XLIST!OD  
;  
.TITLE MNAME, 'PARTNUM^MREV MDATE'  
;  
; PROGRAM NAME: MNAME  
;  
; SOURCE LANGUAGE OF THIS PROGRAM: IMP MACRO-CROSS-ASSEMBLER  
; RUNNING ON PAGE.  
;  
; OBJECT LANGUAGE OF THIS PROGRAM: IMP16C/200A MACHINE CODE  
;
```



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```

; MNAME IS A MWARE^WARE PROGRAM WHICH IS INTENDED FOR USE
; WITH THE NATIONAL SEMICONDUCTOR 'COP DEVELOPMENT SYSTEM'
; (CDS), WHICH CONTAINS AN IMP16C/200A MICROCOMPUTER BOARD.
; FOR ADDITIONAL INFORMATION ON THIS DEVELOPMENT SYSTEM, SEE
; 'COP DEVELOPMENT SYSTEM USER'S MANUAL'.
;
; REVISION LEVEL (A=NO REVISIONS, B=FIRST REVISION, ETC.): MREV
;
; DATE OF THIS REVISION: MDATE
;
; FOLLOWING IS A SUMMARY OF THE REVISIONS MADE IN EACH
; REVISION LEVEL OF THIS PROGRAM FOLLOWING REVISION A:
;
; .LIST XLIST
; .ENDM
;
; MACRO FOR GENERATING PROGRAM PROMPT AND SIGNON LINE
;
; .MACRO PRINT,STRING
; .MSTAT 1
; .IFC 'STRING' EQ 'SIGNON'
MESSAGE 1, "PGNNM",REV:"PGMREV", "PGMDAT"
OUTPUT 'NEW LINE'
; .ELSE
; .IFC 'STRING' EQ 'PROMPT'
OUTPUT 'NEW LINE'
JSR CNSTUP
LD ACO, .+3
JSR PUT2C
JMP .+2
; .WORD Z^"PGNNM"
; .ELSE
; .ERROR 'PRINT'
; .ENDIF
; .ENDIF
; .MSTAT 0
; .ENDM
;
; MACRO FOR SETTING START OF BASE PAGE AND PROGRAM
;
; .MACRO START,DUMMY,MBP
; .MSTAT 1
; .LIST XLIST!OD
; .IFC 'MBP' EQ 'BASE'
; .PAGE 'BASE PAGE DEFINITIONS'
; .ASECT
;
; .=010 ; BASE PAGE STARTS AT 010
; .ELSE
; .IFC 'MBP' EQ 'PROGRAM'
; .PAGE 'START OF PROGRAM'
; .LOCAL

```



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```

.ASECT
;
;=0100 ; PROGRAM STARTS AT 0100
;
"PGMMN":
.ELSE
.ERROR 'START'
.ENDIF
.ENDIF
.LIST XLIST
.MSTAT 0
.ENDM
;
; MACRO FOR SETTING END OF BASE PAGE AND PROGRAM
;
.MACRO END, DUMMY, MBP
.IFC 'MBP' EQ 'BASE'
EASECT= ; SAVE LOC CTR FOR USE BELOW
.ELSE
.IFC 'MBP' EQ 'PROGRAM'
.BSECT ; SET UP BASE PAGE LOC CTR
.=. +EASECT
.MSTAT 1
.ELSE
.ERROR 'END'
.ENDIF
.ENDIF
.ENDM
;
; MACRO FOR OUTPUT CHARACTER ROUTINE
;
.MACRO OUTPUT, STRING
.IFC 'STRING' EQ 'NEW LINE'
JSR CRLF
.ELSE
.IFC 'STRING' EQ ' '
LI ACO, 6
JSR PUTB
.ELSE
.IFC 'STRING' EQ ' '
LI ACO, 5
JSR PUTB
.ELSE
.IFC 'STRING' EQ ' '
LI ACO, 4
JSR PUTB
.ELSE
.IFC 'STRING' EQ ' '
LI ACO, 3
JSR PUTB
.ELSE

```



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```

        . MICRO    LONG, 9, 1, *STRING*
        . IFC      '"SHORT"' EQ ''
        . ERROR    'STRING TOO SHORT'
        . ELSE
        . IFC      '"LONG"' NE ''
        . ERROR    'STRING TOO LONG'
        . ELSE
        JMP        OUTPUT

MESS:
        . ASCII   'STRING'
OUTPUT:
        JSR      FPOUT
        . WORD    MESS
        . ENDIF
        . ENDIF
        . MDEL    SHORT, LONG
        . MSTAT   0
        . ENDM

;
; MACRO FOR FRONT PANEL MESSAGE WITH DECIMAL POINT
;
        . MACRO   COPPNL, PSTR
        . MLOC    MESS, OUTPUT
        JMP      OUTPUT
MESS:
        . PNLASC 'PSTR'
OUTPUT:
        JSR      MSGOUT
        . WORD    MESS
        . ENDM

;
; MACRO FOR ERROR MESSAGE TO CONSOLE AND FRONT PANEL
;
        . MACRO   CPMSG, ST1, ST2
        . MLOC    MESS
        JSR      MSGOUT
        . WORD    MESS
        ERROR    'ST2'
MESS:
        . PNLASC 'ST1'
        . ENDM

;
; MACRO FOR DISK I/O
;
        . MACRO   WAIT, STRING
        . IFC      'STRING' EQ 'UNTIL DATA IS READY'

        BOC      NRDY, .

        . ELSE
        . IFC      'STRING' EQ 'UNTIL DATA HAS CLEARED'

        BOC      NRDY, . +2
        JMP      . -1

```



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```
. ELSE
. ERROR 'WAIT'
. ENDIF
. ENDIF
. ENDM
```

```
;
; MACROS FOR THE REFERENCED FIOSYS UTILITY ROUTINES
;
```

```
. MACRO CLEAR
JSR CLRHS ; CLEAR HARDWARE STACK
. ENDM
```

```
. MACRO RESET
JSR RESETD ; RESET DISK STATUS
. ENDM
```

```
. MACRO REPORT
LD AC2,=#4
JSR DERROR ; REPORT DISK ERRORS
. ENDM
```

```
. MACRO SEARCH
JSR DISER ; DIRECTORY FILE SEARCH
JMP DSKERR ; (?? DISK ERRORS ??)
JMP DSKERR ; (FILE NOT FOUND)
. ENDM
```

```
. MACRO OPEN
LD AC2,=#2
. IFC '#4' EQ 'READ'
JSR OPENR ; OPEN FILE FOR READ
. ELSE
. IFC '#4' EQ 'WRITE'
JSR OPENW ; OPEN FILE FOR WRITE
. ELSE
. IFC '#4' EQ 'MODIFY'
JSR OPENM ; OPEN FILE FOR MODIFY
. ELSE
. ERROR 'OPEN'
. ENDIF
. ENDIF
. ENDIF
JMP DSKERR ; DISK ERRORS
. ENDM
```

```
. MACRO CLOSE
LD AC2,=#2
JSR CLOSE ; CLOSE FILE
JMP DSKERR ; DISK ERRORS
. ENDM
```

```
. MACRO READ
```



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```

LD      AC2,=#4
.IFC   '#1' EQ 'SECTOR'
JSR    RCSECT      ; READ NEXT SECTOR OF FILE
.ELSE
.IFC   '#1' EQ 'WORD'
JSR    RWORD      ; READ NEXT WORD FROM FILE
.ELSE
.ERROR 'READ'
.ENDIF
.ENDIF
JMP    DSKERR      ; DISK ERRORS
.IFC   '#1' EQ 'WORD'
.IFC   '#5' EQ '8'
AND    ACO,=OFF    ; LM WORDS ARE 8 BITS ONLY
.ENDIF
.ENDIF
.ENDM

;

.MACRO WRITE
LD      AC2,=#4
.IFC   '#1' EQ 'SECTOR'
JSR    WCSECT      ; WRITE NEXT SECTOR FILE
.ELSE
.IFC   '#1' EQ 'WORD'
JSR    WWORD      ; WRITE NEXT WORD TO FILE
.ELSE
.ERROR 'WRITE'
.ENDIF
.ENDIF
JMP    DSKERR      ; DISK ERRORS
.ENDM

;

.MACRO DELETE,AFST
LD      AC2,=#2
JSR    DELF        ; DELETE FILE
JMP    DSKERR      ; DISK ERRORS
.ENDM

;

.MACRO DIRECTORY
.IFC   '#1' EQ 'READ'
.IFC   '#2' EQ 'FIRST'
JSR    DIRF        ; READ FIRST DIRECTORY SECTOR
.ELSE
.IFC   '#2' EQ 'NEXT'
JSR    DIRN        ; READ NEXT DIRECTORY SECTOR
.ELSE
.ERROR 'DIRECTORY'
.ENDIF
.ENDIF
.ELSE
.IFC   '#1' EQ 'WRITE'
JSR    DIRW        ; WRITE DIRECTORY SECTOR

```



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```

. ELSE
. ERROR 'DIRECTORY'
. ENDIF
. ENDIF
JSR DSKERR ; DISK ERRORS
. ENDM

```

```

;
; MACRO FOR DOUBLE LOAD AND DOUBLE STORE INSTRUCTIONS
;

```

```

. MACRO DLD, REGISTER, DISPLACEMENT
LD REGISTER, DISPLACEMENT
LD REGISTER+1, 1+DISPLACEMENT
. ENDM

```

```

. MACRO DST, REGISTER, DISPLACEMENT
ST REGISTER, DISPLACEMENT
ST REGISTER+1, 1+DISPLACEMENT
. ENDM

```

```

;
; MACROS FOR LOAD AND STORE WITH AUTOINCREMENT ON INDEX
; REGISTERS.
;

```

```

. MACRO LDAI, REGISTER, INDEX
LD REGISTER, INDEX
INC INDEX
. ENDM

```

```

. MACRO STAI, REGISTER, INDEX
ST REGISTER, INDEX
INC INDEX
. ENDM

```

```

. MACRO INC, INDEX
. IFC 'INDEX' EQ '(AC3)'
AISZ AC3, 1
. ELSE
. IFC 'INDEX' EQ '(AC2)'
AISZ AC2, 1
. ELSE
. ERROR 'INDEXING'
. ENDIF
. ENDIF
. ENDM

```

```

;
; MACROS FOR BYTE HANDLING
;

```

```

. MACRO LLB, REGISTER, ADDRESS
LD REGISTER, ADDRESS; LOAD LEFT BYTE
SHR REGISTER, 8
. ENDM

```

```

. MACRO LRB, REGISTER, ADDRESS

```



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```

LD      REGISTER, ADDRESS; LOAD RIGHT BYTE
AND    REGISTER, =X'00FF
.ENDM

;
; MACRO FOR SKIP IF EQUAL INSTRUCTION
;
; .MACRO SKE, REGISTER, DISPLACEMENT
SKNE   REGISTER, DISPLACEMENT
JMP    .+2
; .ENDM

;
; MACRO FOR SKIP IF GREATER THAN OR EQUAL TO
;
; .MACRO SKGE, REGISTER, DISPLACEMENT
SKG    REGISTER, DISPLACEMENT
SKNE   REGISTER, DISPLACEMENT
JMP    .+2
; .ENDM

;
; MACRO FOR COPYING THE TOP OF THE STACK CONTENT INTO
; REGISTER
;
; .MACRO CSR, REGISTER
PULL   REGISTER
PUSH   REGISTER
; .ENDM

;
; MACRO FOR DROPPING THRU TO NEXT ROUTINE
;
; .MACRO DROP, ADDRESS
.MLOC  ADDR
.SET   ADDR, ADDRESS
; IF   ADDR = .
; ELSE
; ERROR 'ADDRESSING'
; ENDF
; .ENDM

;
; MACRO FOR PUTTING ASCII CHARACTERS ONE PER WORD
;
; .MACRO .ASCII, STRING
.NSTAT 1
.SET   POSITION, 1
.DO    100
; MICRO P1, POSITION, 1, *STRING*
; IFC  "'P1"' NE ''
; WORD "'P1"'/256
; SET  POSITION, POSITION+1
; ELSE
; EXIT
; ENDF
; ENDDO

```



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```
.NSTAT 0
.ENDM
```

```
;
; MACRO FOR PUTTING UNPACKED ASCII WITH DECIMAL POINT
;
```

```
.MACRO .PNLASC, STRING
.NSTAT 1
.SET POSITION, 1
.DO 100
.MICRO C1, POSITION, 1, *STRING*
.SET PSNP1, POSITION+1
.MICRO C2, PSNP1, 1, *STRING*
.IFC "C1" EQ ''
.EXIT
.ENDIF
.IFC "C2" EQ ''
.WORD "C1"/256+080
.SET POSITION, POSITION+1
.ELSE
.WORD "C1"/256
.ENDIF
.SET POSITION, POSITION+1
.ENDDO
.NSTAT 0
.ENDM
```

```
;
; MACRO FOR GENERATING COMMAND TABLE
;
```

```
.MACRO COMMAND, COMMAND, STRING
.NSTAT 1
.MICRO CMND, 1, 2, *COMMAND*
.MICRO CMND1, 1, 1, *COMMAND*
.MICRO STRNG, 1, 9, *STRING*
```

```
.WORD "CMND"
.WORD COMMAND
```

```
.IFC "STRNG" EQ 'MOST USED'
.WORD "CMND1" '-B
.WORD COMMAND
.ENDIF
```

```
.NSTAT 0
.ENDM
.LIST GENERAL
```

```
;
; THE FOLLOWING MACRO DEFINES THE FIRMWARE PROGRAM
; STARTING ADDRESSES AND THE ENTRY POINTS FOR THE ROUTINES
; IN THOSE PROGRAMS. (.INCLD ENTRY)
```

```
.LIST ENTRY!OD
```



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```

        .PAGE    'FIRMWARE ENTRY POINTS'
;
; ROM = 0 -> FIRMWARE IN RAM
; ROM = 1 -> FIRMWARE IN ROM/PROM
;
ROM      =      1
;
;   THESE ARE THE MEMORY ADDRESSES OF FIRMWARE WITHIN THE
;   COP DEVELOPMENT SYSTEM.
;
        .IF      ROM
        .ERROR   'FIRMWARE IN ROM' ; WARNING
CONIO    =      0E800
FIOSYS  =      0EAD0
DISKIO  =      0F720
MEMDI   =      0F900
EXEC    =      0FA60
;
TOPUSE  =      03FFF ; TOP OF USER RAM
        .ELSE
CONIO    =      02800
FIOSYS  =      02AD0
DISKIO  =      03730
MEMDI   =      03900
EXEC    =      03A60
;
TOPUSE  =      027FF ; TOP OF USER RAM
        .ENDIF
        .LIST    ENTRY
;
;   MACRO FOR ASSIGNING ENTRY POINTS FOR FIRMWARE PROGRAMS
;
        .MACRO   ENTRY, DUM1, DUM2, PGMNAME
        .MSTAT   1
        .IFC     'PGMNAME' NE 'UTILITY'
        .LIST    FRMEJ
        .PAGE    '"PGMNM" ENTRY JUMPS'
        .ASECT
        .NOBAS
        .="PGMNM"
        .LIST    ENTRY
        .ENDIF
        .MACRO   UTILITY, UTILNAME
        .IFC     'PGMNAME' EQ 'UTILITY'
        .LIST    FRMEP
        .PAGE    'UTILNAME ENTRY POINTS'
;
        .SET     ADDRESS, UTILNAME
;
        .ELSE
        .IFC     '"PGMNM"' EQ 'CONIO'
        JSR     SYSERR ; SAFETY JUMPS IN CONIO

```



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```

JSR      SYSERR
.PTR     SYSERR
.ENDIF
.ENDIF

;

.LIST    ENTRY
.MACRO   ENTPT, ENTNAME
.IFC    'PGMNAME' EQ 'UTILITY'
.LIST    FRMEP
ENTNAME = ADDRESS
.LIST    ENTRY
.SET    ADDRESS, ADDRESS+2
.ELSE
.IFC    '"PGMNM"' EQ 'UTILNAME'
.LIST    FRMEJ
JMP     @. +1
.WORD   E^ENTNAME
.LIST    ENTRY
.ENDIF
.ENDIF
.ENDM
.ENDM

;

UTILITY CONIO
.SET    ADDRESS, ADDRESS+3 ; CONIO SAFETY JUMPS

;

ENTPT    AUTOBD           ; AUTO BAUD DETECT
ENTPT    PRSTUP           ; SET UP FOR PRINTER OUTPUT
ENTPT    CNSTUP           ; SET UP FOR CONSOLE I/O
ENTPT    GETC             ; GET CHAR FROM CONSOLE
ENTPT    GECO             ; GET CHAR WITH ECHO
ENTPT    PUTC             ; SEND CHAR TO CONSOLE
ENTPT    PUT2C            ; SEND TWO CHARS TO CONSOLE
ENTPT    OHEX4            ; PRINT AC1 AS 4 HEX CHARS
ENTPT    OHEX3            ;                3
ENTPT    OHEX2            ;                2
ENTPT    OHEX1            ;                1
ENTPT    CRLF             ; PRINT NEW LINE
ENTPT    PUTB             ; PRINT BLANKS
ENTPT    MSG              ; MESSAGE TO CONSOLE
ENTPT    MSG2             ; MESSAGE, NO NEW LINE
ENTPT    CRESET           ; CONSOLE RESET
ENTPT    INTEST           ; CONSOLE INTERRUPT TEST
ENTPT    ABSTTY           ; LOAD 16 BIT LM TAPE
ENTPT    FPOUT            ; SEND MESSAGE TO DISPLAY
ENTPT    FPO4             ; MESSAGE TO HALF OF DISPLAY
ENTPT    READKB           ; READ FRONT PNL KYBD
ENTPT    READSW           ; READ FRONT PNL SWITCHES

;

UTILITY FIOSYS

;

ENTPT    CLRHS            ; CLEAR HARDWARE STACK

```



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```

ENTPT  RDLIN      ; READ ONE INPUT LINE
ENTPT  GNCHAR    ; GET NEXT CHAR
ENTPT  GNSP      ; GET NON-SPACE CHAR
ENTPT  GNVC      ; GET NEXT CHAR
ENTPT  DECLPT   ; DECREMENT LINE PTR
ENTPT  GCOMMA   ; TEST FOR COMMA
ENTPT  GETHEX   ; GET HEX NUMBER
ENTPT  GETDEC   ; GET DECIMAL NUMBER
ENTPT  GETYN    ; GET YES OR NO RESPONSE
ENTPT  GETCMD   ; GET COMMAND
ENTPT  OUTNAM   ; PRINT FILE NAME
ENTPT  RESETD  ; RESET DISK DRIVE PTRS
ENTPT  DERROR   ; REPORT DISK ERRORS
ENTPT  PGFR     ; PARSE FILE NAME
ENTPT  DISER    ; DIRECTORY SEARCH
ENTPT  FILCOM   ; COMPARE FILE NAMES
ENTPT  EXEC1    ; GET AND EXECUTE DISK FILE
ENTPT  EXEC2    ; EXECUTE DISK FILE, AC3=INPTR
ENTPT  EXEC3    ; EXECUTE DISK FILE, AC2=FAST
ENTPT  OVERLAY  ; PROGRAM OVERLAY
ENTPT  OPENR    ; OPEN FILE FOR READ
ENTPT  OPENW    ; OPEN FILE FOR WRITE
ENTPT  OPENM    ; OPEN FILE FOR MODIFY
ENTPT  CLOSE    ; CLOSE FILE
ENTPT  RCSECT  ; READ CONSECUTIVE SECTOR
ENTPT  WCSECT  ; WRITE CONSECUTIVE SECTOR
ENTPT  RRSECT  ; READ RELATIVE SECTOR
ENTPT  WRSECT  ; WRITE RELATIVE SECTOR
ENTPT  RWORD   ; READ WORD FROM FILE
ENTPT  WWORD   ; WRITE WORD TO FILE
ENTPT  REWIND  ; REWIND FILE
ENTPT  DELF    ; DELETE FILE
ENTPT  DIRF    ; READ FIRST DIRECTORY SECTOR
ENTPT  DIRN    ; READ NEXT DIRECTORY SECTOR
ENTPT  DIRW    ; WRITE CURRENT DIRECT SECTOR

```

UTILITY DISKIO

```

ENTPT  DISK1    ; DISK I/O, PLIST ADR AT CALL
ENTPT  DISK2    ; DISK I/O, PLIST ADR IN AC2

```

UTILITY EXEC

```

ENTPT  PWRON   ; POWER ON INIT
ENTPT  EXECA   ; NORMAL EXEC ENTRY
ENTPT  SYSERR  ; ERROR ENTRY POINT
ENTPT  STKOVR  ; STACK OVFL PROCESSING
ENTPT  BRKPT   ; BRKPT ENTRY
ENTPT  MPASS   ; CHECK FOR MEMORY PASSWORD
ENTPT  DPASS   ; CHECK FOR DISK PASSWORD

```

.MSTAT 0



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. ENDM
. LIST XLIST
. PAGE

3. OPERATING ENVIRONMENT:

STANDARD COPS PDS SYSTEM WHICH CONSISTS OF:

- A) 16K WORDS OF RAM
- B) 6K WORDS OF ROM (440305549)
- C) SINGLE DRIVE FLOPPY DISK (PACE COMPATIBLE)
- D) STANDARD RS-232 OR CURRENT LOOP TERMINAL
- E) IMP-16/200 (980304736-007)
- F) RS-232 PRINTER (OPTIONAL)
- G) 1K BUFFER FOR ALL SYSTEM STORAGE

THE FOLLOWING INCLUDE FILE DEFINES THE HARDWARE
AND THE SHARED MEMORY ADDRESSES FOR THE PDS SYSTEM.
(. INCLD HWADDR)

. PAGE 'HARDWARE ADDRESSES'

```
; HARDWARE BASE ADDRESS FOR THE FRONT PANEL, SERIALIO AND  
; PROM PROGRAMMER:  
;  
PNLIO = X'8380 ; BASE ADDRESS OF PNL HW  
;  
;  
RDSW1 = PNLIO + 010 ; ADR OF FRONT PANEL SWITCHES  
RDSTA1 = PNLIO + 020 ; ADR OF KYBD UART STATUS  
;  
; OFFSETS FROM THE BASE ADDRESS FOR ALL PNL RELATED HARDWARE:  
;  
PNLOFF = 0 ; HARDWARE OFFSET  
RDPR = PNLOFF + 000 ; ADR FOR READING PROM  
LDD = PNLOFF + 000 ; LOAD DATA TO BE PROGRAMMED  
LDA = PNLOFF + 008 ; LOAD ADR TO BE PROGRAMMED  
KYBD = PNLOFF + 008 ; READ KEYBOARD  
RDSW = PNLOFF + 010 ; READ FRONT PANEL SWITCHES  
DWRT0 = PNLOFF + 010 ; WRT PULSE TO DIGIT 0  
DWRT4 = PNLOFF + 014 ; WRT PULSE TO DIGIT 4  
DWRT7 = PNLOFF + 017 ; WRT PULSE TO LEFT DGT (7)  
RDC = PNLOFF + 018 ; READ MODE FOR PROMS  
CSC = PNLOFF + 019 ; PROM CHIP SELECT CONTROL  
VSS = PNLOFF + 01A ; VSS, VDD, VBB CONTROL  
VPC = PNLOFF + 01B ; EPROM PGM PULSE CONTROL  
GRDC = PNLOFF + 01C ; GROUND CONTROL FOR PROMS  
BPPC = PNLOFF + 01D ; BP PROM PROG DATA ENABLE  
BVC = PNLOFF + 01E ; BP PROG VOLTAGE CONTROL  
WRDM = PNLOFF + 01F ; WRT CONTROL FOR DSPLY MEM  
RDSTA = PNLOFF + 020 ; READ KYBD AND UART STATUS
```



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```

TYBAUD   =      PNLOFF + 020   ; TTY BAUD RATE DETECT CNTRL
RDSTB    =      PNLOFF + 040   ; READ KYBD AND UART STATUS
RSBAUD   =      PNLOFF + 040   ; 232 BAUD RATE DETECT CNTRL
UARTWD   =      PNLOFF + 078   ; WRITE UART DATA
UARTRD   =      PNLOFF + 078   ; READ UART DATA
UARTRC   =      PNLOFF + 079   ; READ UART STATUS REGISTER
UARTWC   =      PNLOFF + 079   ; WRT UART MODE/CNTRL WORDS
BAUDET   =      PNLOFF - 080   ; BAUD RATE DETECTOR
URESET   =      PNLOFF - 080   ; UART/BAUD RATE GEN RESET
TTYEN    =      PNLOFF - 07F   ; TTY ENABLE
CRTEN    =      PNLOFF - 07E   ; CRT ENABLE
PRTTTY   =      PNLOFF - 07D   ; PRINTER ENABLE (TTY)
PRT232   =      PNLOFF - 07C   ; PRINTER ENABLE (232)
KBEN     =      PNLOFF - 07B   ; KEYBOARD ENABLE
WDGEN    =      PNLOFF - 060   ; SET UP BAUD RATE GENERATOR
PNLRST   =      PNLOFF - 040   ; RESET ALL IFACE CONTROLS
WRRLY    =      PNLOFF - 020   ; READER RELAY CLOCK

```

```

;
; HARDWARE BASE ADDRESS FOR THE TARGET CARD
;

```

```

TGTIO    =      X'B000
;

```

```

; OFFSETS FROM THE BASE ADDRESS FOR ALL TARGET CARD RELATED
; HARDWARE.
;

```

```

TGTOFF   =      0              ; HARDWARE OFFSET
TCTAC    =      TGTOFF + 000   ; TRACE/TRACE AFTER COUNTER
DCNTR    =      TGTOFF + 001   ; OCCURENCE COUNTER
BPFLG    =      TGTOFF + 002   ; BRKPT FLAGS
FLAGS    =      TGTOFF + 003   ; CONTROL FLAGS
BPDEX    =      TGTOFF + 004   ; BRKPT DUMP EXIT
;

```

```

; SHARED MEMORY DEFINITIONS
;

```

```

SHRMEM   =      X'A000         ; SHARED MEMORY BASE ADDRESS
SHMSIZ   =      X'1000         ; SHARED MEMORY SIZE
;

```

THE FOLLOWING INCLUDE FILE DEFINES THE RESERVED MEMORY LOCATIONS USED BY THE PDS SOFTWARE AND FIRMWARE.
(.INCLD SYSRAM)

.PAGE 'SYSTEM BUFFER AND BASE PAGE DEFINITIONS'

```

;
; THIS IS A COMPLETE DEFINITION OF RESERVED MEMORY
; LOCATIONS IN THE COP DEVELOPMENT SYSTEM. 'SYSBUF
; VARIABLES' ARE MEMORY LOCATIONS IN THE SYSTEM BUFFER REGION
; AT ADDRESSES X'DC00 TO X'DFFF, WHICH ARE RESERVED FOR USE
; BY FIRMWARE PROGRAMS. 'BASE PAGE VARIABLES' ARE MEMORY
; LOCATIONS IN THE IMP BASE PAGE AT ADDRESSES X'0 TO X'F,
; WHICH ARE PERMANENTLY RESERVED FOR USE BY ONE OR MORE

```



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```

; PROGRAMS.
;
;
; BASE PAGE VARIABLES AT ADDRESSES 0 TO X'F:
;
ZERJMP = 0 ; SYSTEM ERROR IF PC HERE,
; INDIRECT JUMP THROUGH X'2
FULSTK = 1 ; STACK FULL INTERRUPT,
; INDIRECT JUMP THROUGH X'3
YSYER = 2 ; ADDRESS OF ROUTINE 'SYSERR'
STKOV = 3 ; ADDRESS OF ROUTINE 'STKOV'
CHIPN = 4 ; CHIP NUMBER FOR 'COPMON'
TCTACB = 5 ; TRACE CONTROL FOR 'COPMON'
DCNTRB = 6 ; OCCURENCE COUNT FOR 'COPMON'
BPFLGB = 7 ; BRKPT CONTROL FOR 'COPMON'
FLAGSB = 8 ; FLAG BUFFER FOR 'COPMON'
BPDEXB = 9 ; DUMP CONTROL FOR 'COPMON'
SRCPTR = 0A ; USED BY MEMORY DIAGNOSTICS
DSTPTR = 0B ; USED BY MEMORY DIAGNOSTICS
ENDBLK = 0C ; USED BY MEMORY DIAGNOSTICS
BASENU = 0D ; NOT USED
BRKPTR = 0E ; ADDRESS OF EXEC 'BRKPT'
MAXRAM = 0F ; BASE PAGE PTR TO SYSBUF
;
;
; .SET OFFSET, X'80 ; SYSBUF OFFSET
;
; MACRO FOR ASSIGNING SYSTEM BUFFER SPACE
;
; .MACRO RESERV, NAME, NUMWDS
; .IFC 'NUMWDS' NE ''
; .SET OFFSET, OFFSET-NUMWDS+1
; .ENDIF
; .SET OFFSET, OFFSET-1
NAME = OFFSET
; .ENDM
;
; SYSBUF DEFINITIONS:
;
TOPSYS = 0FFF ; TOP OF SYSBUF
SSIZ = 0400 ; SYSBUF SIZE
SYSBUF = TOPSYS-OFFSET+1 ; SYSBUF ADR LOCATED AT MAXRAM
;
; SYSBUF VARIABLES:
;
RESERV TAB3 ; TAB COLUMN 3(FIOSYS, EDIT)
RESERV TAB2 ; TAB COLUMN 2(FIOSYS, EDIT)
RESERV TAB1 ; TAB COLUMN 1(FIOSYS, EDIT)
RESERV TRKDIR ; TRACK DIRECTION (DISKIO)
RESERV ERRCNT ; ERROR COUNT(DISKIO)
RESERV VECTOR ; PARAM VECTOR ADR(DISKIO)
RESERV TRKCNT ; TRK CTR(DISKIO)

```



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RESERV	DSTAT	; DISK STATUS ADR(DISKIO)
RESERV	STACK, 16	; STACK(EX, DISKIO)
RESERV	FLGS	; STATUS FLAGS(EX, DISKIO)
RESERV	DR3	; AC3(EX, DISKIO)
RESERV	DR2	; AC2(EX, DISKIO)
RESERV	DR1	; AC1(EX, DISKIO)
RESERV	DRO	; ACO(EX, DISKIO)
RESERV	ET1	; TEMPORARY(EX)
RESERV	ET2	; TEMPORARY(EX)
RESERV	MEMRNG	; NON-SYSBUF TOPRAM ADR(EX)
RESERV	BDATA2	; DATA OF 2ND BREAK(EX)
RESERV	BLOC2	; ADR OF 2ND BRK(EX)
RESERV	BDATA1	; DATA OF 1ST BRK(EX)
RESERV	BLOC1	; ADR OF 1ST BRK(EX)
RESERV	BRKNUM	; CTR FOR # OF BRKS SET(EX)
RESERV	CWRD	; LAST ALTERED MEMORY ADR(EX)
RESERV	DATA	; DATA REG(EX)
RESERV	RNGE	; END OF RANGE INDEX(EX)
RESERV	MODE	; MODE(EX)
RESERV	ADDR	; ADDR(EX)
RESERV	ACCESS	; SECURITY ACCESS CODE(FIOSYS)
RESERV	HIGH	; TEMP RANGE FOR MP LOADING
RESERV	LOW	; (FIOSYS)
RESERV	ASHI	; ABSOLUTE SECTOR RANGE OF
RESERV	ASLO	; MP'S VECTOR(FIOSYS)
RESERV	TSHI	; TOP SECT RNGE OF MP'S VECTOR
RESERV	TSLO	; (FIOSYS)
RESERV	PTRHI	; PTR RNG OF MP'S VECTOR
RESERV	PTRLO	; (FIOSYS)
RESERV	BSHI	; BASE SECT RNG OF MP'S VECTOR
RESERV	BSLO	; (FIOSYS)
RESERV	ENTPT	; ENTPT OF MP'S VECTOR(FIOSYS)
RESERV	CHCNT	; ACTIVE CHANNEL COUNT(FIOSYS)
RESERV	DIR	; DIRECTORY BUF PTR(FIOSYS)
RESERV	DIREND	; END OF DIRECTORY BUF(FIOSYS)
RESERV	DIRP	; TEMP PTR TO DIR(FIOSYS)
RESERV	DIR1	; DIR SECTOR FOR NST1(FIOSYS)
RESERV	DIR2	; DIR SECTOR FOR NST2(FIOSYS)
RESERV	DIRS	; DIRECTORY SECTOR(FIOSYS)
RESERV	DIRSECT	; CURRENT DIR SECTOR #(FIOSYS)
RESERV	FREE1	; FREE SPACE PTR, NST1(FIOSYS)
RESERV	FREE2	; FREE SPACE PTR, NST2(FIOSYS)
RESERV	NST1CT	; CHNL TBL CNT, NST1(FIOSYS)
RESERV	NST2CT	; CHNL TBL CNT, NST2(FIOSYS)
RESERV	CURVOL	; CURRENT VOL NST ADR(FIOSYS)
RESERV	FSADR	; FST ADDRESS(FIOSYS)
RESERV	CTADR	; CHANNEL TBL ADR(FIOSYS)
RESERV	FR3	; AC3(FIOSYS)
RESERV	FR2	; AC2(FIOSYS)
RESERV	FR1	; AC1(FIOSYS)
RESERV	FRO	; ACO(FIOSYS)
RESERV	FTO	; TEMPORARY(FIOSYS)



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RESERV FT1 ; TEMPORARY(FIOSYS)
RESERV FT2 ; TEMPORARY(FIOSYS)
RESERV FT3 ; TEMPORARY(FIOSYS)
RESERV FT4 ; TEMPORARY(FIOSYS)
RESERV FT5 ; TEMPORARY(FIOSYS)
RESERV FT6 ; TEMPORARY(FIOSYS)
RESERV FT7 ; TEMPORARY(FIOSYS)
RESERV FT8 ; TEMPORARY(FIOSYS)
RESERV FT9 ; TEMPORARY(FIOSYS)
RESERV CNBAUD ; CON BAUD RATE(CONIO, FIOSYS)
RESERV PRBAUD ; PRTR BAUD RATE(CONIO, FIOSYS)
RESERV CNCRDL ; CON CR DELAY(CONIO, FIOSYS)
RESERV PRCRDL ; PRTR CR DELAY(CONIO, FIOSYS)
RESERV CNLFDL ; CON LF DELAY(CONIO, FIOSYS)
RESERV PRLFDL ; PRTR LF DELAY(CONIO, FIOSYS)
RESERV PRFFDL ; PRTR FF DELAY(CONIO, FIOSYS)
RESERV PRVTDL ; PRTR VT DELAY(CONIO, FIOSYS)
RESERV CNMODE ; CONSOLE MODE(CONIO)
RESERV PRMODE ; PRINTER MODE(CONIO)
RESERV CNTYPE ; CONSOLE TYPE(CONIO)
RESERV PRTYPE ; PRINTER TYPE(CONIO)
RESERV CONPRT ; SERIAL I/O SET UP 0=CON/3=PRT
RESERV FST, FSSIZE ; FILE STATUS TBL(FIOSYS)
RESERV ANY, 16 ; TEMP FOR ANYBODY
RESERV ANYTMP ; TEMP FOR ANYBODY @MAXRAM
. IF OFFSET = 0

```

```

; ABOVE VARIABLES USE UP ALL 128 TOPSYS +RELATIVE WORDS
;

```

```

. ELSE
. ERROR 'SYSBUF'
. ENDIF
RESERV NU1, 34 ; UNUSED TOPSYS -RELATIVE WRDS
RESERV LINPTR ; INPUT LINE BUF PTR(FIOSYS)
RESERV CWIDTH ; CARRIAGE WIDTH(FIOSYS)
RESERV PLIST, PLSIZE ; DISKIO PARAM LIST(FIOSYS)
RESERV FIOSTK, 16 ; STACK SAVE(FIOSYS)
RESERV TRPLST, 51 ; PLIST FOR MEMDI
RESERV TRDLST, 4 ; DLIST FOR FPOUT4
RESERV DIRBUF, SECTSZ ; DIRECTORY BUF(FIOSYS)
MWP1 = MXWIDTH+1
RESERV LINBUF, MWP1 ; INPUT LINE BUF(FIOSYS)
CHNSIZ = CTSIZE*MAXCHN ; CHANNEL TBL BUFFER SIZE
RESERV CHANNEL, CHNSIZ ; CHANNEL TABLES(FIOSYS)
RESERV NSTBF1, NSTSIZ ; NST1(FIOSYS)
RESERV NSTBF2, NSTSIZ ; NST2(FIOSYS)
. IF OFFSET+SSIZ-128 = 0

```

```

; ABOVE VARIABLES USE UP ALL WORDS IN SYSBUF
;

```

```

. ELSE
. ERROR 'SYSBUF'

```



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.ENDIF

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4. DETAILED COMPONENT DESIGN:

NOT APPLICABLE

5. SYSTEM GENERATION ENVIRONMENT:

IMP MACRO ASSEMBLER RUNNING
ON 28K PACE. (MODIFIED PIMPAS)

35 SIZE12 = 1-SIZE8
36 ;
37 ; COPS CHANGES
38 ;
39 FIRE = 1
40 ;

63 .ENDIF
64 .ENDIF
65 .IF IMP16
66 .TITLE PIMPAS, ' P05493A 08/16/78 COPS'
67 .ENDIF
68 .ELSE

1402 LD RO,=\$MBUF ; TEMP BUFF POINTER
1403 ST RO,\$MPNTR
1404 ;
1405 ; COPS CHANGE
1406 ;
1407 \$1:
1408 ;
1409 JSR NXCHAR ; GET A CHARACTER
1410 SKNE RO,MMARK ; CHECK FOR MICRO-MARK

1425 SKNE RO,MMARK
1426 JMP \$5 ; PROCESS MICRO
1427 ;
1428 ; COPS CHANGE
1429 ;
1430 DSZ INPTR
1431 \$3: ISZ ITEMLN
1432 LD RO,ITEMLN
1433 BOC ZRO,\$1
1434 \$4: DSZ INPTR
1435 AISZ RO,-1
1436 JMP \$4
1437 JMP \$1



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1438 ;
1439 ;
1440 ;
1441 $5:      LI      RO, 0          ; SEARCH FOR DEFINED MICRO
1442          JSR     NCSRCH
1443          JMP     $B            ; NOT FOUND - ERROR
*****
1576 $3:      JSR     NXCHAR        ; PROCESS STRING
1577          SKNE   RO, $DELIM
1578 ;
1579 ;          COPS CHANGE
1580 ;
1581          JMP     $6            ; TERMINATING DELIMITER
1582 ;
1583          LD      RO, CHARTP      ; TEST FOR EOL
1584          SKNE   RO, =NCEOL
*****
1743          LI      RO, DFPRM     ; PARAMETER FLAG
1744          JMP     $4
1745 ;
1746 ;          COPS CHANGES
1747 ;
1748 $LOC:
1749          JSR     $CKLVL         ; IGNORE LOCAL IF MACRO NEST
1750          JMP     $STORE        ; LEVEL IS NOT 1
1751 ;
1752          SFLG   CRYFLG         ; ADJUST LOCAL NUMBER TO 3*NUM
1753          SUBB   RO, $PLIM
*****
1796 $LOCS:   . = +1              ; LIMIT OF LOCAL SYMBOL STACK
1797 $PLIM:   . = +1              ; LIMIT OF PARAMETER STACK
1798 ;
1799 ;          COPS CHANGES
1800 ;
1801 $CKLVL:
1802          PUSH   RO
1803          LD      RO, $MCNT
1804          SKNE   RO, =1
1805          JMP     $LEV1
1806          PULL   RO
1807          RTS
1808 $LEV1:
1809          PULL   RO
1810          RTS     1
1811 ;
1812          .POOL  16
1813 ;
1814 ; CHECK FOR MACRO DIRECTIVE
1815 ;
*****
1818          LD      R3, $DTAB      ; R3 POINTS AT MACRO DIRECTIVE TAB
1819          JSR     TBSRCH        ; SEARCH TABLE

```



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1820 ;
1821 ; COPS CHANGE
1822 ;
1823 $32: JMP $STORE ; NOT FOUND, SIMPLY PUT IN DEFINITION
1824 SKNE R3,=$MLOC ; .MLOC DIRECTIVE
1825 JMP $5
1826 SKNE R3,=$ENDM ; .ENDM DIRECTIVE
1827 JMP $7
1828 SKNE R3,=$MACRO ; .MACRO DIRECTIVE
1829 JMP $9
1830 SKNE R3,=$END ; .END DIRECTIVE
1831 JMP $32
1832 ;
1833 ;
1834 HALT ; SYSTEM ERROR
*****
1844 ; .MLOC PROCESSING
1845 ;
1846 ;
1847 ; COPS CHANGES
1848 ;
1849 $5:
1850 JSR $CKLVL ; IGNORE MLOC IF MACRO NEST
1851 JMP $STORE ; LEVEL IS NOT 1
1852 ;
1853 JSR $CHKV ; CHECK WHETHER TO RECOGNIZE DIRECTIVE
1854 LI RO,DFSKIP ; PUT SKIP FLAG IN DEF SO THIS LINE
*****
1926 JMP $STORE ; NO SPECIAL SIGNIFICANCE IN ITEM
1927 ; SIMPLY SAVE IN DEFINITION
1928 ;
1929 ; COPS CHANGES
1930 ;
1931 $PREF:
1932 JSR $CKLVL ; IGNORE PARAM DEF IF MACRO
1933 JMP $STORE ; NEST LEVEL IS NOT 1
1934 ;
1935 JSR NXITEM ; NEXT ITEM A CONSTANT?
1936 LI RO,0 ; CLEAR BACKUP FLAGS AND BACK
*****
1956 JMP $NXT
1957 $20: LI RO,DFARG ; SET ARGUMENT REFERENCE FLAG
1958 ;
1959 ; COPS CHANGES
1960 ;
1961 JMP .+2
1962 $CONC:
1963 LI RO,DFCON ; SET CONCATENATION FLAG.
1964 JSR $CKLVL ; IGNORE CONCATENATION IF
1965 JMP $STORE ; MACRO NEST LEVEL IS NOT 1
1966 ;
*****

```



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3080 $LOOP: JSR GETNM1 ; GET MACRO NAME
3081 JMP XERROR ; NO NAME, SYNTAX ERROR
3082 ;
3083 ; COPS CHANGE
3084 ;
3085 LD RO, XE000
3086 ;
3087 ;
3088 JSR MCSRCH ; SEARCH FOR DEFINED MACRO
3089 JMP $UND ; MACRO UNDEFINED
*****
3107 ; BEEN DELETED SINCE LAST COMP
3110 BOC ZRO, $RTS ; NO
3111 ;
3112 ; COPS CHANGES
3113 ;
3114 LD RO, MACPTR ; SEE IF MACRO BEING EXPANDED
3115 BOC NZR, $RTS ; IF SO, DON'T COMPRESS NOW
3116 LI RO, 0 ; CLEAR COMPRESS FLAG
3117 ST RO, CMPFLG
3118 ;
3119 ;
3120 LD R3, BASE ; R3 POINTS AT NEXT MACRO DEF
3121 $2: SKNE R3, NXTMAC ; AT END OF STACK?
*****
8688 PRMSTK: .= +299 ; PARAMETER STACK BUILDS UP
8689 CALSTK: .= +1 ; MACRO CALL STACK BUILDS DOWN
8690 ;
8691 ; COPS CHANGE
8692 ;
8693 PTRTAB: .= +2300
8694 PTREND:
8695 .END START
*****

```

6. MANUFACTURING REPRODUCTION

LOAD DSKIT INTO THE PDS SYSTEM.

INSERT DISK TO BE INITIALIZED.

DSKIT WILL PROMPT FOR A COMMAND
ENTER THE FOLLOWING:

D> IN "PDS", "PDS MASTER DISK"

WHEN THE DISK IS INITIALIZED IT MAY
BE DUPLICATED ON A PACE MACHINE IN THE
NORMAL MANNER OR IT MAY BE DUPLICATED
ON PDS.

TO DUPLICATE ON PDS :



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LOAD FM
FM WILL PROMPT FOR A COMMAND
ENTER THE FOLLOWING:

F> DJ CDS TO PDS
FOLLOW THE INSTRUCTIONS ON THE
CONSOLE.

7. LIST OF RELATED DOCUMENTS:

430305767-000	COPMON
430305768-000	EDIT
430305769-000	DSKIT
430305770-000	FM
430305807-000	ASM
430305771-000	LIST
430305772-000	XREF
430305938-000	MASKTR
430305937-000	MDIAG
420305548-001	COP SYSTEM USERS MANUAL
091305548-000	CUSTOMER SUPPORT PACKAGE

8. CHANGES:

CHANGES FROM REV "A" TO "B"

MODIFIED COPMON, EDIT, FM, ASM AND DSKIT.
ADDED LIST, XREF, MASKTR AND MDIAG.

CHANGES FROM REV "B" TO "C"

MODIFIED COPMON AND MASKTR

SEE APPROPRIATE 43030XXXX-000 PACKAGE FOR DETAILS.



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9. CONTENTS OF MASTER DISKETTE

COPMON	430305767	REV. C
EDIT	430305768	REV. B
DSKIT	430305769	REV. B
FM	430305770	REV. B
ASM	430305807	REV. B
LIST	430305771	REV. A
XREF	430305772	REV. A
MASKTR	430305938	REV. B
MDIAG	430305937	REV. A

LABEL DISKETTE USING A BLANK INDEX LABEL MARKED WITH:

"PDS MASTER 440305834-200C"

NOTE: THE 440305834-200 IS CREATED FROM A BLANK,
UNINITIALIZED, SINGLE DENSITY DISKETTE P/N 205004514-001



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